AIPMT - 2012 (Pre)

1. CH_3CHO and $C_6H_5CH_2CHO$ can be distinguished chemically by

(1) Fehling solution test (2) Benedict test

(3) Iodoform test (4) Tollen's reagent test

Sol: **[3]** Aldehydes and ketones having $CH_3-\overset{\overset{O}{\|}}{C}-$ group give iodoform test.

$$CH_3-\overset{\overset{O}{\|}}{C}-H+3I_2+4NaOH\longrightarrow \underset{\text{Yellow ppt.}}{CHI_3}+HCOONa+3NaI+3H_2O$$

2. p_A and p_B are the vapour pressure of pure liquid components. A and B, respectively of an ideal binary solution. If x_A represents the mole fraction of component A, the total pressure of the solution will be

(1) $p_B + x_A (p_A - p_B)$ (2) $p_A + x_A (p_B - p_A)$ (3) $p_A + x_A (p_A - p_B)$ (4) $p_B + x_A (p_B - p_A)$

Sol: **[1]** $p_{Total} = p_A \cdot x_A + p_B \cdot x_B$

$x_B + x_A = 1$

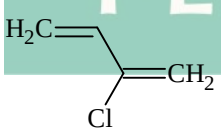
$x_B = 1 - x_A$

$p_{Total} = p_A \cdot x_A + p_B(1 - x_B)$

3. Which one of the following is **not** a condensation polymer?

(1) Neoprene (2) Melamine (3) Glyptal (4) Dacron

Sol: **[1]** Addition polymer of chloroprene is neoprene

Chloroprene is 

4. A metal crystallizes with a face-centered cubic lattice. The edge of the unit cell is 408 pm. The **diameter** of the metal atom is :

(1) 204 pm (2) 288 pm (3) 408 pm (4) 144 pm

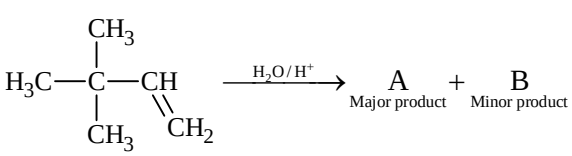
Sol: **[2]** $\sqrt{2}a = 4r \Rightarrow 2\pi = \frac{a}{\sqrt{2}} = \frac{408}{1.414} = 288pm$

5. Equimolar solutions of the following substances were prepared separately. Which one of these will record the highest pH value?

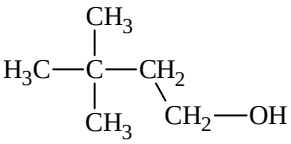
(1) $BeCl_2$ (2) $BaCl_2$ (3) $AlCl_3$ (4) LiCl

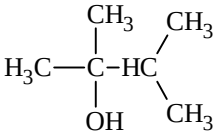
Sol: **[2]** Salt of strong acid and strong base

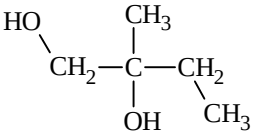
6. In the following reaction:

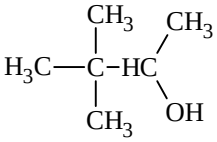


The major product is:

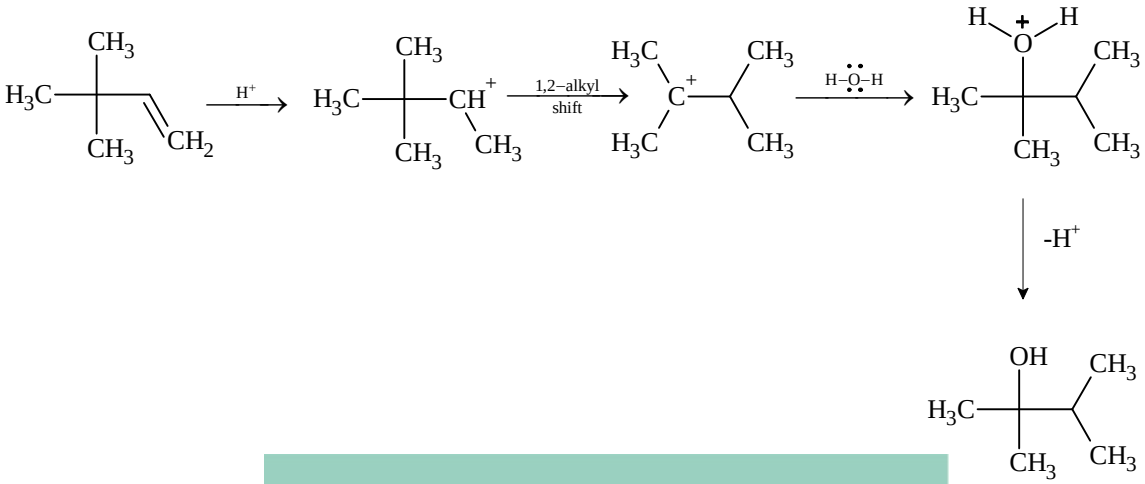
(1) 

(2) 

(3) 

(4) 

Sol: [2]



7. The enthalpy of fusion of water is 1.435 kcal/mol. The molar entropy change for the melting of ice at 0°C

(1) 0.526 cal/(mol K) (2) 10.52 cal / (mol K)

(3) 21.04 cal / (mol K) (4) 5.260 cal/(mol K)

Sol: [4] $\Delta S_{fusion} = \frac{\Delta H_f}{T} = \frac{1.435 \times 10^3}{273} = 5.256 \text{ cal / molK}$

8. Limiting molar conductivity of NH_4OH (i.e. $\wedge_m(NH_4OH)$) is equal to:

(1) $\wedge_m(NH_4Cl) + \wedge_m(NaOH) - \wedge_m(NaCl)$ (2) $\wedge_m(NH_4Cl) + \wedge_m(NaCl) - \wedge_m(NaOH)$

(3) $\wedge_m(NaOH) + \wedge_m(NaCl) - \wedge_m(NH_4Cl)$ (4) $\wedge_m(NH_4OH) + \wedge_m(NH_4Cl) - \wedge_m(HCl)$

Sol: [1] $\wedge_m^0(NH_4Cl) + \wedge_m^0(NaOH) - \wedge_m^0(NaCl)$

Self explained

9. Which one of the following is a mineral of iron?

(1) Magnetite (2) Malachite (3) Cassiterite (4) Pyrolusite

Sol: [1] Magnetite (Fe_3O_4)

10. In Freundlich Adsorption isotherm, the value of 1/*n* is:

(1) 1 in case of chemisorption (2) between 0 and 1 in all cases

(3) between 2 and 4 in all cases (4) 1 in case of physical adsorption

Sol: [2] $\frac{x}{m} = Kp^{1/n}$

11. Identify the alloy containing a non-metal as a constituent in it.

(1) Bronze (2) Invar (3) Steel (4) Bell metal

Sol: **[3]** In steel, C is also present

12. Buffer solutions have constant acidity and alkalinity because:

(1) they have fixed value of pH

(2) these give unionised acid or base on reaction with added acid or alkali

(3) acids and alkalies in these solutions are shielded from attack by other ions

(4) they have large excess of H^+ or OH^- ions

Sol: **[2]** Self explanatory

13. Which *one* of the following pairs is isostructural (i.e. having the same shape and hybridization)?

(1) [BF_4^- and NH_4^+] (2) [BCl_3 and $BaCl_3$] (3) [NH_3 and NO_3^-] (4) [NF_3 and BF_3]

Sol: **[1]** In both the compounds, central atom is sp^3 hybridized and structure is tetrahedral.

14. pH of a saturated solution of $Ba(OH)_2$ is 12. The value of solubility product (K_{sp}) of $Ba(OH)_2$ is

(1) 5.0×10^{-6} (2) 3.3×10^{-7} (3) 5.0×10^{-7} (4) 4.0×10^{-6}

Sol: **[3]** pH = 12

pOH = 2 $\Rightarrow$ $[OH^-] = 10^{-2}$

$Ba(OH)_2 \rightleftharpoons Ba^{2+} + 2OH^-$ $\Rightarrow 2x = 10^{-2}$

$x \quad 2x$ $\Rightarrow x = 5 \times 10^{-3}$

$K_{sp} = x\,(2x)^2 = 5 \times 10^{-3} \times (10^{-2})^2 = 5 \times 10^{-7}$

15. 50 mL of each gas A and of gas B takes 150 and 200 seconds respectively for effusing through a pin hole under the similar conditions. If molecular mass of gas B is 36, the molecular mass of gas A will be

(1) 64 (2) 96 (3) 128 (4) 32

Sol: **[4]** However question is wrong.

16. The protecting power of lyophilic colloidal sol is expressed in terms of

(1) Oxidation number (2) Coagulation value

(3) Gold number (4) Critical miscelle concentration

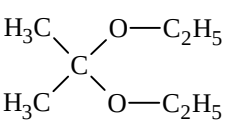
Sol: **[3]** Factual

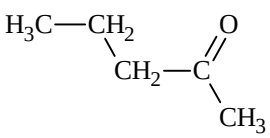
17. Deficiency of vitamin B_1 causes the disease

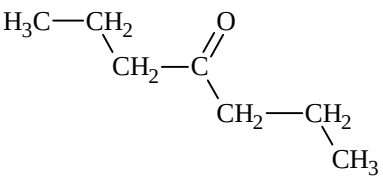
(1) Sterility (2) Convulsions (3) Beri-Beri (4) Cheilosis

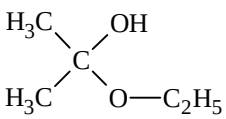
Sol: **[3]** Factual

18. Acetone is treated with excess of ethanol in the presence of hydrochloric acid. The product obtained is:

(1) 

(2) 

(3) 

(4) 

Sol: **[1]**

19. The ease of adsorption of the hydrated alkali metal ions on an ion-exchange resins follows the order:

(1) $Na^+ < Li^+ < K^+ < Rb^+$ (2) $Li^+ < K^+ < Na^+ < Rb^+$

(3) $Rb^+ < K^+ < Na^+ < Li^+$ (4) $K^+ < Na^+ < Rb^+ < Li^+$

Sol: [3] Greater the size of the hydrated ion, more will be the surface area and more will be its ease of adsorption.

20. Which one of the following statements is **incorrect** about enzyme catalysis?

(1) Enzymes are least reactive at optimum temperature

(2) Enzymes are mostly proteinous in nature

(3) Enzyme action is specific

(4) Enzymes are denaturated by ultraviolet rays and at high temperature

Sol: [1] Enzyme is most active at optimum temperature and pH

21. In which of the following compounds, nitrogen exhibits highest oxidation state?

(1) NH_2OH (2) N_2H_4 (3) NH_3 (4) N_3H

Sol: [4] Oxidation state of N is $N_3H = -1/3$

22. Bond order of 1.5 is shown by:

(1) O_2 (2) O_2^+ (3) O_2^- (4) O_2^{2-}

Sol: [3] Bond Order = $\frac{1}{2}(N_b - N_a) = \frac{1}{2}(10-7) = 1.5$

23. Maximum number of electrons in a subshell with $l = 3$ and $n = 4$ is:

(1) 12 (2) 14 (3) 16 (4) 10

Sol: [2] i.e. 4f maximum number of electrons that can be accommodated in f-subshell = 14

24. The correct set of four quantum numbers for the valence electron of rubidium atom (Z = 37) is

(1) 5, 1, 0, +1/2 (2) 5, 1, 1, +1/2 (3) 6, 0, 0, +1/2 (4) 5, 0, 0, +1/2

Sol: [4] i.e. $[Kr]5s^1$ so $n = 5$, $l = 0$, $m = 0$, $s = +1/2$

25. In a reaction, A + B → Product, rate is doubled when the concentration of B is doubled, and rate increases by a factor of 8 when the concentrations of both the reactants (A and B) are doubled, rate law for the reaction can be written as:

(1) Rate = $k[A]^2[B]$ (2) Rate = $k[A][B]^2$ (3) Rate = $k[A]^2[B]^2$ (4) Rate = $k[A][B]$

Sol: [1] A + B → Product

$r_1 = [A]^x[B]^y$

$r_2 = [A]^x[2B]^y = 2r_1 = 2 \times [A]^x[B]^y \Rightarrow 2^y = 2 \Rightarrow y = 1$

$r_3 = [2A]^x[2B]^y = 8r_1 = 8 \times [A]^x[B]^y$

$= 2^x \times 2^y = 2^3 = 2^x = 2^2$

Rate = $k[A]^2[B]$

26. A mixture of potassium chlorate, oxalic acid and sulphuric acid is heated. During the reaction which element undergoes maximum change in the oxidation number?

(1) C (2) S (3) H (4) Cl

Sol: [4] ClO_3^- changes to Cl^-

$Cl^{5+} \longrightarrow Cl^{-1}$

27. Which one of the following sets of monosaccharides forms sucrose?

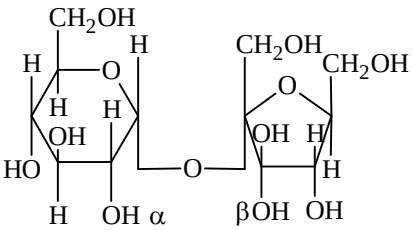
(1) α-D-Glucopyranose and β-D-fructopyranose

(2) α-D-Galactopyranose and α-D-Glucopyranose

(3) α-D-Glucopyranose and β-D-fructofuranose

(4) β-D-Glucopyranose and α-D-fructofuranose

Sol: [3]



28. Which one of the following statements regarding photochemical smog is **not** correct?

(1) Photochemical smog does not cause irritation in eyes and throat

(2) Carbon monoxide does not play any role in photochemical smog formation

(3) Photochemical smog is an oxidizing agent in character

(4) Photochemical smog is formed through photochemical reaction involving solar energy.

Sol: [1] Factual

29. Which of the following statements is **not** valid for oxoacids of phosphorus?

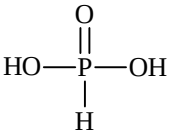
(1) All oxoacids contain atleast one P = O unit and one P – OH group

(2) Orthophosphoric acid is used in the manufacture of triple superphosphate.

(3) Hypophosphorous acid is a diprotic acid.

(4) All oxoacids contain tetrahedral four coordinated phosphorous

Sol: [2]



30. In the following sequence of reactions $CH_3-Br \xrightarrow{KCN} A \xrightarrow{H_3O^+} B \xrightarrow[ether]{LiAlH_4} C$, the end product (C) is

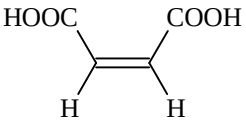
(1) Ethyl alcohol (2) Acetone (3) Methane (4) Acetaldehyde

Sol: [a] $CH_3-Br \xrightarrow{KCN} \underset{(A)}{CH_3CN} \xrightarrow{H_3O^+} \underset{(B)}{CH_3COOH} \xrightarrow{LiAlH_4} \underset{(C)}{CH_3-CH_2-OH}$

31. Which of the following acids does **not** exhibit optical isomerism?

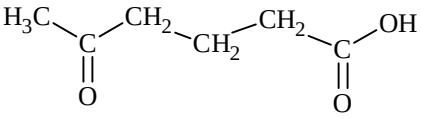
(1) Tartaric acid (2) Maleic acid (3) α-amino acids (4) Lactic acid

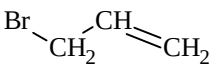
Sol: [2]

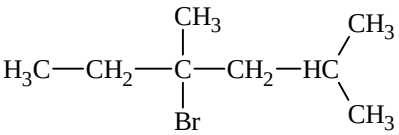


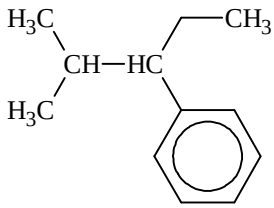
Maleic acid will not show optical isomerism due to absence of chirality.

32. Which nomenclature is **not** according to IUPAC system?

(1) 
5-oxohexanoic acid

(2) 
1-Bromo-prop-2-ene

(3) 
4-bromo-2,4-dimethylhexane

(4) 
2-methylpentan-3-ylbenzene

Sol: **[2]** The correct name of compound will be 3-Bromoprop-1-ene

33. The pair of species with the same bond order is

(1) N_2, O_2 (2) O_2^{2-}, B_2 (3) O_2^{+}, NO^{+} (4) NO, CO

Sol: **[2]** $O_2^{2-} \longrightarrow B.O. = 1$

$B_2 \longrightarrow B.O. = 1$

34. In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide with:

(1) Carbon monoxide (CO) (2) Copper (I) sulphide (Cu_2S)

(3) Sulphur dioxide (SO_2) (4) Iron sulphide (FeS)

Sol: **[2]** Cu_2O is reduced with Cu_2S

It is self reduction phenomena

35. The correct order of decreasing acid strength of trichloroacetic acid (A), trifluoroacetic acid (B), acetic acid (C) and formic acid (D) is:

(1) A > C > B > D (2) B > A > D > C (3) B > D > C > A (4) A > B > C > D

Sol: **[2]** Due to –I effect.

36. Aluminium is extracted from alumina (Al_2O_3) by electrolysis of a molten mixture of :

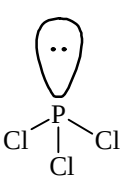
(1) $Al_2O_3 + KF + Na_3AlF_6$ (2) $Al_2O_3 + HF + NaAlF_4$

(3) $Al_2O_3 + CaF_2 + NaAlF_4$ (4) $Al_2O_3 + Na_3AlF_6 + CaF_2$

Sol: **[4]** Alumina + Fluorspar + Cryolite

37. Which of the following species contains three bond pairs and one lone pair around the central atom?

(1) PCl_3 (2) H_2O (3) BF_3 (4) NH_2^-

Sol: **[1]** 

38. Which of the following statements is **false**?

(1) Both starch and cellulose are polymers of glucose

(2) Artificial silk is derived from cellulose

(3) Nylon-66 is an example of elastomer

(4) The repeat unit in natural rubber is isoprene

Sol: [3] Factual

39. The number of octahedral void(s) per atom present in a cubic close-packed structure is

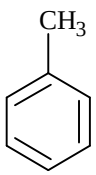
(1) 4 (2) 1 (3) 3 (4) 2

Sol: [2] In ccp the no. of atoms present per unit cell is 4 and total no. of O.V = 4

$\Rightarrow$ per atom the no. of O.V. = 1

40. Among the following compounds the one that is most reactive towards electrophilic nitration is:

(1) Benzene (2) Benzoic acid (3) Nitrobenzene (4) Toluene

Sol: [4] In 

, CH_3 is ortho para directing and also ring activator.

41. Identify the **wrong** statement in the following:

(1) Atomic radius of the elements decreases as one moves across from left to right in the 2nd period of the periodic table

(2) Amongst isoelectronic species, smaller the positive charge on the carbon, smaller is the ionic radius

(3) Amongst isoelectronic species, greater the negative charge on the anion, larger is the ionic radius

(4) Atomic radius of the elements increases as one moves down the first group of the periodic table.

Sol: [2] With increasing positive charge, effective nuclear charge increases so ionic radii decreases.

42. In a zero-order reaction for every 10° rise of temperature, the rate is doubled. If the temperature is increased from 10°C to 100°C, the rate of the reaction will become:

(1) 128 times (2) 256 times (3) 512 times (4) 64 times

Sol: [3] $\frac{r_2}{r_1} = 2$ for every 10°

Temperature is raised from 10° to 100°

So $\frac{r_n}{r_1} = 2^{\frac{\Delta T}{10}} = 2^9$

$r_n = r_1 \times 512$

43. Which of the statements is **not** true?

(1) $K_2Cr_2O_7$ solution becomes yellow on increasing the pH beyond 7

(2) On passing H_2S through acidified $K_2Cr_2O_7$ solution, a milky colour is observed

(3) $Na_2Cr_2O_7$ is preferred over $K_2Cr_2O_7$ in volumetric analysis

(4) $K_2Cr_2O_7$ solution in acidic medium is orange

Sol: [3] Factual

44. In which of the following reactions, standard reaction entropy change ($\Delta S°$) is positive and standard Gibb's energy change ($\Delta G°$) decreases sharply with increasing temperature?

(1) $\frac{1}{2}C\ \text{graphite} + \frac{1}{2}O_2(g) \longrightarrow \frac{1}{2}CO_2(g)$

(2) $C\ \text{graphite} + \frac{1}{2}O_2(g) \longrightarrow CO(g)$

(3) $CO(g) + \frac{1}{2}O_2(g) \longrightarrow CO_2(g)$

(4) $Mg(s) + \frac{1}{2}O_2(g) \longrightarrow MgO(s)$

Sol: [2] $C(g) + \frac{1}{2}O_2(g) \longrightarrow CO(g)$

ΔS° = +ve

45. When Cl_2 gas reacts with hot and concentrated sodium hydroxide solution, the oxidation number of chlorine changes from

(1) Zero to + 1 and zero to –3

(2) Zero to +1 and zero to –5

(3) Zero to –1 and zero to + 5

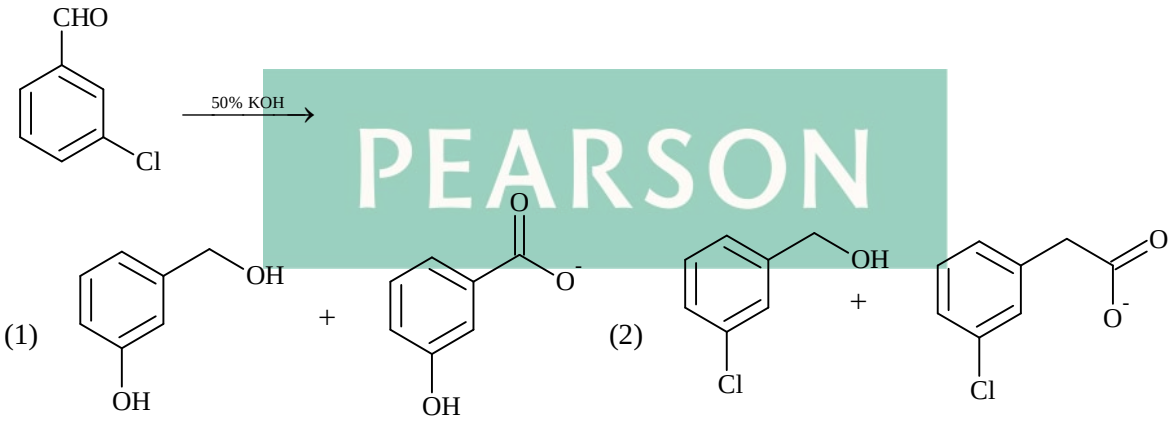
(4) Zero –1 and zero to + 3

Sol: [3] $Cl_2 + NaOH(\text{hot conc.}) \longrightarrow NaCl + NaClO_3$

In NaCl , oxidation no. of Cl is –1

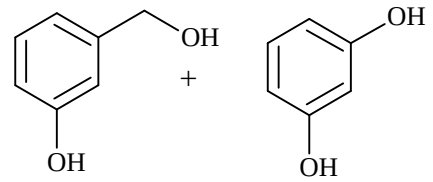
and in ClO_3^-, oxidation no. of Cl is +5

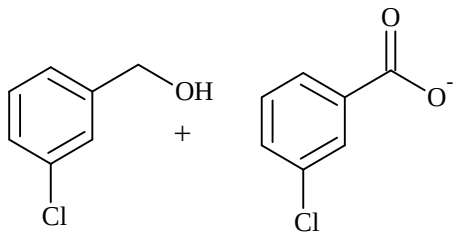
46. Predict the products in the given reaction

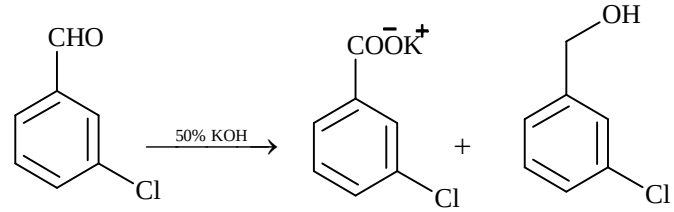


(1)

(2)

(3) 

(4) 

Sol: [4] 

47. Which one of the alkali metals, forms only, the normal oxide, M_2O on heating in air

(1) Na (2) Rb (3) K (4) Li

Sol: [4] $Li + O_2 \longrightarrow Li_2O$

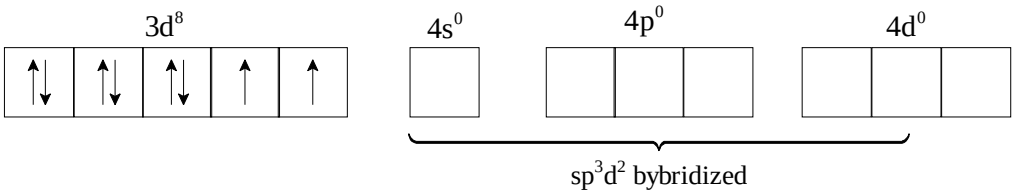
Other forms peroxides and super oxides also

48. Which *one* of the following is an outer orbital complex and exhibits paramagnetic behaviour?

(1) $[Co(NH_3)_6]^{3+}$ (2) $[Ni(NH_3)_6]^{2+}$ (3) $[Zn(NH_3)_6]^{2+}$ (4) $[Cr(NH_3)_6]^{3+}$

Sol: [2] $[Ni(NH_3)_6]^{2+}$

Here in Ni^{2+} the configuration is



Hence it gives outer orbital octahedral complex which is paramagnetic

49. Sulphur trioxide can be obtained by which of the following reaction:

(1) $H_2SO_4 + PCl_5 \xrightarrow{\Delta}$ (2) $CaSO_4 + C \xrightarrow{\Delta}$

(3) $Fe_2(SO_4)_3 \xrightarrow{\Delta}$ (4) $S + H_2SO_4 \xrightarrow{\Delta}$

Sol: [3] $Fe_2(SO_4)_3 \xrightarrow{\Delta} 3SO_3 + Fe_2O_3$

50. Standard enthalpy of vapourisation $\Delta_{vap}H^-$ for water at 100°C is 40.66 kJmol^{-1}. The internal energy of vapourisation of water at 100°C (in kJ mol^{-1}) is

(1) +40.66 (2) +37.56 (3) –43.76 (4) +43.76

Sol: [2] $H_2O(l) \longrightarrow H_2O(g)$

V_1 of liq. H_2O = 18 ml

and V_2 of H_2O (vap) = $\frac{nRT}{P}$

$$= \frac{1 \times 0.0821 \times 373}{1} = 30.6233 \text{ lit}$$

ΔV = (30623.3 ml – 18 ml)

= 30605.3 ml = 30.605 lit

$\Delta E = \Delta H - P\Delta V$

$= 40.66 \times 10^3 J - 1 \times 30.605 \times 101.325$ J

= 36557.9 = 37.5589 kJ mol^{-1}

51. Removal of introns and joining of exons in a defined order during transcription in called

(1) Splicing (2) Looping (3) Inducing (4) Slicing

Ans. [1]

52. Common cold differs from pneumonia in, that

(1) Pneumonia pathogen infects alveoli whereas the common cold affects nose and respiratory passage but not the lungs

(2) Pneumonia is a communicable disease whereas the common cold is a nutritional deficiency disease

(3) Pneumonia can be prevented by a live attenuated bacterial vaccine whereas the common cold has no effective vaccine

(4) Pneumonia is caused by a virus while the common cold is caused by the bacterium *Haemophilus influenzae*

Ans. [1]

53. Which one of the following in not a property of cancerous cells whereas the remaining three are ?

(1) They show contact inhibition

(2) They compete with normal cells for vital nutrients

(3) They do not remain confined in the area of formation

(4) They divide in an uncontrolled manner

Ans. [1]

54. How many plants in the list given below have composite fruits that develop from an inflorescence ? Walnut, poppy, radish, fig, pineapple, apple, tomato, mulberry.

(1) Three (2) Four (3) Five (4) Two

Ans. [1]

55. An organic substance that can withstand environmental extremes and cannot be degraded by any enzyme is

(1) Cellulose (2) Cuticle (3) Sporopollenin (4) Lignin

Ans. [3]

56. Both, autogamy and geitonogamy are prevented in

(1) Maize (2) Papaya (3) Cucumber (4) Castor

Ans. [2]

57. Which part of the human ear plays no role in hearing as such but is otherwise very much required ?

(1) Ear ossicles (2) Eustachian tube

(3) Organ of Corti (4) Vestibular apparatus

Ans. [4]

58. Water containing cavities in vascular bundles are found in

(1) *Pinus* (2) Sunflower (3) Maize (4) *Cycas*

Ans. [3]

59. Which one of the following is a case of wrong matching ?

(1) Callus - Unorganised mass of cells produced in tissue culture

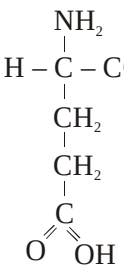
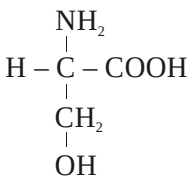
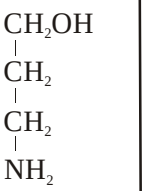
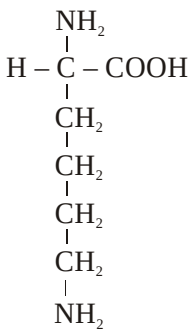
(2) Somatic hybridization - Fusion of two diverse cells

(3) Vector DNA - Site for t-RNA synthesis

(4) Micropropagation - In vitro production of plants in large numbers

Ans. [3]

60. Which one out of A – D given below correctly represents the structural formula of the basic amino acid?

A	B	C	D
			

Options :

(1) B (2) C (3) D (4) A

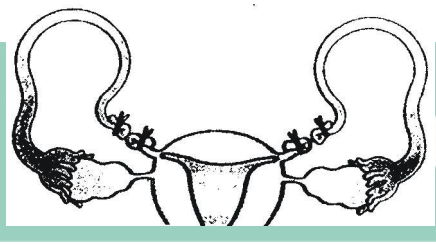
Ans. (3)

61. A patient brought to a hospital with myocardial infarction is normally immediately given

(1) Statins (2) Penicillin (3) Streptokinase (4) Cyclosporin–A

Ans. (3)

62. What is the figure given below showing in particular ?



(1) Vasectomy (2) Ovarian cancer (3) Uterine cancer (4) Tubectomy

Ans. [4]

63. Ribosomal RNA is actively synthesized in

(1) Ribosomes (2) Lysosomes (3) Nucleolus (4) Nucleoplasm

Ans. (3)

64. Which one of the following does not differ in *E.coli* and *Chlamydomonas* ?

(1) Cell membrane (2) Ribosomes

(3) Chromosomal Organization (4) Cell wall

Ans. [1]

65. Which one is the most abundant protein in the animal world ?

(1) Insulin (2) Trypsin (3) Haemoglobin (4) Collagen

Ans. [4]

66. Consumption of which one of the following foods can prevent the kind of blindness associated with vitamin 'A' deficiency ?

(1) Bt-Brinjal (2) 'Flaver Savr' tomato

(3) Canolla (4) Golden rice

Ans. [4]

67. Which one of the following options gives one correct example each of convergent evolution and divergent evolution ?

	Convergent evolution	**Divergent evolution**
(1)	Thorns of Bougainvillia and tendrils of *Cucurbita*	Eyes of Octopus and mammals
(2)	Eyes of octopus and mammals	Bones of forelimbs of vertebrates
(3)	Thorns of Bougainvillia and tendrils of *Cucurbita*	Wings of butterflies and birds
(4)	Bones of forelimbs of vertebrates	Wings of butterfly and birds

Ans. [2]

68. The gynoecium consists of many free pistils in flowers of

(1) *Michelia* (2) *Aloe* (3) Tomato (4) *Papaver*

Ans. [1]

69. Evolution of different species in a given area starting from a point and spreading to other geographical areas is known as

(1) Divergent evolution (2) Adaptive radiation (3) Natural selection (4) Migration

Ans. [2]

70. Which one of the following statements is false in respect of viability of mammalian sperm ?

(1) Sperms must be concentrated in a thick suspension
(2) Sperm is viable for only up to 24 hours
(3) Survival of sperm depends on the pH of the medium and is more active in alkaline medium
(4) Viability of sperm is determined by its motility

Ans. [2]

71. A single strand of nucleic acid tagged with a radioactive molecule is called

(1) Probe (2) Vector (3) Selectable marker (4) Plasmid

Ans. [1]

72. Measuring Biochemical Oxygen Demand (BOD) is a method used for

(1) Working out the efficiency of R.B.Cs. about their capacity to carry oxygen
(2) Estimating the amount of organic matter is sewage water
(3) Working out the efficiency of oil driven automobile engines
(4) Measuring the activity of *Sacccharomyces cerevisae* in producing curd on a commercial scale

Ans. [2]

73. Yeast is used in the production of

(1) Cheese and butter (2) Citric acid and lactic acid
(3) Lipase and pectinase (4) Bread and beer

Ans. [4]

74. In an area where DDT had been used extensively, the population of birds declined significantly because

(1) Many of the birds eggs laid, did not hatch (2) Birds stopped laying eggs
(3) Earthworms in the area got eradicated (4) Cobras were feeding exclusively on birds

Ans. [1]

75. *Pheretima* and its close relatives derive nourishment from

(1) Small pieces of fresh fallen leaves of maize, etc
(2) Sugarcane roots
(3) Decaying fallen leaves and soil organic matter
(4) Soil insects

Ans. (3)

76. People who have migrated from the planes to an area adjoining Rohtang Pass about six months back
(1) Have the usual RBC count but their haemoglobin has very high binding affinuty of O_2
(2) Have more RBCs and their haemoglobin has a lower binding affinity of O_2
(3) Are not physically fit to play games like football
(4) Suffer from altitude sickness with symptoms like nausea, fatigue, etc

Ans. [2]

77. Which one of the following is correctly matched ?
(1) Bakane of rice seedlings – F.Skoog
(2) Passive transport of nutrients – ATP
(3) Apoplast – Plasmodesmata
(4) Potassium – Readily immobilisation

Ans. [4]

78. Maximum nutritional diversity is found in the group
(1) Plantae (2) Fungi (3) Animalia (4) Monera

Ans. [4]

79. Which one of the following is common to multicellular fungi, filamentous algae and protonema of mosses ?
(1) Multiplication by fragmentation
(2) Diplontic life cycle
(3) Members of kingdom Plantae
(4) Mode of Nutrition

Ans. [1]

80. In which one of the following options the two examples are correctly matched with their particular type of immunity ?

	Examples	**Type of immunity**
(1)	Mucus coating of epithelium lining the urinogenital tract and the HCl in stomach	Physiological barriers
(2)	Polymorpho-nuclear leukocytes and monocytes	Cellular barriers
(3)	Anti-tetanus and anti-snake bite injections	Active immunity
(4)	Saliva in mouth and Tears in eyes	Physical barriers

Ans. [2]

81. Which one of the following pairs of hormones are the examples of those that can easily pass through the cell membrane of the target cell and bind to a receptor inside it (mostly in the nucleus)
(1) Cortisol, testosterone
(2) Insulin, glucagon
(3) Thyroxin, Insulin
(4) Somatostatin, oxytocin

Ans. [1]

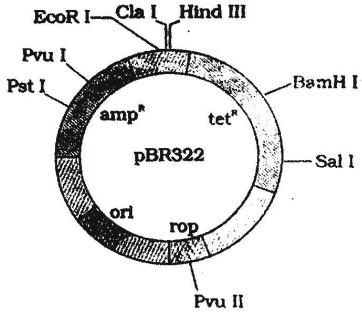
82. Closed vascular bundles lack
(1) Pith (2) Ground tissue (3) Conjunctive tissue (4) Cambium

Ans. [4]

83. Which one of the following is **wrong** statement ?
(1) *Nitrosomonas* and *Nitrobacter* are chemoautotrophs
(2) *Anabaena* and *Nostoc* are capable of fixing nitrogen in free-living state also
(3) Root nodule forming nitrogen fixers live as aerobes under free-living conditions
(4) Phosphorus is a constituent of cell membranes, certain nucleic acids and all proteins

Ans. [4]

84. The figure below is the diagrammatic representation of the *E.Coli* vector pRB 322. Which one of the given options correctly identifies its certain component (s) ?



(1) amp^R, tet^R- antibiotic resistance genes (2) ori-original restriction enzyme
(3) rop-reduced osmotic pressure (4) Hind III, EcoRI-selectable markers

Ans. [1]

85. Which one of the following is a correct statement ?
(1) Origin of seed habit can be traced in pteridophytes
(2) Pteridophyte gametophyte has a protonemal and leafy stage
(3) In gymnosperms female gametophyte is free-living
(4) Antheridiophores and archegoniophores are present in pteridophytes

Ans. [1]

86. Widal Test is carred out to test
(1) Typhoid fever (2) Malaria (3) Diabetes mellitus (4) HIV/AIDS

Ans. [1]

87. The maximum amount of electrolytes and water (70 – 80 percent) from the glomerular filtrate is reabsorbed in which part of the nephron ?
(1) Descending limb of loop of Henle (2) Ascending limb of loop of Henle
(3) Distal convoluted tubule (4) Proximal convoluted tubule

Ans. [4]

88. The Test-tube Baby Programme employs which one of the following techniques ?
(1) Zygote intra fallopian transfer (ZIFT) (2) Intra cytoplasmic sperm injection (ICSI)
(3) Intra uterine insemination (IUI) (4) Gamete intra fallopian transfer (GIFT)

Ans. [1]

89. Which one of the following is a wrong statement ?
(1) Eutrophication is a natural phenomenon in freshwater bodies
(2) Most of the forests have been lost in tropical areas
(3) Ozone in upper part of atmosphere is harmful to animals
(4) Greenhouse effect is a natural phenomenon

Ans. (3)

90. Identify the possible line "A" in the following food chain : Plant $\rightarrow$ insect $\rightarrow$ frog $\rightarrow$ "A" $\rightarrow$ Eagle
(1) Parrot (2) Rabbit (3) Wolf (4) Cobra

Ans. [4]

91. The human hind brain comprises three parts, one of which is
(1) Hypothalamus (2) Spinal cord (3) Corpus callosum (4) Cerebellum

Ans. [4]

92. PCR and Restriction Fragment Length Polymorphism are the methods for
(1) Genetic Fingerprinting (2) Study of enzymes
(3) Genetic transformation (4) DNA sequencing

Ans. [1]

93. Which one of the following areas in India, is a hotspot of biodiversity ?
(1) Western Ghats (2) Eastern Ghats (3) Gangetic Plain (4) Sunderbans

Ans. [1]

94. Phyllode is present in

(1) *Opuntia* (2) *Asparagus* (3) *Euphorbia* (4) Australian Acacia

Ans. [4]

95. The highest number of species in the world is represented by

(1) Lichens (2) Fungi (3) Mosses (4) Algae

Ans. [2]

96. Motile zygote of *Plasmodium* occurs in

(1) Human liver (2) Gut of female *Anopheles*

(3) Salivary glands of *Anopheles* (4) Human RBCs

Ans. [2]

97. Select the correct statement regarding the specific disorder of muscular or skeletal system

(1) *Gout*-inflammation of joints due to extra deposition of calcium

(2) *Muscular dystrophy*-age related shortening of muscles

(3) *Osteoporosis*-decrease in bone mass and higher chances of fractures with advancing age

(4) *Myasthenia gravis*-Auto immune disorder which inhibits sliding of myosin filaments

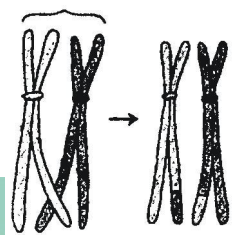
Ans. [3]

98. Vexillary aestivation is characteristic of the family

(1) Brassicaceae (2) Fabaceae (3) Asteraceae (4) Solanaceae

Ans. [2]

99. Give below is the representation of a certain event at a particular stage of a type of cell division. Which is this stage ?



(1) Both prophase and metaphases of mitosis (2) Prophase I during meiosis

(3) Prophase II during meiosis (4) Prophase of Mitosis

Ans. [2]

100. Which statement is wrong for viruses ?

(1) Antibiotics have no effect on them

(2) All are parasites

(3) All of them have helical symmetry

(4) They have ability to synthesize nucleic acids and proteins

Ans. [3]

101. The correct sequence of cell organelles during photorespiration is

(1) Chloroplast, -vacuole, -peroxisome

(2) Chloroplast,-Golgibodies,-mitochondria

(3) Chloroplast,-Rough Endoplasmic reticulum,-Dictyosomes

(4) Chloroplast,-mitochondria,-peroxisome

Ans. [4]

102. Which one of the following is an example of carrying out biological control of pests/diseases using microbes ?

(1) Lady bird beetle against aphids in mustard

(2) *Trichoderma* sp. against certain plant pathgens

(3) Nucleopolyhedrovirus against white rust in *Brassica*

(4) Bt-cotton to increase cotton yield

Ans. [2]

103. The extinct human who lived 1,00,000 to 40,000 years ago, in Europe, Asia and parts of Africa, with short stature, heavy eye brows, retreating for heads, large jaws with heavy teeth, stocky bodies, a lumbering gait and stooped posture was

(1) *Ramapithecus* (2) *Homo habilis*

(3) Neanderthal human (4) Cro-magnan humans

Ans. [3]

104. A normal-visioned man whose father was colour-blind, marries a woman whose father was also colour-blind. They have their first child as a daughter. What are the chances that this child would be colour-blind ?

(1) 50% (2) 100% (3) Zero percent (4) 25%

Ans. [3]

105. Best defined function of Manganese in green plants is

(1) Water absorption (2) Photolysis of water (3) Calving cycle (4) Nitrogen fixation

Ans. [2]

106. Even in absence of pollinating agents seed-setting is assured in

(1) Fig (2) *Commellina* (3) *Zostera* (4) *Salvia*

Ans. [2]

107. What was the most significant trend in the evolution of modern man (*Homo sapiens*) from his ancestors?

(1) Upright posture (2) Shortening of jaws

(3) Binocular vision (4) Increasing cranial capacity

Ans. [4]

108. The most abundant prokaryotes helpful to humans in marking curd from milk and in production of antibiotics are the ones categorised as

(1) Heterotrophic bacteria (2) Cyanobacteria

(3) Archaebacteria (4) Chemosynthetic autotrophs

Ans. [1]

109. A person entering an empty room suddenly finds a snake right in front on opening the door. Which one of the following is likely to happen in his neuro-hormonal control system ?

(1) Sympathetic nervous system is activated releasing epinephrin and norepinephrin from adrenal cortex

(2) Sympathetic nervous system is activated releasing epinephrin and norepinephrin from adrenal medulla

(3) Neurotransmitters diffuse rapidly across the cleft and transmit a nerve impulse

(4) Hypothalamus activates the parasympathetic division of brain

Ans. [2]

110. Which one single organisms or the pair of organisms is correctly assigned to its or their named taxonomic group ?

(1) *Nostoc* and *Anabaena* are examples of protista

(2) *Paramecium* and *Plasmodium* belong to the same kingdom as that of *Penicillium*

(3) Lichen is a composite organism formed from the symbiotic association of an algae and a protozoan

(4) Yeast used in making bread and beer is a fungus

Ans. [4]

111. In a normal pregnant woman, the amount of total gonadotropin activity was assessed. The result expected was

(1) High level of circulating HCG to stimulate estrogen and progesterone synthesis

(2) High level of circulating FSH and LH in the uterus to stimulate implantation of the embryo

(3) High level of circulating HCG to stimulate endometrial thickening

(4) High levels of FSH and LH in uterus to stimulate endometrial thickening

Ans. [1]

112. Which part would be most suitable for raising virus-free plants for micropropagation ?

(1) Node (2) Bark (3) Vascular tissue (4) Meristem

Ans. [4]

113. The Leydig cells as found in the human body are the secretory source of

(1) Androgens (2) Progesterone (3) Intestinal mucus (4) Glucagon

Ans. [1]

114. Which one of the following is not a part of a transcription unit in DNA ?

(1) The structural gene (2) The inducer (3) A terminator (4) A promoter

Ans. [2]

115. Gymnosperms are also called soft wood spermatophytes because they lack

(1) Xylem fibres (2) Cambium

(3) Phloem fibres (4) Thick-walled tracheids

Ans. [4]

116. *Cycas* and *Adiantum* resemble each other in having

(1) Vessels (2) Seeds (3) Motile Sperms (4) Cambium

Ans. [3]

117. A certain road accident patient with unknown blood group needs immediate blood transfusion. His one doctor friend at once offers his blood. What was the blood group of the donor ?

(1) Blood group A (2) Blood group B (3) Blood group AB (4) Blood group O

Ans. [4]

118. Compared to those of humans, the erythrocytes in frog are

(1) Nucleated and without haemoglobin (2) Without nucleus but with haemoglobin

(3) Nucleated and with haemoglobin (4) Very much smaller and fewer

Ans. [3]

119. A nitrogen-fixing microbe associated with *Azolla* in rice fields is

(1) *Tolypothrix* (2) *Spirulina* (3) *Anabaena* (4) *Frankia*

Ans. [3]

120. What is correct to say about the hormone action in humans ?

(1) FSH stimulates the secretion of estrogen and progesterone

(2) Glucagon is secreted by β-cells of Islets of Langerhans and stimulates glycogenolysis

(3) Secretion of thymosins is stimulated with aging

(4) If females, FSH first binds with specific receptors on ovarian cell membrane

Ans. [4]

121. Cymose inflorescence is present in

(1) *Brassica* (2) *Solanum* (3) *Sesbania* (4) *Trifolium*

Ans. [2]

122. Which one of the following is correctly matched ?

(1) Yeast – Zoospores (2) Onion – Bulb

(3) Ginger – Sucker (4) *Chlamydomonas* – Conidia

Ans. [2]

123. What is true about ribosomes ?

(1) These are self - splicing introns of some RNAs

(2) The prokaryotic ribosomes are 80S, where "S" stands for sedimentation coefficient

(3) These are composed of ribonucleic acid and proteins

(4) These are found only in eukaryotic cells

Ans. [3]

124. A process that makes important difference between C_3 and C_4 plants is

(1) Photorespiration (2) Transpiration (3) Glycolysis (4) Photosynthesis

Ans. [1]

125. Placentation in tomato and lemon is

(1) Axile (2) Parietal (3) Free central (4) Marginal

Ans. [1]

126. If one strand of DNA has the nitrogenous base sequence as ATCTC, what would be the complementary RNA strand sequence ?

(1) ATCGU (2) TTAGU (3) UAGAC (4) AACTG

Ans. [3]

127. Select the correct statement from the following regarding cell membrane

(1) Fluid mosaic model of cell membrane was proposed by Singer and Nicolson

(2) Na^+ and K^+ ions move across cell membrane by passive transport

(3) Proteins make up 60 to 70% of the cell membrane

(4) Lipids are arranged in a bilayer with polar heads towards the inner part

Ans. [1]

128. For transfomation, micro-particles coated with DNA to be bombarded with gene gun are made up of

(1) Gold or Tungsten (2) Silver or Platinum (3) Platinum or Zinc (4) Silicon or Platinum

Ans. [1]

129. Which one is a true statement regarding DNA polymerase used in PCR ?

(1) It remains active at hight temperature

(2) It is used to ligate introduced DNA in recipient cells

(3) It serves as a selectable marker

(4) It is isolated from a virus

Ans. [1]

130. The upright pyramid of number is absent in

(1) Grassland (2) Pond (3) Forest (4) Lake

Ans. [3]

131. Signals for parturition originate from

(1) Fully developed foetus only

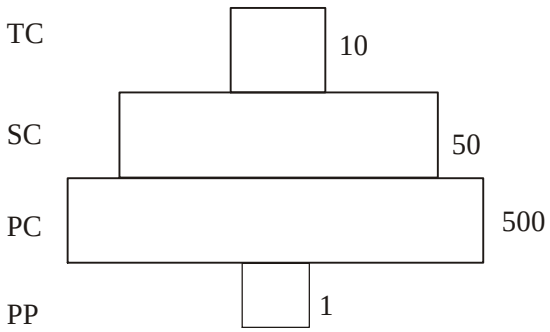
(2) Both placenta as well as fully developed foetus

(3) Oxytocin released from maternal pituitary

(4) Placenta only

Ans. [2]

132. Given below is an imaginary pyramid of numbers. What could be one of the possibilities about certain organisms at some of the different levels ?



(1) Level PC is "rats" and level SC is "cats"

(2) Level PC is "insects" and level SC is "small insectivorous birds"

(3) Level PP is "phytoplanktons" in sea and "Whale" on top level TC

(4) Level one PP is "pipal trees" and the level SC is "sheep

Ans. [2]

133. The common bottle cork is a product of

(1) Vascular Cambium (2) Dermatogen (3) Phellogen (4) Xylem

Ans. [3]

134. Nuclear membrane is absent in

(1) *Nostoc* (2) *Penicillium* (3) *Agaricus* (4) *Volvox*

Ans. [1]

135. The cyanobacteria are also referred to as

(1) Blue green algae (2) Protists (3) Golden algae (4) Slime moulds

Ans. [1]

136. Which one of the following microbes forms symbiotic association with plants and helps them in their nutrition ?

(1) *Trichoderma* (2) *Azotobacter* (3) *Aspergillus* (4) *Glomus*

Ans. [4]

137. Which one of the following is not a functional unit of an exosystem ?

(1) Stratification (2) Energy flow (3) Decomposition (4) Productivity

Ans. [1]

138. During gamete formation, the enzyme recombinase participates during

(1) Prophase-II (2) Metaphase-I (3) Anaphase-II (4) Prophase-I

Ans. [4]

139. Anxiety and eating spicy food together in an otherwise normal human, may lead to

(1) Vomiting (2) Indigestion (3) Jaundice (4) Diarrhoea

Ans. [2]

140. Removal of RNA polymerase III from nucleoplasm will affect the synthesis of

(1) rRNA (2) tRNA (3) hnRNA (4) mRNA

Ans. [2]

141. In which one of the following, the genus name, its two characters and its phylum are not correctly matched, whereas the remaining three are correct ?

	Genus Name	**Two Characters**		**Phylum**
(1)	*Periplaneta*	(a)	Jointed appendages	Arthropoda
		(b)	Chitinous exoskeleton	
(2)	*Pila*	(a)	Body segmented	Mollusca
		(b)	Mouth with radula	
(3)	*Asterias*	(a)	Spiny Skinned	Echinodermata
		(b)	Water vascular system	
(4)	*Sycon*	(a)	Pore bearing	Porifera
		(b)	Canal system	

Ans. [2]

142. F_2 generation in a Mendelian cross showed that both genotypic and phenotypic ratios are same as 1 : 2 : 1. It represents a case of

(1) Monohybrid cross with incomplete dominance

(2) Co-dominance

(3) Dihybrid cross

(4) Monohybrid cross with complete dominance

Ans. [1]

143. Select the correct statement from the ones given below with respect to *Periplaneta americana*

(1) Grinding of food is carried out *only* by the mouth parts

(2) Nervous system located dorsally, consists of segmentally arranged ganglia joined by a pair of longitudinal connectives

(3) Males bear a pair of short thread like anal styles

(4) There are 16 very long Malpighian tubules present at the junctions of midgut and hindgut

Ans. [3]

144. Cirrhosis of liver is caused by the chronic intake of

(1) Cocaine (2) Opium

(3) Alcohol (4) Tobacco (Chewing)

Ans. [3]

145. *Monascus purpureus* is a yeast used commercially in the production of

(1) Blood cholesterol lowering statins

(2) Ethanol

(3) Streptokinase for removing clots from the blood vessels

(4) Citric acid

Ans. [1]

146. The coconut water and the edible part of coconut are equivalent to

(1) Embryo (2) Endosperm (3) Endocarp (4) Mesocarp

Ans. [2]

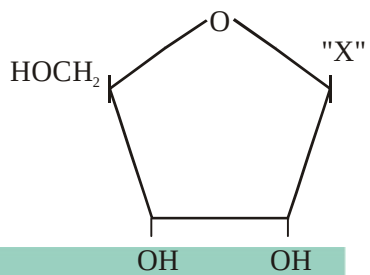
147. Companion cells are closely associated with

(1) Guard cells (2) Sieve elements (3) Vessel elements (4) Trichomes

Ans. [2]

148. Given below is the diagrammatic representation of one of the categories of small molecular weight organic compounds in the living tissues. Identify the category shown and the *one blank* component "X" in it

	Category	**Component**
(1)	Nucleoside	Uracil
(2)	Cholesterol	Guanin
(3)	Amino acid	NH_2
(4)	Nucleotide	Adenine



Ans. [1]

149. Which one of the following is not a gaseous biogeochemical cycle in ecosystem ?

(1) Carbon cycle (2) Sulphur cycle (3) Phosphorus cycle (4) Nitrogen cycle

Ans. [3]

150. Which one of the following is the correct statement for respiration in humans ?

(1) About 90% of carbon dioxide (CO_2) is carried by haemoglobin as carbamino-haemoglobin

(2) Cigarette smoking may lead to inflammation of bronchi

(3) Neural signals from pneumotoxic centre in pons region of brain can increase the duration of inspiration

(4) Workers in grinding and stone-breaking industries may suffer, from lung fibrosis.

Ans. [4]

151. In a CE transistor amplifier, the audio signal voltage across the collector resistance of 2 kΩ is 2V. If the base resistance is 1 kΩ and the current amplification of the transistor is 100, the input signal voltage is

(1) 10 mV (2) 0.1 V (3) 1.0 V (4) 1 mV

Sol: [1] $\frac{2}{V_i} = 100 \times \frac{2 \times 10^3}{10^3}$

$\Rightarrow V_i = 10$ mV

152. A coil of resistance 400 Ω is placed in a magnetic field. If the magnetic flux ϕ (wb) linked with the coil varies with time t (sec) as $\phi = 50\,t^2 + 4$, the current in the coil at $t = 2$ sec is

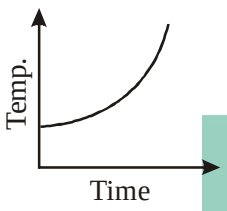
(1) 1 A (2) 0.5 A (3) 0.1 A (4) 2 A

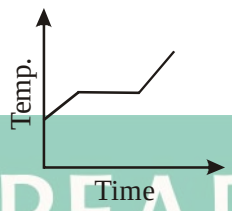
Sol: [2] $|emf| = \frac{d\phi}{dt} = 100t$

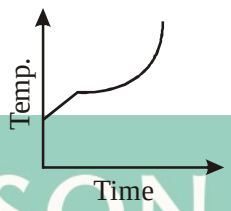
at $t = 2$, $emf = 200$ V

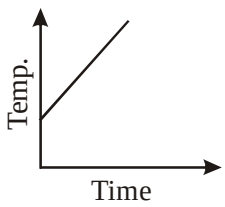
$\Rightarrow i = \frac{200}{400} = 0.5$ A

153. Liquid oxygen at 50 K is heated to 300 K at constant pressure of 1 atm. The rate of heating is constant. Which one of the following graphs represents the variation of temperature with time?

(1) 

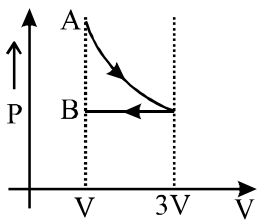
(2) 

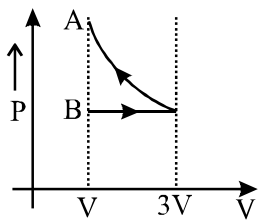
(3) 

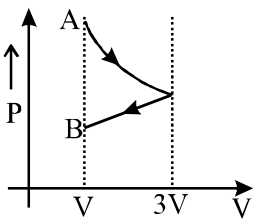
(4) 

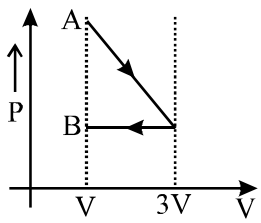
Sol: [2] Factual

154. One mole of an ideal gas goes form an initial state A to final state B via two processes: It first undergoes isothermal expansion from volume V to 3V and then its volume is reduced from 3V to V at constant pressure. The correct P-V diagram representing the two processes is:

(1) 

(2) 

(3) 

(4) 

Sol: [1] Factual

155. A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity 4 ms^{-1}. It collides with a horizontal spring of force constant 200 Nm^{-1}. The maximum compression produced in the spring will be

(1) 0.2 m (2) 0.5 m (3) 0.6 m (4) 0.7 m

Sol: [3] $\frac{1}{2}\times 3(4)^2+\frac{1}{2}\times\frac{(3\times R^2)}{2}\times\left(\frac{4}{R}\right)^2=\frac{1}{2}\ Kx^2$

$\Rightarrow x = 0.6$ m

156. An electric dipole of moment '*p*' is placed in an electric field of intensity 'E'. The dipole acquires a position such that the axis of the dipole makes an angle θ with the direction of the field. Assuming that the potential energy of the dipole to be zero when θ = 90°, the torque and the potential energy of the dipole will respectively be

(1) pE cosθ, – pE sinθ (2) pE sinθ, – pE cosθ (3) pE sinθ, – 2pE cosθ (4) pEsinθ, 2pEcosθ

Sol: [2] Potential energy = $-\vec{P}.\vec{E}$

157. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is

(1) θ = 45° (2) $\theta=\tan^{-1}\left(\frac{1}{4}\right)$ (3) $\theta=\tan^{-1}(4)$ (4) $\theta=\tan^{-1}(2)$

Sol: [3] $\frac{u^2\sin^2\theta}{2g}=\frac{2u^2\sin\theta\cos\theta}{g}$

$\Rightarrow \tan\theta = 4 \Rightarrow \theta = \tan^{-1}(4)$

158. If the nuclear radius of ^{27}Al is 3.6 Fermi, the approximate nuclear radius of ^{64}Cu in Fermi is:

(1) 3.6 (2) 2.4 (3) 1.2 (4) 4.8

Sol: [4] $R \propto A^{1/3}$

$\Rightarrow \left(\frac{3.6}{R}\right)=\left(\frac{27}{64}\right)^{1/3}=\frac{3}{4} \Rightarrow R = 4.8$ F

159. Two similar coils of radius R are lying concentrically with their planes at right angles to each other. The currents flowing in them are I and 2I, respectively. The resultant magnetic field induction at the centre will be

(1) $\frac{\mu_0 I}{R}$ (2) $\frac{\sqrt{5}\mu_0 I}{2R}$ (3) $\frac{3\mu_0 I}{2R}$ (4) $\frac{\mu_0 I}{2R}$

Sol: [2] $B=\sqrt{\left(\frac{\mu_0 I}{2R}\right)+\left(\frac{\mu_0\times 2I}{2R}\right)^2}=\frac{\sqrt{5}\mu_0 I}{2R}$

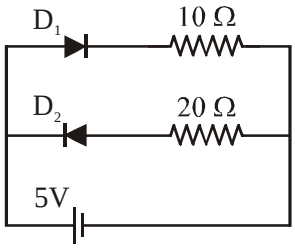
160. When a biconvex lens of glass having refractive index 1.47 is dipped in a liquid, it acts as a plane sheet of glass. This implies that the liquid must have refractive index

(1) less than that of glass (2) equal to that of glass

(3) less than one (4) greater than that of glass

Sol: [2] $\frac{1}{f}=\left(\frac{\mu_2}{\mu_1}-1\right)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

161. Two ideal diodes are connected to a battery as shown in the circuit. The current supplied by the battery is



(1) 0.5 A (2) 0.75 A

(3) zero (4) 0.25 A

Sol: **[1]** D_1 is forward bias while D_2 is reverse bias

$$\Rightarrow i = \frac{5}{10} = 0.5\ \text{A}$$

162. Two spheres A and B of masses m_1 and m_2 respectively collide. A is at rest initially and B is moving with velocity v along x-axis. After collision B has a velocity $\frac{v}{2}$ in a direction perpendicular to the original direction. The mass A moves after collision in the direction

(1) $\theta = \tan^{-1}(-½)$ to the x-axis (2) same as that of B

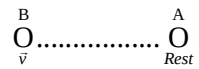
(3) opposite to that of B (4) $\theta = \tan^{-1}(½)$ to the x-axis

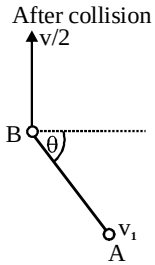
Sol: **[4]** $m_1 v_1 \cos\theta = m_2 v$ ....(i)

$m_1 v_1 \sin\theta = m_2 v/2$ ....(ii)

Divide : (ii) by (i) $\tan\theta = \frac{1}{2} \Rightarrow \theta = \tan^{-1}\frac{1}{2}$

Before collision





163. A particle has initial velocity $(2\vec{i} + 3\vec{j})$ and acceleration $(0.3\vec{i} + 0.2\vec{j})$. The magnitude of velocity after 10 seconds will be

(1) 9 units (2) $9\sqrt{2}$ units (3) $5\sqrt{2}$ units (4) 5 units

Sol: **[3]** $\vec{v} = \vec{u} \perp \vec{a}t$

$= (2\hat{i} + 3\hat{j}) + (0.3\hat{i} + 0.2\hat{j}) \times 10$

$= (5\hat{i} + 5\hat{j})$

$\Rightarrow |\vec{v}| = 5\sqrt{2}$ units

164. The height which the weight of a body becomes 1/16th, its weight on the surface of earth (radius R) is

(1) 4 R (2) 5 R (3) 15 R (4) 3 R

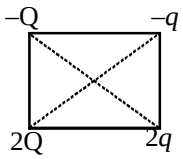
Sol: **[4]** $\frac{g}{16} = \frac{g}{\left(1+\frac{h}{R}\right)^2}$

$\Rightarrow \left(1+\frac{h}{R}\right) = 4 \qquad (h = 3R)$

165. Four point charges $-Q$, $-q$, $2q$ and $2Q$ are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is

(1) $Q = \frac{1}{q}$ (2) $Q = -q$ (3) $Q = -\frac{1}{q}$ (4) $Q = q$

Sol: **[2]** $O = \frac{k(-Q)}{x} + \frac{k(-q)}{x} + \frac{k(2q)}{x} + \frac{k(2Q)}{x}$



$\Rightarrow Q + q = 0$

$\Rightarrow Q = -q$

166. When a string is divided into three segments of length l_1, l_2 and l_3, the fundamental frequencies of these three segments are v_1, v_2 and v_3 respectively. The original fundamental frequency (v) of the string is

(1) $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{\sqrt{v_2}} + \frac{1}{\sqrt{v_3}}$

(2) $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$

(3) $v = v_1 + v_2 + v_3$

(4) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$

Sol: **[4]** $v = \frac{v}{2l}$

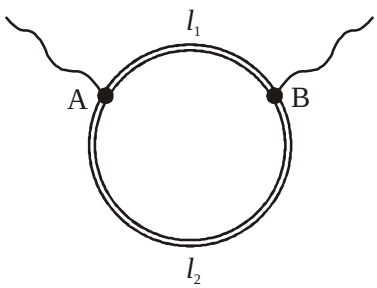
$v_1 = \frac{v}{2l_1}$

$v_2 = \frac{v}{2l_2}$

$v_3 = \frac{v}{2l_3}$

$\Rightarrow \frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$

167. A ring is made of a wire having a resistance $R_0 = 12\ \Omega$. Find the points A and B, as shown in the figure, at which a current carrying conductor should be connected so that the resistance R of the sub circuit between these points is equal to $\frac{8}{3}\Omega$



(1) $\frac{l_1}{l_2} = \frac{1}{2}$

(2) $\frac{l_1}{l_2} = \frac{5}{8}$

(3) $\frac{l_1}{l_2} = \frac{1}{3}$

(4) $\frac{l_1}{l_2} = \frac{3}{8}$

Sol: **[1]** $\left(\frac{A}{\rho l_1} + \frac{A}{\rho l_2}\right) = \frac{3}{8}$ ....(i)

$\frac{\rho(l_1 + l_2)}{A} = 12$ .... (ii)

Solving $\frac{l_1}{l_2} = \frac{1}{2}$

168. A geostationary satellite is orbiting the earth at a height of 5R above the surface of the earth, R being the radius of the earth. The time period of another satellite in hours at a height of 2R from the surface of the earth is

(1) $\frac{6}{\sqrt{2}}$ (2) 5 (3) 10 (4) $6\sqrt{2}$

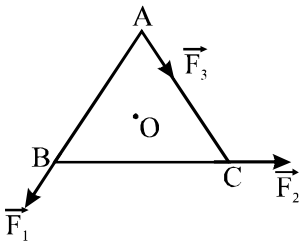
Sol: [4] $\because \quad T^2 \propto r^3$

$$\Rightarrow \quad \left(\frac{24}{T}\right) = \left(\frac{6R}{3R}\right)^{3/2}$$

$$\frac{24}{T} = 2\sqrt{2}$$

$$T = 6\sqrt{2}$$

169. ABC is an equilateral triangle with O as its centre. $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$ represent three forces acting along the sides AB, BC and AC respectively. If the total torque about O is zero then the magnitude of $\vec{F}_3$ is

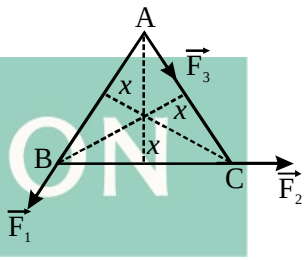


(1) $2(F_1 + F_2)$ (2) $F_1 + F_2$

(3) $F_1 - F_2$ (4) $\frac{F_1 + F_2}{2}$

Sol: [2] $F_2 \times x - F_3 \times x + F_1 \times x = 0$

$F_3 = F_1 + F_2$



170. If the radius of a star is R and it acts as a black body, what would be the temperature of the star, in which the rate of energy production is Q?

(1) $\left(\frac{Q}{4\pi R^2\sigma}\right)^{1/4}$ (2) $\frac{Q}{4\pi R^2\sigma}$ (3) $\left(\frac{Q}{4\pi R^2\sigma}\right)^{-1/2}$ (4) $\left(4\pi R^2 Q/\sigma\right)^{1/4}$

(σ stands for Stefan's constant)

Sol: [1] $Q = 4\pi R^2\sigma T^4$

$$\Rightarrow \quad T = \left(\frac{Q}{4\pi R^2\sigma}\right)^{1/4}$$

171. When a mass is rotating in a plane about a fixed point, its angular momentum is directed along:

(1) the tangent to the orbit

(2) a line perpendicular to the plane of rotation

(3) the line making an angle of 45° to the plane of rotation

(4) the radius

Sol: [2] Factual

172. Two sources of sound placed close to each other, are emitting progressive waves given by

$y_1 = 4 \sin 600 \pi t$ and $y_2 = 5 \sin 608 \pi t$. An observer located near these two sources of sound will hear:

(1) 4 beats per second with intensity ratio 81 : 1 between waxing and waning

(2) 4 beats per second with intensity ratio 25 : 16 between waxing and waning

(3) 8 beats per second with intensity ratio 25 : 16 between waxing and waning

(4) 8 beats per second with intensity ratio 81 : 1 between waxing and waning

Sol: [1] $\frac{I_1}{I_2} = \frac{(A_1 + A_2)^2}{(A_1 - A_2)^2} = \frac{81}{1}$

Beat frequency = 304 – 300 = 4 Hz.

173. A car of mass 1000 kg negotiates a banked curve of radius 90 m on a frictionless road. If the banking angle is 45°, the speed of the car is

(1) 10 ms^{-1} (2) 20 ms^{-1} (3) 30 ms^{-1} (4) 5 ms^{-1}

Sol: [3] $\tan\theta = \frac{v^2}{rg} \Rightarrow v = \sqrt{90 \times 10 \times \tan 45^\circ} = 30 \text{ m/sec}$

174. The magnifying power of a telescope is 9. When it is adjusted for parallel rays the distance between the objective and eyepiece is 20 cm. The focal length of lenses are

(1) 11 cm, 9 cm (2) 10 cm, 10 cm (3) 15 cm, 5 cm (4) 18 cm, 2 cm

Sol: [4] $f_0 + f_e = 20$ ... (i)

$\left|\frac{f_0}{f_e}\right| = a$ ... (ii)

Solving, $f_0 = 18$ cm

$f_e = 2$ cm

175. What is the flux through a cube of side 'a' if a point charge of q is at one of its corner?

(1) $\frac{q}{2\epsilon_0}6a^2$ (2) $\frac{2q}{\epsilon_0}$ (3) $\frac{q}{8\epsilon_0}$ (4) $\frac{q}{\epsilon_0}$

Sol: [3] Application of Gauss's theorem

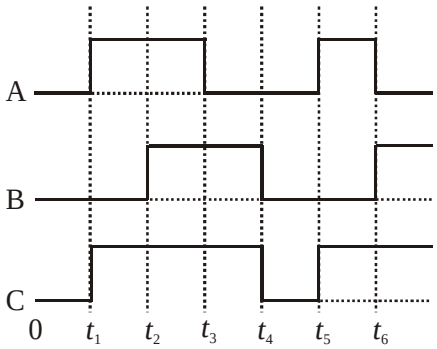
176. An α-particle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb/m^2. The de Broglie wavelength associated with the particle will be

(1) 0.01 Å (2) 1 Å (3) 0.1 Å (4) 10 Å

Sol: [1] $0.83 \times 10^2 = \left(\frac{P}{2eB}\right)$ ... (i)

$$\lambda = \frac{h}{p} = \left(\frac{6.6 \times 10^{-34}}{0.83 \times 10^{-2} \times 2 \times 1.6 \times 10^{-19} \times 0.25}\right) = 9.94 \times 10^{-13} m \approx 0.01 \text{ Å}$$

177. The figure shows a logic circuit with two inputs A and B and the output C. The voltage wave forms across A, B and C are as given. The logic circuit gate is



(1) NAND gate (2) OR gate (3) NOR gate (4) AND gate

Sol: [2]

A	B	C
0	0	0
1	0	1
0	1	1
1	1	1

or Gate

178. A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole. It:

(1) will stay in east-west direction only (2) will become rigid showing no movement

(3) will stay in any position (4) will stay in north-south direction only

Sol: [2] Magnetic field is vertical at poles.

179. A spherical planet has a mass M_p and diameter D_p. A particle of mass m falling freely near the surface of this planet will experience an acceleration due to gravity, equal to

(1) $4\,GM_p\,m\,/\,D_p^2$ (2) $4GM_p\,/\,D_p^2$ (3) $GM_p\,m/D_p^2$ (4) $GM_p\,/\,D_p^2$

Sol: [2] $g=\dfrac{GM_P}{R^2}=\dfrac{GM_P}{(D_{P/2})^2}=\dfrac{4GM_P}{D_P^2}$

180. A 200 W sodium street lamp emits yellow light of wavelength 0.6 μm. Assuming it to be 25% efficient in converting electrical energy to light, the number of photons of yellow light it emits per second is

(1) 3×10^{19} (2) 1.5×10^{20} (3) 6×10^{18} (4) 62×10^{20}

Sol: [2] Energy emitted = $200\times\dfrac{25}{100}=50\text{ W}=50\text{ J/sec.}$

No. of photons = $\dfrac{50\times0.6\times10^{-6}}{6.6\times10^{-34}\times3\times10^{8}}=1.5\times10^{20}$

181. The potential energy of a particle in a force field is: $U=\dfrac{A}{r^2}-\dfrac{B}{r}$, where A and B are positive constants and r is the distance of particle from the centre of the field. For stable equilibrium the distance of the particle is

(1) B/A (2) B/2A (3) 2A/B (4) A/B

Sol: [3] $F = -\left(\frac{dV}{dr}\right) = -\left(\frac{-2A}{r^3} + \mathrm{B}\right) r^2 = c$

$\Rightarrow \quad r = \frac{2A}{B}$

182. An electrons of a stationary hydrogen atom passes from the fifth energy level to the ground level. The velocity that the atom acquired as a result of photon emission will be

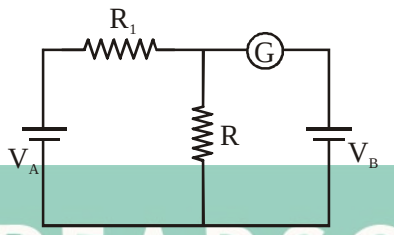
(1) $\frac{24m}{25hR}$ (2) $\frac{24hR}{25m}$ (3) $\frac{25hR}{24m}$ (4) $\frac{25m}{24hR}$

(*m* is the mass of the electron, *R*, Rydberg constant and *h*, Planck's constant)

Sol: [2] Momentum of atom, $P = \left(\frac{\Delta E}{C}\right)$

Velocity of H_2 atom = $\left(\frac{P}{m}\right) = \frac{\Delta E}{mc} = \frac{hcR}{mc}\left(1 - \frac{1}{25}\right) = \frac{h \times R}{m}\left(\frac{24}{25}\right) = \left(\frac{24h \times R}{25\,m}\right)$

183. In the circuit shown the cells A and B have negligible resistances. For V_A = 12V, R_1 = 500 Ω and R = 100 Ω the galvanometer (G) shows no deflection. The value of V_B is



(1) 6 V (2) 4 V (3) 2 V (4) 12 V

Sol: [3] $i = \frac{12}{600} = \frac{1}{50} A$

P.D. across, *R* = 100 Ω = $100 \times \frac{1}{50} = 2$ volt

184. Monochromatic radiation emitted when electron on hydrogen atom jumps from first excited to the ground state irradiates a photosensitive material. The stopping potential is measured to be 3.57 V. The threshold frequency of the material is

(1) 2.5×10^{15} Hz (2) 4×10^{15} Hz (3) 5×10^{15} Hz (4) 1.6×10^{15} Hz

Sol: [4] $1.6 \times 10^{-19} \times 3.75 = 13.6 \times 1.6 \times 10^{-19}\left(1 - \frac{1}{4}\right) - 6.6 \times 10^{-34} \nu_{\mathrm{Th}}$

Solving, $\nu_{\mathrm{Th}} = 1.6 \times 10^{15}$ Hz

185. A mixture consists of two radioactive materials A_1 and A_2 with half lives of 20 s and 10 s respectively. Initially the mixture has 40 g of A_1 and 160 g of A_2. The amount of the two in the mixture will become equal after

(1) 40 s (2) 60 s (3) 80 s (4) 20 s

Sol: [1] $40 \longrightarrow 20 \longrightarrow 10$

$160 \longrightarrow 80 \longrightarrow 40 \longrightarrow 10$

t = 40 sec.

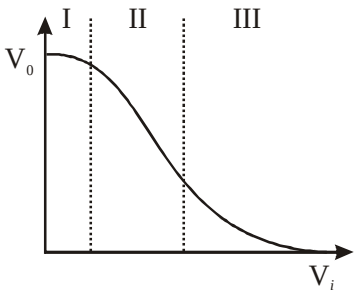
186. If voltage across a bulb rated 220 Volt-100 Watt drops by 2.5% of its rated value, the percentage of the rated value by which the power would decrease is

(1) 10% (2) 20% (3) 2.5% (4) 5%

Sol: [4] $P = \frac{V^2}{R}$

$$100 \times \frac{\Delta P}{P} = 2\frac{\Delta V}{V} \times 100 = 2 \times 2.5 = 5\%$$

187. Transfer characteristics [output voltage(V_0) vs input voltage (V_i)] for a base biased transistor in CE configuration is as shown in the figure. For using transistor as a switch, it is used



(1) in region I (2) in region III

(3) both in region (I) and (III) (4) in region II

Sol: [3] Factual

188. C and Si both have same lattice structure, having 4 bonding electrons in each. However, C is insulator where as Si is intrinsic semiconductor. This is because

(1) The four bonding electrons in the case of C lie in the third orbit, whereas for Si they lie in the fourth orbit

(2) In case of C the valance band is not completely filled at absolute zero temperature

(3) In case of C the conduction band is partly filled even at absolute zero temperature

(4) The four bonding electrons in the case of C lie in the second orbit, whereas in the case of Si they lie in the third

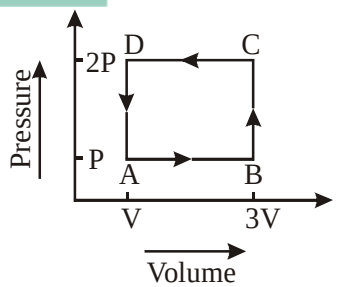
Sol: [4] Factual

189. Two persons of masses 55 kg and 65 kg respectively, are at the opposite ends of a boat. The length of the boat is 3.0 m and weighs 100 kg. The 55 kg man walks up to the 65 kg man and sits with him. If the boat is in still water the centre of mass of the system shifts by

(1) 0.75 m (2) 3.0 m (3) 2.3 m (4) zero

Sol: [4] There is no external force.

190. A thermodynamic system is taken through the cycle ABCD as shown in figure. Heat rejected by the gas during the cycle is



(1) PV (2) 2 PV

(3) 4 PV (4) ½ PV

Sol: [2] $W = -2PV$

$\because \quad Q = W + \Delta E$

$\Rightarrow \quad Q = -2PV$

191. The motion of a particle along a straight line is described by equation:

$x = 8 + 12t - t^3$ where x is in metre and t in second. The retardation of the particle when its velocity becomes zero, is

(1) 12 ms^{-2} (2) 24 ms^{-2} (3) zero (4) 6 ms^{-2}

Sol: [1] $v = \frac{dv}{dt} = 12 - 3t^2 = 0 \Rightarrow t = 2\,\text{sec.}$

$$a = \frac{d^2x}{dt^2} = -6t = -12\ ms^{-2}$$

192. A concave mirror of focal length f_1 is placed at a distance of d from a convex lens of focal length f_2. A beam of light coming from infinity and falling on this convex lens-concave mirror combination returns to infinity. The distance 'd' must equal

(1) $-2f_1 + f_2$ (2) $f_1 + f_2$ (3) $-f_1 + f_2$ (4) $2f_1 + f_2$

Sol: **[4]** $d = (f_2 + 2f_1)$

193. A milli voltmeter of 25 milli volt range is to be converted into an ammeter of 25 ampere range. The value (in ohm) of necessary shunt will be

(1) 0.05 (2) 0.001 (3) 0.01 (4) 1

Sol: **[2]** $i_g = \left(\frac{25\times10^{-3}}{R_g}\right)$

$$R = \frac{i_g R_g}{i - i_g} = \frac{25\times10^{-3}}{25} = 10^{-3}\Omega$$

194. The damping force on an oscillator is directly proportional to the velocity. The units of the constant of proportionality are

(1) kgs (2) $kgms^{-1}$ (3) $kgms^{-2}$ (4) kgs^{-1}

Sol: **[4]** $F = -kv$

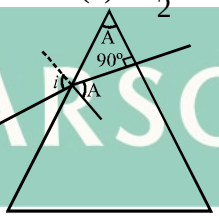
195. A ray of light is incident at an angle of incidence, i on one face of a prism of angle A (assumed to be small) and emerges normally from the opposite face. If the refractive index of the prism is μ, the angle of incidence i, is nearly equal to

(1) $\frac{A}{2\mu}$ (2) μA (3) $\frac{\mu A}{2}$ (4) $\frac{A}{\mu}$

Sol: **[2]** $\sin i = \mu.\sin A$

$\sin i \simeq \mu A$

or $i \approx \mu A$



196. Electron in hydrogen atom first jumps from third excited state to second excited state and then from second excited to the first excited state. The ratio of the wavelengths $\lambda_1 : \lambda_2$ emitted in the two cases is

(1) $\frac{20}{7}$ (2) $\frac{7}{5}$ (3) $\frac{27}{20}$ (4) $\frac{27}{5}$

Sol: **[1]** $\frac{1}{\lambda_1} = R\left(\frac{1}{9} - \frac{1}{10}\right) = \frac{7R}{9\times16}$

$$\frac{1}{\lambda_2} = R\left(\frac{1}{4} - \frac{1}{9}\right) = \frac{5R}{36}$$

$$\Rightarrow \quad \frac{\lambda_1}{\lambda_2} = \frac{20}{7}$$

197. The electric field associated with an e.m. wave in vacuum is given by $\vec{E} = \hat{i}40\cos(kz - 6\times10^{-8}t)$, where E, z and t are in volt/m, meter and seconds respectively. The value of wave vector k is

(1) 3 m^{-1} (2) 2 m^{-1} (3) 0.5 m^{-1} (4) 6 m^{-1}

Sol: **[2]** Wave velocity, $3\times10^8 = \frac{6\times10^8}{k} \Rightarrow$ k = 2 m/sec

198. An alternating electric field, of frequency v, is applied across the dees (radius = R) of a cyclotron that is being used to accelerate protons (mass = m). The operating magnetic field (B) used in the cyclotron and the kinetic energy (K) of the proton beam, produced by it, are given by

(1) $B = \frac{mv}{e}$ and $K = m^2\pi vR^2$

(2) $B = \frac{mv}{e}$ and $K = 2m\pi^2v^2R^2$

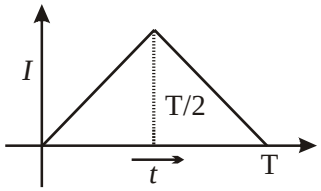
(3) $B = \frac{2\pi mv}{e}$ and $K = m^2\pi vR^2$

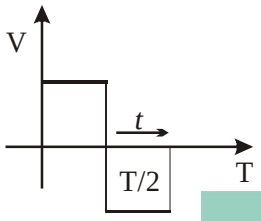
(4) $B = \frac{2\pi mv}{e}$ and $K = 2m\pi^2v^2R^2$

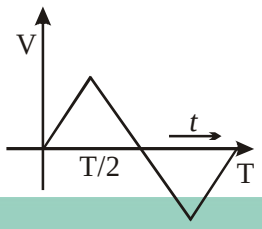
Sol: [4] $v = \left(\frac{eB}{2\pi m}\right)$ ... (i)

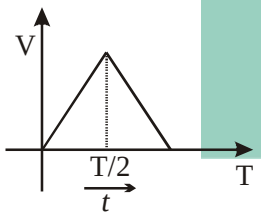
$$\frac{\sqrt{2mk}}{eB} = R \Rightarrow k = \left(\frac{R^2e^2B^2}{2m}\right) = 2m\pi^2v^2R^2$$

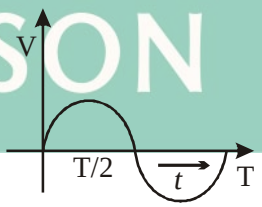
199. The current (I) in the inductance is varying with time according to the plot shown in figure. Which one of the following is the correct variation of voltage with time in the coil?



(1)


(2)


(3)


(4)


Sol: Ans [1] $emf = -L\frac{di}{dt}$

in inductor $\Rightarrow v_s = L\frac{di}{dt}$

200. In an electrical circuit R, L, C and an a.c voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and the current in the circuit is $\pi/3$. If instead, C is removed from the circuit, the phase difference is again $\pi/3$. The power factor of the circuit is

(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{1}{2}$ (3) $\frac{1}{\sqrt{2}}$ (4) 1

Sol: Ans [4] Circuit is at resonance

$\because x_L = x_C$

$\Rightarrow \cos\phi = 1$

AIPMT - 2012 (Mains)

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1. Vapour pressure of chloroform ($CHCl_3$) and dichloromethane (CH_2Cl_2) at 25°C are 200 mm Hg and 41.5 mm Hg respectively. Vapour pressure of the solution obtained by mixing 25.5 g of $CHCl_3$ and 40 g of CH_2Cl_2 at the same temperature will be:

(Molecular mass of $CHCl_3$ = 119.5 u and molecular mass of CH_2Cl_2 = 85 u)

(1) 285.5 mm Hg (2) 173.9 mm Hg (3) 615.0 mm Hg (4) 347.9 mm Hg

Sol: Ans [Bonus]

$$\underset{P_A^0=200}{CHCl_3} \Big| \underset{P_B^0=41.5}{CH_2Cl_2}$$

$$P_T = P_A + P_B$$

$$P_T = P_A^0 x_A + P_B^0 x_B = P_A^0 \times \frac{\frac{25.5}{119.5}}{\frac{25.5}{119.5}+\frac{40}{85}} + P_B^0 \times \frac{\frac{40}{85}}{\frac{25.5}{119.5}+\frac{40}{85}}$$

$$= 200 \times \frac{0.2133}{0.2133+0.4785} + 41.5 \times \frac{0.4785}{0.2133+0.4785}$$

$$P_T = \frac{42.66}{0.6918} + \frac{19.85775}{0.6918}$$

$$P_T = \frac{42.66}{0.6918} + \frac{19.85775}{0.6918} = \frac{62.51775}{0.6918} = 90.36968$$

2. The Gibbs energy for the decomposition of Al_2O_3 at 500°C is as follows:

$$\frac{2}{3}Al_2O_3 \longrightarrow \frac{4}{3}Al + O_2; \qquad \Delta_r G = +960 kJ\ mol^{-1}$$

The potential difference needed for the electrolytic reduction of aluminium oxide (Al_2O_3) at 500°C at least

(1) 5.0 V (2) 4.5 V (3) 3.0 V (4) 2.5 V

Sol: Ans [4]

$$\frac{2}{3}Al_2O_3 \longrightarrow \frac{4}{3}Al + O_2$$

$$Al_2O_6 \longrightarrow 2Al^{3+} + 3O^{2-}$$

$\Delta G = -nFE \Rightarrow 960 \times 10^3 = -6 \times 96500 \times E$

$$E = \frac{9.448}{6} = 1.65V \text{ required}$$

3. Four successive members of the first series of the transition metals are listed below. For which one of them the standard potential $\left(E^0_{M^{2+}/M}\right)$ value has a positive sign?

(1) Fe (Z = 26) (2) Co (Z = 27) (3) Ni (Z = 28) (4) Cu (Z = 29)

Sol: Ans [4]

Cu

$E^0_{Cu^{2+}/Cu} = 0.34$ volt

4. Which of the following exhibits only +3 oxidation state?

(1) Pa (2) U (3) Th (4) Ac

Sol: Ans [4]

$Ac \rightarrow [Rn]_{86}\ 7s^2 6d^1 5f^0$

5. Molar conductivities $\left(\wedge^0_m\right)$ at infinite dilution of NaCl, HCl and CH_3COONa are 126.4, 425.9 and 91.0 S cm^2 mol^{-1} respectively. $\wedge^0_m$ for CH_3COOH will be:

(1) 390.5 S cm^2 mol^{-1} (2) 425.5 S cm^2 mol^{-1}

(3) 180.5 S cm^2 mol^{-1} (4) 290.8 S cm^2 mol^{-1}

Sol: Ans [1]

$$\wedge^0_{m\,CH_3COOH} = \wedge^0_{m\,CH_3COONa} + \wedge^0_{m\,HCl} - \wedge^0_{m\,NaCl}$$

$= 91.0 + 425.9 - 126.4 = 390.5$

6. In which of the following arrangements the given sequence is not strictly according to the property indicated against it?

(1) $CO_2 < SiO_2 < SnO_2 < PbO_2$: increasing oxidising power

(2) HF < HCl < HBr < HI : increasing acidic strength

(3) $H_2O < H_2S < H_2Se < H_2Te$: increasing pK_a values

(4) $NH_3 < PH_3 < AsH_3 < SbH_3$: increasing acidic character

Sol: Ans [3]

7. Consider the reaction:

$$RCHO + NH_2NH_2 \longrightarrow RCH = N - NH_2$$

What sort of reaction is it?

(1) Nucleophilic addition - elimination reaction (2) Electrophilic addition - elimination reaction

(3) Free radical addition - elimination reaction (4) Electrophilic substitution elimination reaction

Sol: Ans [1]

$$R - \overset{\overset{O}{\|}}{C} - H + NH_2 - NH_2 \longrightarrow R - \overset{\overset{N}{|}}{C} = N = NH_2$$

Nucleophilic addition then elimination

8. During change of O_2 to O_2^- ion, the electron adds on which one of the following orbitals?

(1) σ orbital (2) π* orbital (3) π orbital (4) σ* orbital

Sol: Ans [2]

$O_2 \longrightarrow O_2^-$

Electron is added in π^* orbital

9. Standard reduction potentials of the half reactions are given below:

$F_{2(g)} + 2e^- \longrightarrow 2F^-_{(aq)}$; $E^0 = +2.85V$

$Cl_{2(g)} + 2e^- \longrightarrow 2Cl^-_{(aq)}$; $E^0 = +1.36$ V

$Br_{2(g)} + 2e^- \longrightarrow 2Br^-_{(aq)}$; $E^0 = +1.06$ V

$I_{2(g)} + 2e^- \longrightarrow 2I^-_{(aq)}$; $E^0 = +0.53$ V

The strongest oxidising and reducing agents respectively are:

(1) Cl_2 and I_2 (2) F_2 and I^- (3) Br_2 and Cl^- (4) Cl_2 and Br^-

Sol: Ans [2]

$F_2 + 2e^- \longrightarrow 2F^-$ $E^0 = +2.85V$

$I_2 + 2e^- \longrightarrow 2I^-$ $E^0 = +0.53V$

F_2 with highest reduction potential is the strongest oxidising agent.

10. The catalytic activity of transition metals and their compounds is ascribed mainly to

(1) their chemical reactivity (2) their magnetic behaviour

(3) their unfilled d-orbitals (4) their ability to adopt variable oxidation states

Sol: Ans [4]

Catalytic action is due to variable oxidation state.

11. Equal volumes of two monoatomic gases, A and B, at same temperature and pressure are mixed. The ratio of specific heats (C_p/C_v) of the mixture will be

(1) 1.67 (2) 0.83 (3) 1.50 (4) 3.3

Sol: Ans [1]

C_p of the mixture = $2 \times \frac{5}{2} R$

C_v of the mixture = $2 \times \frac{3}{2} R$

$\frac{C_p}{C_v}$ of the mixture = 1.67

12. Given that the equilibrium constant for the reaction

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

has a value of 278 at a particular temperature. What is the value of the equilibrium constant for the following reaction at the same temperature.

$SO_{3(g)} \rightleftharpoons SO_{2(g)} + \frac{1}{2} O_{2(g)}$

(1) 1.3×10^{-5} (2) 1.8×10^{-3} (3) 3.6×10^{-3} (4) 6.0×10^{-2}

Sol: Ans [4]

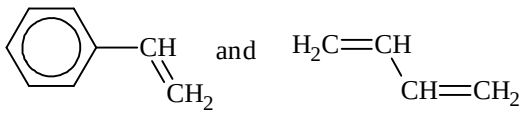
$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

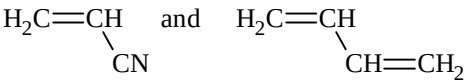
$K_{eq} = 278$

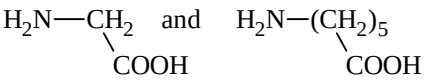
$$SO_3 \rightleftharpoons SO_2 + \frac{1}{2}O_2$$

$$K'_{eq} = \sqrt{\frac{1}{K_{equilibrium}}} = \sqrt{\frac{1}{278}} = 5.99 \times 10^{-2}$$

13. Which one of the following sets forms the bidegradable polymer?

(1)  and

(2) 

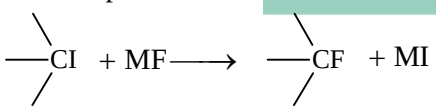
(3) 

(4) 

Sol: Ans [3]

Biodegradable polymer are easily attacked by enzymes, like Ester or amide linkage polymer.

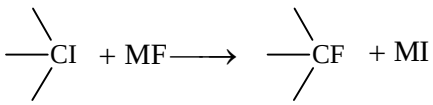
14. In the replacement reaction



The reaction will be most favourable if M happens to be:

(1) Li (2) Na (3) K (4) Rb

Sol: Ans [4]



M happens to be Rb

15. Activation energy (E_a) and rate constants (k_1 and k_2) of a chemical reaction of two different temperatures (T_1 and T_2) are related by:

(1) $\ln\frac{k_2}{k_1} = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$ (2) $\ln\frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

(3) $\ln\frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$ (4) $\ln\frac{k_2}{k_1} = -\frac{E_a}{R}\left(\frac{1}{T_2} + \frac{1}{T_1}\right)$

Sol: Ans [1] and [3]

$$\ln\frac{k_2}{k_1}=\frac{E_a}{R}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$$

16. Which one of the following does not correctly represent the correct order of the property indicated against it?

(1) Ti < V < Mn < Cr : increasing 2nd ionization enthalpy

(2) Ti < V < Cr < Mn : increasing number of oxidation states

(3) $Ti^{3+} < V^{3+} < Cr^{3+} < Mn^{3+}$: increasing magnetic moment

(4) Ti < V < Cr < Mn : increasing melting points

Sol: Ans [4]

Cr has highest melting point in the series.

17. Red precipitate is obtained when ethanol solution of dimethylglyoxime is added to ammoniacal Ni(II). Which of the following statements is **not** true?

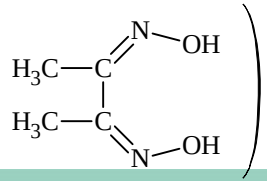
(1) Dimethylglyoxime functions as bidentate ligand

(2) Red complex has a square planar geometry

(3) Complex has symmetrical H-bonding

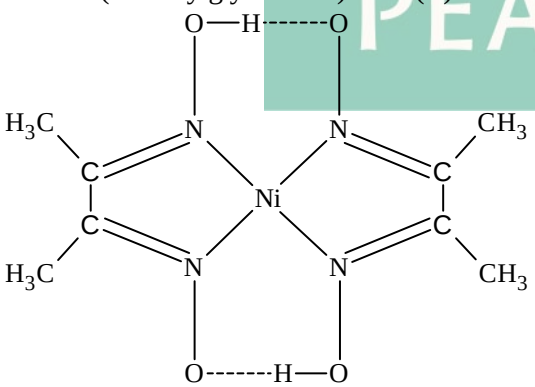
(4) Red complex has a tetrahedral geometry

dimethylglyoxime =



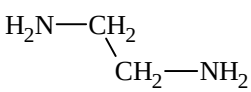
Sol: Ans [4]

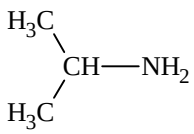
Red bis (dimethylglyoximato)nickel(II)

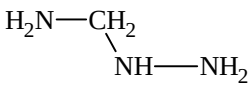


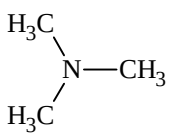
Square complex

18. An organic compound (C_3H_9N) (A), when treated with nitrous acid, gave an alcohol and N_2 gas was evolved. (A) on warming with $CHCl_3$ and caustic potash gave (C) which on reduction gave isopropylmethylamine. Predict the structure (A).

(1) 

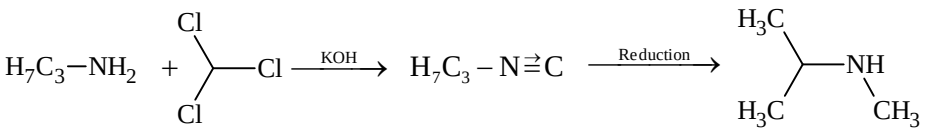
(2) 

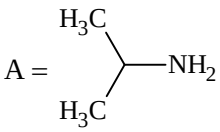
(3) 

(4) 

Sol: Ans [2]

$$\underset{\text{A(1° amine)}}{C_3H_9N} \xrightarrow{HONO} C_3H_7OH + N_2$$





19. Structure of a mixed oxide is cubic close-packed (c.c.p). The cubic unit cell of mixed oxide is composed of oxide ions. One fourth of the tetrahedral voids are occupied by divalent metal A and the octahedral voids are occupied by a monovalent metal B. The formula of the oxide is:

(1) AB_2O_2 (2) ABO_2 (3) A_2BO_2 (4) $A_2B_3O_4$

Sol: Ans [1]

O^{2-} makes c.c.p.

So No. of $O^{2-} = 4$

And $\frac{1}{4}$th of tetrahedal void = $\frac{1}{4}\times 8 = 2$ occupied by A^{2+}

And octahedral voids = 4 occupied by B^{+}

So formula is $A_2B_4O_4$ on AB_2O_2

20. The orbital angular momentum of a p-electron is given as:

(1) $\sqrt{6}, \frac{h}{2\pi}$ (2) $\frac{h}{2\pi}$ (3) $\sqrt{3}, \frac{h}{2\pi}$ (4) $\sqrt{\frac{3}{2}}, \frac{h}{\pi}$

Sol: Ans [2]

Orbital angular momentum $= \sqrt{l(l+1)}\cdot\frac{h}{2\pi} = \sqrt{1(1+1)}\cdot\frac{h}{2\pi} = \sqrt{2}\times\frac{h}{2\pi} = \frac{h}{\sqrt{2}\pi}$

21. Four diatomic species are listed below. Identify the correct order in which the bond order is increasing in them:

(1) $He_2^+ < O_2^- < NO < C_2^{2-}$ (2) $NO < O_2^- < C_2^{2-} < He_2^+$

(3) $O_2^- < NO < C_2^{2-} < He_2^+$ (4) $C_2^{2-} < He_2^+ < O_2^- < NO$

Sol: Ans [1]

B.O. He_2^+ = 0.5; B.O. NO = 2.5; B.O. O_2^- = 1.5; B.O. C_2^{2-} = 3

22. Which of the following compounds can be used as antifreeze in automobile radiators?

(1) Ethyl alcohol (2) Methyl alcohol (3) Glycol (4) Nitrophenol

Sol: Ans [3]

Glycol is used as antifreeze

23. For real gases van der Waals equation is written as

$$\left(P+\frac{an^2}{V^2}\right)(V-nb)=nRT$$

where 'a' and 'b' are van der Waals constants.

Two sets of gases are:

I. O_2, CO_2, H_2 and He

II. CH_4, O_2 and H_2

The gases given in set-I in increasing order of 'b' and gases given in set-II in decreasing order of 'a', are arranged below. Select the correct order from the following:

(1) (I) $H_2 < O_2 < He < CO_2$ (II) $O_2 > CH_4 > H_2$

(2) (I) $He < H_2 < CO_2 < O_2$ (II) $CH_4 > H_2 > O_2$

(3) (I) $O_2 < He < H_2 < CO_2$ (II) $H_2 > O_2 > CH_4$

(4) (I) $H_2 < He < O_2 < CO_2$ (II) $CH_4 > O_2 > H_2$

Sol: Ans [4]

(I) $H_2 < He < O_2 < CO_2$ (II) $CH_4 > O_2 > H_2$

24. A certain gas takes three times as long to effuse out as helium. Its molecular mass will be:

(1) 9 u (2) 27 u (3) 36 u (4) 64 u

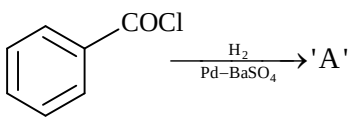
Sol: Ans [3]

$$\frac{V_{gas}/t_{gas}}{V_{He}/t_{He}}=\sqrt{\frac{M_{He}}{M_{gas}}}$$

$$\Rightarrow \frac{t_{He}}{t_{gas}}=\sqrt{\frac{4}{M_{gas}}} \Rightarrow \left(\frac{1}{3}\right)^2=\frac{4}{M_{gas}}$$

$$\Rightarrow M_{gas}=4\times 9=36$$

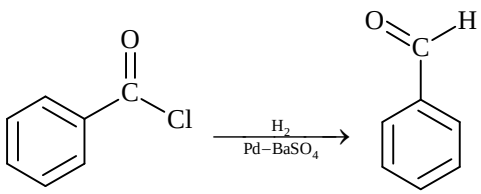
25. Consider the following reaction:



The product 'A' is

(1) C_6H_5Cl (2) C_6H_5CHO (3) C_6H_5OH (4) $C_6H_5COCH_3$

Sol: Ans [2]



Rosenmunds Reduction

26. Which of the following reagents will be able to distinguish between 1-butyne and 2-butyne?

(1) Br_2 (2) $NaNH_2$ (3) HCl (4) O_2

Sol: Ans [2]

$$\underset{\text{1–butyne}}{H-C\equiv C-C_2H_5} \xrightarrow{NaNH_2} Na^+ \ddot{\overset{\cdot\cdot}{C}}\equiv C-C_2H_5 + NH_3$$

It has one acidic hydrogen

$$CH_3-C\equiv C-CH_3 \xrightarrow{NaNH_2}$$

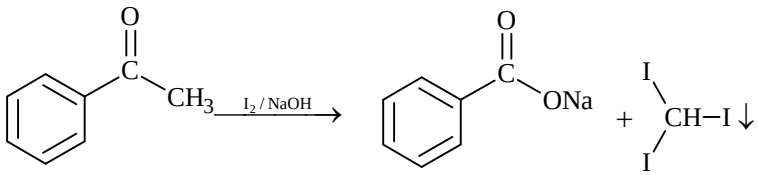
No acidic hydrogen

27. Which of the following compounds will give a yellow precipitate with iodine and alkali?

(1) 2-Hydroxypropane (2) Acetophenone (3) Methyl acetate (4) Acetamide

Sol: Ans [2]

Yellow ppt is given by $-\overset{\overset{O}{\|}}{C}-CH_3$ group compounds.



28. Chloroamphenicol is an:

(1) antibiotic - broad spectrum (2) antifertility drug

(3) antihistaminic (4) antiseptic and disinfectant

Sol: Ans [1]

Chloroamphenicol is antibiotic broad spectrum

29. Given the reaction between 2 gases represented by A_2 and B_2 to give the compound $AB_{(g)}$.

$$A_{2(g)} + B_{2(g)} = 2AB_{(g)}$$

At equilibrium, the concentration

of $A_2 = 3.0 \times 10^{-3}$ M

of $B_2 = 4.2 \times 10^{-3}$ M

of AB = 2.8×10^{-3} M

If the reaction takes place in a sealed vessel at 527°C, then the value of K_c will be:

(1) 4.5 (2) 2.0 (3) 1.9 (4) 0.62

Sol: Ans [4]

$$A_2 + B_2 \rightleftharpoons 2AB$$

$$K_c = \frac{[AB]^2}{[A_2][B_2]}$$

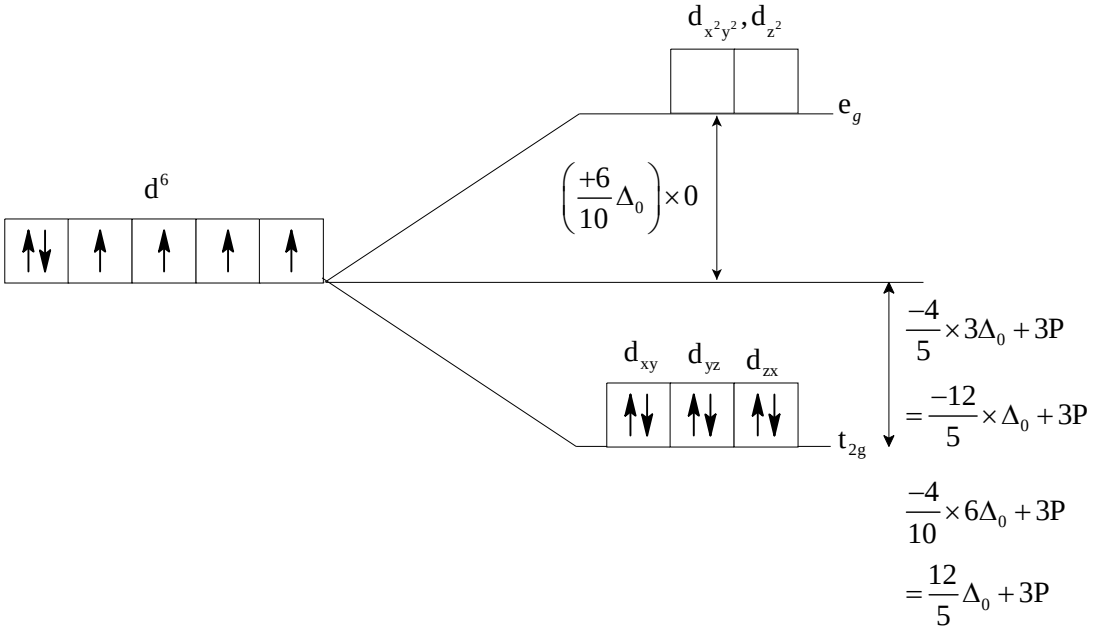
$$K_c = \frac{[AB]^2}{[A_2][B_2]} = \frac{[2.8\times10^{-3}]^2}{[3\times10^{-3}][4.2\times10^{-3}]} = 0.62$$

30. Low spin complex of d^6 - cation in an octahedral field will have the following energy:

(1) $\frac{-2}{5}\Delta_0 + P$ (2) $\frac{-12}{5}\Delta_0 + P$ (3) $\frac{-12}{5}\Delta_0 + 3P$ (4) $\frac{-2}{5}\Delta_0 + 2P$

(D_0 = Crystal Field Splitting Energy in an octahedral field, P = Electron pairing energy)

Sol: Ans [3]

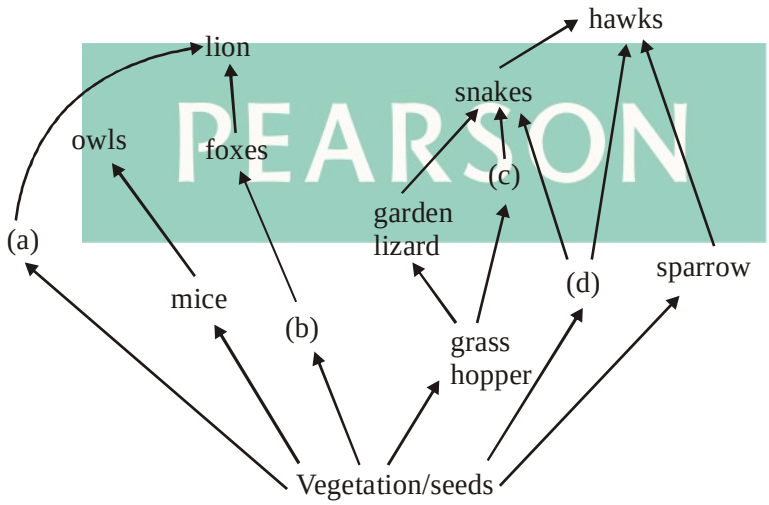


31. In the five-kingdom classification, *Chlamydomonas* and *Chlorella* have been included in

(1) Monera (2) Protista (3) Algae (4) Plantae

Sol: Ans [2]

32. Indentify the likely organisms (a), (b) (c) and (d) in the food web shown below



Options :

	(a)	(b)	(c)	(d)
(1)	squirrel	cat	rat	pigeon
(2)	deer	rabbit	frog	rat
(3)	dog	squirrel	bat	deer
(4)	rat	dog	tortoise	crow

Sol: Ans [2]

33. A test cross is carried out to

(1) determine whether two species or varieties will breed successfully

(2) determine the genotype of a plant at F_2

(3) predict whether two traits are linked

(4) assess the number of alleles of a gene

Sol: Ans [3]

34. Read the following five statements (A – E) and answer as asked next to them.

(A) In *Equisetum* the female gametophyte is retained on the parent sporophyte

(B) In *Ginkgo* male gametophyte is not independent

(C) The sporophyte in *Riccia* is more developed than that in *Polytrichum*

(D) Sexual reproduction in *Volvox* is isogamous

(1) One (2) Two (3) Three (4) Four

Sol: Ans [1]

35. Which one of the following human organs is often called the "graveyard" of RBCs ?

(1) Liver (2) Gall bladder (3) Kidney (4) Spleen

Sol: Ans [4]

36. Which one of the following generally acts as an antagonist to gibberellins ?

(1) IAA (2) Zeatin (3) Ethylene (4) ABA

Sol: Ans [4]

37. Tobacco plants resistant to a nematode have been developed by the introduction of DNA that produced (in the host cells).

(1) A toxic protein (2) Both sense and anti-sense RNA

(3) A particular hormone (4) An antifeedant

Sol: Ans [2]

38. How many plants in the list given below have marginal placentation ?

Mustard, Gram, Tulip, Asparagus, Arhar, Sun hemp, Chilli, Colchicine, Onion, Moong, Pea, Tobacco, Lupin

(1) Three (2) Four (3) Five (4) Six

Sol: Ans [4]

39. For its activity, carboxypeptidase requires

(1) Copper (2) Zinc (3) Iron (4) Niacin

Sol: Ans [2]

40. The second stage of hydrosere is occupied by plants like

(1) *Vallisneria* (2) *Azolla* (3) *Typha* (4) *Salix*

Sol: Ans [1]

41. Which one of the following structures is an organelle within an organelle ?

(1) Mesosome (2) Ribosome (3) Peroxisome (4) ER

Sol: Ans [2]

42. In gobar gas, the maximum amont is that of

(1) Carbon dioxide (2) Butane (3) Methane (4) Propane

Sol: Ans [3]

43. The first clinical gene therapy was given for treating

(1) Adenosine deaminase deficiency (2) Diabetes mellitus

(3) Chicken pox (4) Rheumatoid arthritis

Sol: Ans [1]

44. Which one of the following biomolecules is **correctly** characterised ?

(1) Alanine amino acid – Contains an amino group and an acidic group anywhere in the molecule

(2) Licithin – a phosphorylated glyceride found in cell membrane

(3) Palmitic acid – an unsaturated fatty acid with 18 carbon atoms

(4) Adenylic acid – adenosine with a glucose phosphate molecule

Sol: Ans [2]

45. Green revolution in India occurred during

(1) 1950's (2) 1960's (3) 1970's (4) 1980's

Sol: Ans [2]

46. *Cuscuta* is an example of

(1) Endoparasitism (2) Ecotoparasitism (3) Brood parasitism (4) Predation

Sol: Ans [2]

47. Consider the following four statements (a–d) and select the option which includes all the correct ones only

(a) Single cell *Spirulina* can produce large quantities of food rich in protein, minerals, vitamins etc

(b) Body weight-wise the microorganism *Methylophilus methylotrophus* may be able to produce several times more proteins than the cows per day

(c) Common button mushrooms are a very rich source of vitamin C

(d) A rice variety has been developed which is very rich in calcium

Options

(1) Statements (a), (b) (2) Statements (c), (d)

(3) Statements (a), (c) and (d) (4) Statements (b), (c) and (d)

Sol: Ans [1]

48. How many organisms in the list given below are *autotrophs* ?

Lactobacillus, Nostoc, Chara, Nitrosomonas, Nitrobacter, Streptomyces, Sacharomyces, Trypanosoma, Porphyra, Walfia

(1) Three (2) Four (3) Five (4) Six

Sol: Ans [4]

49. Which one of the following categories of animals, is correctly described with no single exception in it ?

(1) All mammals are viviparous and possess diaphragm for breathing

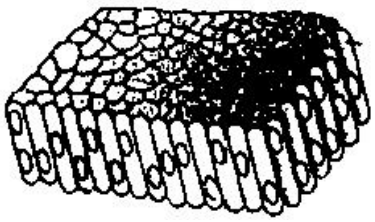
(2) All reptiles possess scales, have a three chambered heart and are cold blooded (poikilothermal)

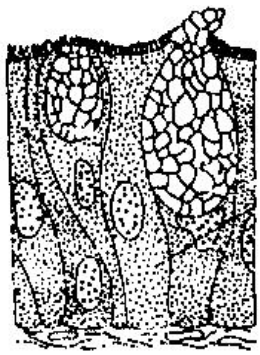
(3) All bony fishes have four pairs of gills and an operculum on each side

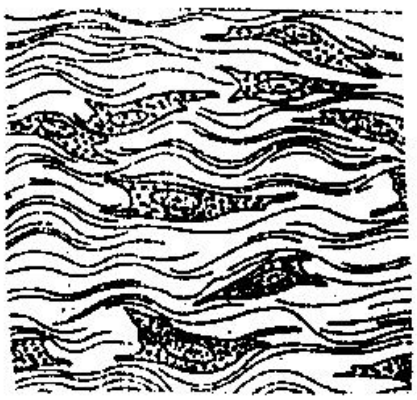
(4) All sponges are marine and have collared cells

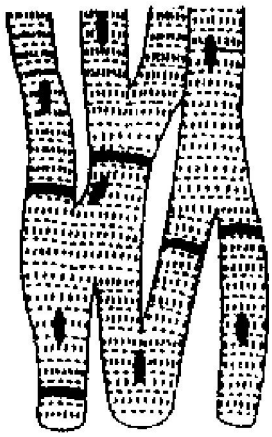
Sol: Ans [3]

50. The four sketches (A, B, C and D) given below, represent four different types of animal tissues. Which one of these is correctly identified in the options given, along with its correct location and function ?

(A) 

(B) 

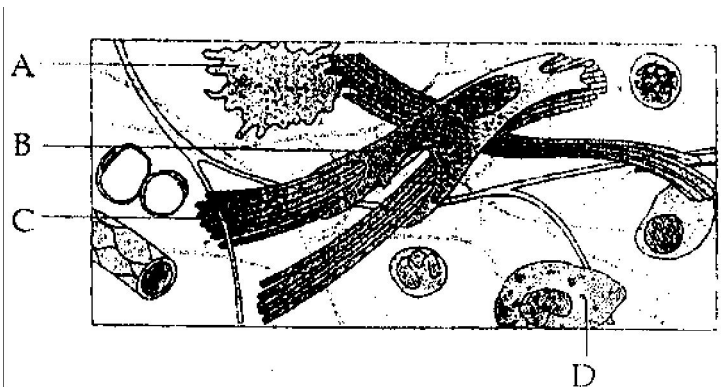
(C) 

(D) 

		Tissue	Location	Function
(1)	(A)	Columnar epithelium	Nephron	Secretion and absorption
(2)	(B)	Glandular epithelium	Intestine	Secretion
(3)	(C)	Collagen fibres	Cartilage	Attach skeletal muscles to bones
(4)	(D)	Smooth muscle tissue	Heart	Heart contraction

Sol: Ans [2]

51. Given below is the diagrammatic sketch of a certain type of connective tissue. Identify the parts labelled A, B, C and D, and select the right option about them.



Options :

	Part-A	Part-B	Part-C	Part-D
(1)	Mast Cell	Collagen fibres	Fibroblast	Macro-phage
(2)	Macro-phage	Fibroblast	Collagen fibres	Mast Cell
(3)	Mast Cell	Macro-phage	Fibroblast	Collagen fibres
(4)	Macro-phage	Collagen fibres	Fibroblast	Mast Cell

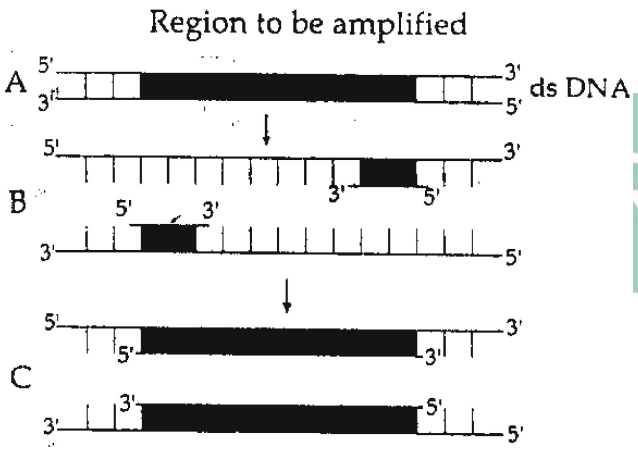
Sol: Ans [2]

52. Sacred groves are specially useful in

(1) Conserving rare and threatened species
(2) Generating environmental awareness
(3) Preventing soil erosion
(4) Year-round flow of water in rivers

Sol: Ans [1]

53. The figure below shows three steps (A, B, C) of Polymerase Chain Reaction (PCR). Select the option giving correct identification together with what it represents ?



Options :

(1) A – Annealing with two sets of primers
(2) B – Denaturation at a temperature of about 98°C separatiing the two DNA strands
(3) A – Denaturation at a temperature of about 50°C
(4) C – Extension in the presence of heat stable DNA polymerase

Sol: Ans [4]

54. The rate of formation of new organic matter by rabbit in a grassland, is called

(1) Gross primary probductivity
(2) Net productiivty
(3) Secondary productivity
(4) Net primary productivity

Sol: Ans [3]

55. Which one of the following organisms is scientifically correctly named, correctly printed according to the International Rules of Nomenclature and correctly described ?

(1) *E.coli* – Full name *Entamoeba coli*, a commonly occuring bacterium in human intestine

(2) *Musca domestica* – The common house lizard, a reptile

(3) *Plasmodium falciparum* – A protozoan pathogen causing the most serious type of malaria

(4) *Felis tigris* – The Indian tiger, well protected in Gir forests

Sol: Ans [3]

56. Which one of the following represents palindromic sequence in DNA ?

(1) 5′ - GATACC - 3′ / 3′ - CCTAAG - 5′ (2) 5′ - GAATTC - 3′ / 3′ - CTTAAG - 5′ (3) 5′ - CCAATG - 3′ / 3′ - GAATCC - 5′ (4) 5′ - CATTAG - 3′ / 3′ - GATAAC - 5′

Sol: Ans [2]

57. Vernalisation stimulates flowering in

(1) Ginger (2) Zamikand (3) Turmeric (4) Carrot

Sol: Ans [4]

58. Which one of the following statements is correct with respect to immunity ?

(1) Rejection of a kidney graft is the function of B-lymphocytes

(2) Preformed antibodies need to the injected to treat the bite by a viper snake

(3) The antibodies against small pox pathogen are produced by T-lymphocytes

(4) Antibodies are protein molecules, each of which has four light chains

Sol: Ans [2]

59. Which one of the following sets of items in the options 1 - 4 are correctly categorised with one exception in it ?

	ITEMS	**CATEGORY**	**EXCEPTION**
(1)	Typhoid, Pneumonia, Diphtheria	Bacterial diseases	Diphtheria
(2)	UAA, UAG, UGA	Stop codons	UAG
(3)	Kangaroo, Koala, Wombat	Australian marsupials	Wombat
(4)	*Plasmodium*, *Cuscuta*, *Trypanosoma*	Protozoan parasites	*Cuscuta*

Sol: Ans [4]

60. Which one of the following pairs is wrongly matched ?

(1) Mustard – Synergids (2) *Ginkgo* – Archegonia (3) *Salvinia* – Prothallus (4) Viroids – RNA

Sol: Ans [3]

61. Which one of the following is a wrong statement regarding mutations ?

(1) Change in a single base pair of DNA does not cause mutation

(2) Deletion and insertion of base pairs cause frame-sheft mutations

(3) Cancer cells commonly show chromosomal aberrations

(4) UV and Gamma rays are mutagens

Sol: Ans [1]

62. Read the following four statements (A – D)

(A) Both, photophosphorylation and oxidative phosphorylation involve uphill transport of protons across the membrane

(B) In dicot stems, a new cambium originates from cells of pericycle at the time of secondary growth

(C) Stamens in flowers of *Gloriosa* and *Petunia* are polyndrous

(D) Symbiotic nitrogen-fixers occur in free-living state also in soil

How many of the above statements are right ?

(1) One (2) Two (3) Three (4) Four

Sol: Ans [2]

63. Where do certain symbiotic microorganisms normally occur in human body ?

(1) Duodenum (2) Caecum

(3) Oral lining and tongue surface (4) Vermiform appndix and rectum

Sol: Ans [2]

64. The secretory phase in the human menstrual cycle in also called

(1) follicular phase and lasts for about 13 days (2) luteal phase and lasts for about 6 days

(3) follicular phase lasting for about 6 days (4) luteral phase and lasts for about 13 days

Sol: Ans [4]

65. Biolistics (gene-gun) is suitable for

(1) DNA finger printing

(2) Disarming pathogen vectors

(3) Transformation of plant cells

(4) Constructing recombinant DNA by joing whith vectors

Sol: Ans [3]

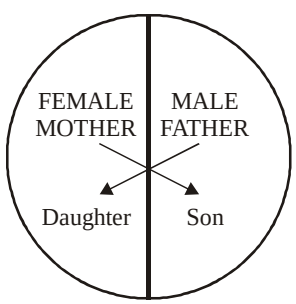
66. A fall in glomeruclar filtration rat (GFR) activates

(1) Posterior pituitary ot release vasopressin (2) Juxtra glomerular cells to release renin

(3) Adrenal cortex to release aldosterone (4) Adrenal medulla to release adrenaline

Sol: Ans [2]

67. Represented below is the inheritance pattern of a certain type of traits in humans. Which one of the following conditions could be an example of this pattern ?



(1) Thalassemia (2) Phenylketonuria

(3) Sickle cell anaemia (4) Haemophilia

Sol: Ans [4]

68. Which one of the following cellular parts is correctly described ?

(1) Lysosomes - optimally active at a pH of about 8.5

(2) Thylakoids - flattened membranous sacs forming the grana of chloroplasts

(3) Centrioles - sites for active RNA synthesis

(4) Ribosomes - those on chloroplasts are larger (80s) while those in the cytoplasm are smaller (70s)

Sol: Ans [2]

69. Which one of the following options gives the correct categorisation of six animals according to the type of nitrogenous wastes (A, B, C), they give out ?

	A AMMONOTELIC	B UREOTELIC	C URICOTELIC
(1)	Aquatic Amphibia	Cockroach, humans	Frog, Pigeon, Lizards
(2)	Pigeon, Humans	Aquatic Amphibia, Lizards	Cockroach, Frog
(3)	Frog, Lizards	Aquatic Amphibia, Humans	Cockroach, Pigeon
(4)	Aquatic Amphibia	Frog, Humans	Pigeon, Lizards Cockroach

Sol: Ans [4]

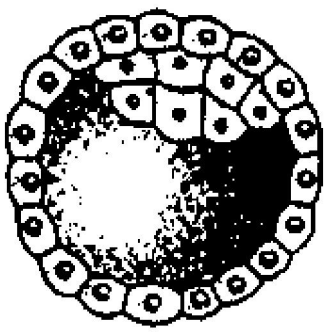
70. Which one of the following characteristics is common both in humans and adult frogs ?

(1) Ureotelic mode of excretion (2) Four - chambered heart

(3) Internal fertilisation (4) Nucleated RBCs

Sol: Ans [1]

71. Identify the human developmental stage shown below as well as the related ritght palce of its occurrence in a normal pregnant woman, and select the right option for the two together.



Options :

	Developmental stage	Site of occurrence
(1)	8 - celled morula	Starting point of Fallopian tube
(2)	Late morula	Middle part of fallopian tube
(3)	Blastula	End part of Fallopian tube
(4)	Blastocyst	Uterine wall

Sol: Ans [4]

72. What is the function of germ pore ?

(1) Release of male gametes
(2) Emergence of radicle
(3) Absorption of water for seed germination
(4) Initiation of pollen tube

Sol: Ans [4]

73. For its action, nitrogenase requires

(1) Super oxygen radicals
(2) Higth input of energy
(3) Light
(4) Mn^{2+}

Sol: Ans [2]

74. In genetic engineering, the antibiotics are used

(1) To keep the cultures free of infection
(2) As selectable markers
(3) To select healthy vectors
(4) As sequences from where replicaton starts

Sol: Ans [3]

75. Through their effect on plant growth regulators, what do the temperature and light control in the plants?

(1) Fruit elongation (2) Apical dominance (3) Flowering (4) Closure of stomata

Sol: Ans [3]

76. What is it that forms the basis of DNA fingerprinting ?

(1) Satellite DNA occuring as hightly repeated short DNA segments
(2) The relative proportions of purines and pyrimidines in DNA
(3) The relative difference in the DNA occurrence in blood, skin and saliva
(4) The relative amount of DNA in the ridges and grooves of the fingerprints

Sol: Ans [1]

77. Select the correct statements bout biodiversity

(1) Conservation of biodiversity is just a fad pursued by the developed countries
(2) The desert areas of Rajasthan and Gujarat have a very high level of desert animal species as well as numerous rare animals
(3) Large scale planting of Bt cotton has no adverse effect on biodiversity
(4) Western Ghats have a very high degree of species richness and endemism

Sol: Ans [4]

78. The domestic sewage in large cities

(1) Have very high amounts of suspended solids and dissolved salts
(2) Has a high BOD as it contains both aerobic and anaerobic bacteria
(3) Is processed by aerobic and then anaerobic bacteria in the secondary treatment is Sewage Treatment Plants (STPs)
(4) When treated in STPs does not really require the aeration step as the sewage contains adequate oxygen

Sol: Ans [3]

79. Plants with ovaries having only one or a few ovules, are generally pollinated by

(1) Wind (2) Bees (3) Butterflies (4) Birds

Sol: Ans [1]

80. Read the following four statements (A - D)

(A) Colostrum is recommended for the new born because it is rich in antigens

(B) Chikengunya is caused by a Gram negative bacterium

(C) Tissue culture has proved useful in obtaining virus-free plants

(D) Beer is manufactured by distillation of fermented grape juice

How many of the above statement are worng ?

(1) One (2) Two (3) Three (4) Four

Sol: Ans [3]

81. The supportive skeletal structures in the human external ears and in the nose tip are examples of

(1) Cartilage (2) Ligament (3) Areolar tissue (4) Bone

Sol: Ans [1]

82. As compared to a dicot root, a monocot root has

(1) Relatively thicker periderm (2) More abundant secondary xylem

(3) Many xylem bundles (4) Inconspicuous annual rings

Sol: Ans [3]

83. Which one of the following organisms is correctly matched with its three characteristics ?

(1) Maize : C_3 pathway, Closed vascular bundles, Scutellum

(2) Pea : C_3 pathway, Endospermic seed, Vexillary aestivation

(3) Tomato : Twisted aestivation, Axile placentation, Berry

(4) Onion : Bulb, Imbricate aestivation, Axile placentation

Sol: Ans [3]

84. Which one of the following pairs of chemical substances, is correctly categorised ?

(1) Secretin and rhodopsin - Polypeptide hormones

(2) Calcitonin and thymosin - Thyroid hormones

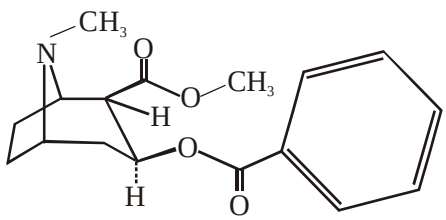
(3) Pepsin and prolactin - Two digestive enzymes secreted in stomach

(4) Troponin and myosin - Complex proteins in striated muscles

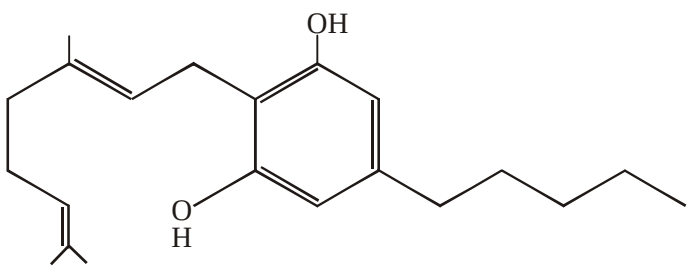
Sol: Ans [4]

85. Indenfity the molecules (a) and (b) shown below and select the right option giving their source and use

(a)



(b)



Options

	Molecule	Source	Use
(1)	(a) Morphine	*Papaver somniferum*	Sedative and pain killer
(2)	(b) Cocaine	*Erythroxylum coca*	Accelerates the transport of dopamine
(3)	(c) Heroin	*Cannabis sativa*	Depressant and slows down body functions
(4)	(d) Cannabinoid	*Atropa belladona*	Produces hallucinations

Sol: Ans [1]

86. Indentify the meiotic stage in which the homologous chromosomes separate while the sister chromatids remain associated at their centromeres

(1) Anaphase II (2) Metaphase I (3) Metaphase II (4) Anaphase I

Sol: Ans [4]

87. Which one of the following statements is worng ?

(1) Intine is made up of cellulose and pectin

(2) When pollen is shed at two-celled stage, double fertilization does not take place

(3) Vegetative cell is larger than generative cell

(4) Pollen grains in some plants remain viable for months

Sol: Ans [2]

88. The idea of mutations was brought forth by

(1) **Charles Darwin**, who observed a side variety of organisms during sea voyage

(2) **Hugo do Vries**, who worked on evening primrose

(3) **Gregor Mendel**, who worked on *Pisum sativum*

(4) **Hardy Weinberg,** who worked on allele frequencies in a population

Sol: Ans [2]

89. Read the following four statements (A - D)

(A) In transcription, adenosine pairs with uracil

(B) Regulation of *lac* operon by repressor is referred to as positive regulation

(C) The human genome has approximately 50,000 genes

(D) Haemophilia is sex-linked recessive disease

How many of the above statements are right ?

(1) One (2) Two (3) Three (4) Four

Sol: Ans [2]

90. Which one of the following pairs of animals are similar to each other pertaining to the feature stated against them ?

(1) Sea horse and Flying fish - Cold blooded (Poikilothermal)

(2) *Pteropus* and *Ornithorhyncus* - Viviparity

(3) Garden lizard and Crocodile - Three chambered heart

(4) *Ascaris* and *Ancylostoma* - Metameric segmentation

Sol: Ans [1]

91. Two metallic spheres of radii 1 cm and 3 cm are given charges of -1×10^{-2} C and 5×10^{-2} C, respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is

(1) 1×10^{-2} C (2) 2×10^{-2} C (3) 3×10^{-2} C (4) 4×10^{-2} C

Sol: Ans [3]

Common potential $V = \dfrac{Q_1 + Q_2}{C_1 + C_2}$

Change on bigger sphere is $Q_2^1 = C_2 V$

$$Q_2^1 = \left(\frac{C_2}{C_1 + C_2}\right)(Q_1 + Q_2)$$

$C_1 = 4\pi\varepsilon_o R_1$

$C_2 = 4\pi\varepsilon_o R_2$

$$Q_2^1 = \left(\frac{R_2}{R_1 + R_2}\right)(Q_1 + Q_2) = \left(\frac{3}{3+1}\right)(5-1)\times 10^{-2} = \frac{3}{4}\times 4\times 10^{-2} = 3\times 10^{-2} C$$

92. A proton carrying 1 MeV kinetic energy is moving in a circular path of radius R in uniform magnetic field. What should be the energy of an α-particle to describe a circle of same radius in the same field?

(1) 4 MeV (2) 2 MeV (3) 1 MeV (4) 0.5 MeV

Sol: Ans [3]

$$R = \frac{\sqrt{2mE}}{qB}$$

For equal readius of proton and α-particle

$$\frac{\sqrt{2m_p E_p}}{q_p B} = \frac{\sqrt{2m_\alpha E_\alpha}}{q_\alpha B}$$

$$\Rightarrow \quad E_\alpha = \left(\frac{q_\alpha}{q_p}\right)^2 \times \left(\frac{m_p}{m_\alpha}\right) E_p \qquad \frac{m_p}{m_\alpha} = \frac{1}{4};\ \frac{q_\alpha}{q_p} = \frac{2}{1}$$

$$E_\alpha = \left(\frac{1}{4}\right)\times (2)^2 \times E_p$$

$E_\alpha = E_p$ $E_\alpha = 1 MeV$

93. A circular platform is mounted on a frictionless vertical axle. Its radius R = 2 m and its moment of inertia about the axle is 200 kg m^2. It is initially at rest. A 50 kg man stands on the edge of the platform and begins to walk along the edge at the speed of 1 ms^{-1} relative to the ground. Time taken by the man to complete one revolution is

(1) $\dfrac{\pi}{2} s$ (2) π s (3) $\dfrac{3\pi}{2} s$ (4) 2π s

Sol: Ans [4]

Using conservation of angular momentum

$I_p w_p = I_m W_m$

$200 \times w_p = 50(2)^2 w_m$

$w_p = \frac{1}{2}$ rad/s

$w_{m/p} = w_m - w_p = \left(\frac{1}{2}\right) - \left(-\frac{1}{2}\right) = 1$ rad/s

Time taken to complete one revolution is $T = \frac{2\pi}{w} = 2\pi$ sec.

94. The ratio of amplitude of magnetic field to the amplitude of electric field for an electromagnetic wave propagating in vacuum is equal to

(1) unity

(2) the speed of light in vacuum

(3) reciprocal of speed of light in vacuum

(4) the ratio of magnetic permeability to the electric susceptibility of vacuum

Sol: Ans [3]

Conceptual Question

95. A magnetic needle suspended parallel to a magnetic field requires √3 J of work to turn it through 60°. The torque needed to maintain the needle in this position will be

(1) $\frac{3}{2}J$ (2) $2\sqrt{3}$ J (3) 3 J (4) $\sqrt{3}$ J

Sol: Ans [3]

Work done $U_f - U_i = -MB\cos 60° - (-MB\cos 0°)$

$= -MB\left(\frac{1}{2} - 1\right)$

$\sqrt{3} = \frac{MB}{2}$ MB = $2\sqrt{3}$

$\tau = MB\sin 60° = 2\sqrt{3} \times \frac{\sqrt{3}}{2} = 3\text{J}$

96. A rod of length 10 cm lies along the principal axis of a concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away for the mirror. The length of the image is

(1) 5 cm (2) 10 cm (3) 15 cm (4) 2.5 cm

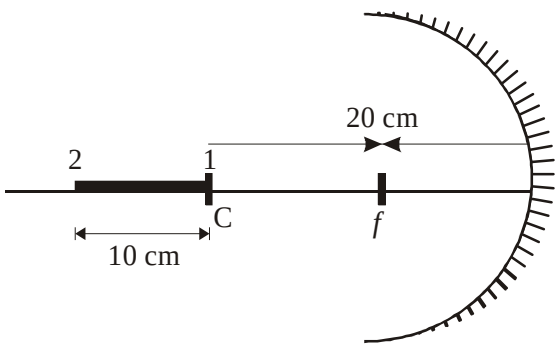
Sol: Ans [1]

$v_1 = -20\,\text{cm};\ u_2 = -10\,\text{cm}$

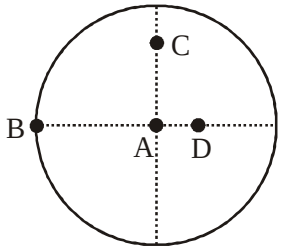
$\frac{1}{f} = \frac{1}{v_2} + \frac{1}{u_2};\ \frac{1}{-10} = \frac{1}{v_2} + \frac{1}{-30}$ $v_2 = -15$ cm

Similarly $v_1 = -20$ cm

Length of image is $V_2 - V_1 = 5\,\text{cm}$



97. The moment of inertia of uniform circular disc is maximum about an axis perpendicular to the disc and passing through



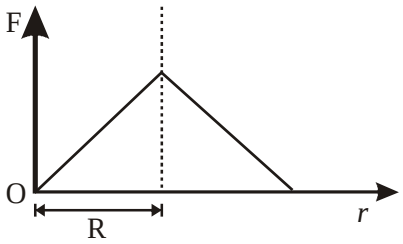
(1) A (2) B (3) C (4) D

Sol: Ans [2]

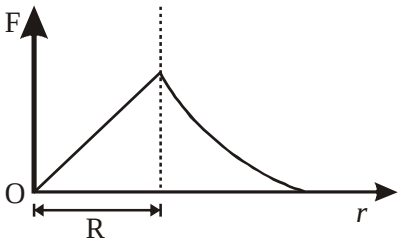
Conceptual Question

98. Which one of the following plots represents the variation of gravitational field on a particle with distance *r* due to a thin spherical shell of radius R? (*r* is measured from the centre of the spherical shell)

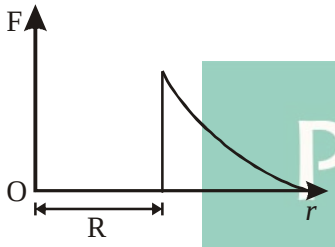
(1)



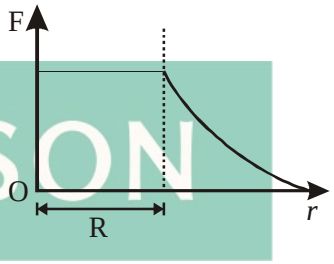
(2)



(3)



(4)

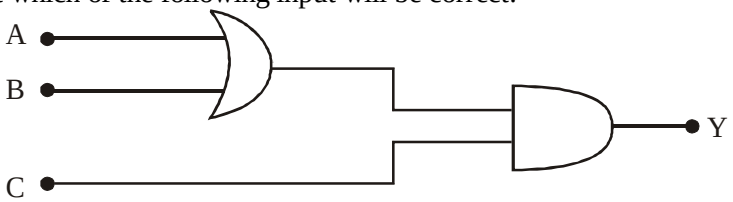


Sol: Ans [3]

Conceptual Question

99. To get an output Y = 1 in given circuit which of the following input will be correct:

	A	B	C
(1)	0	1	0
(2)	1	0	0
(3)	1	0	1
(4)	1	1	0



Sol: Ans [3]

Conceptual Question

100. The equation of a simple harmonic wave is given by

$$y = 3\sin\frac{\pi}{2}(50t - x)$$

where *x* and *y* are in metres and *t* is in seconds. The ratio of maximum particle velocity to the wave velocity is

(1) $\frac{2}{3}\pi$ (2) 2π (3) $\frac{3}{2}\pi$ (4) 3π

Sol: Ans [3]

$V_{max} = A\omega;\ V_w = \frac{\omega}{k}$

$\frac{V_{max}}{V_\omega} = Ak;\quad y = 3\sin\frac{\pi}{2}(50t - x)$

A = 3; $k = \pi/2$

$\frac{V_{max}}{V_\omega} = \frac{3}{2}\pi$

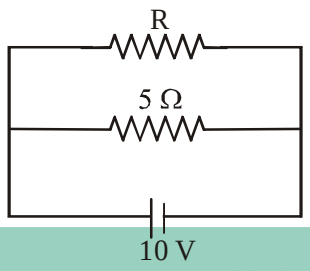
101. A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is *d* and area of each plate is A, the energy stored in the capacitor is

(1) $\varepsilon_o EAd$ (2) $\frac{1}{2}\varepsilon_o E^2$ (3) E^2Ad/ε_o (4) $\frac{1}{2}\varepsilon_o E^2 Ad$

Sol: Ans [4]

Energy = $\frac{1}{2}CV^2 = \frac{1}{2}\times\varepsilon_o\frac{A}{d}\times(E\times d)^2 = \frac{1}{2}\varepsilon_o E^2 Ad$

102. The power dissipated in the circuit shown in the figure is 30 Watts. The value of R is



(1) 30 Ω (2) 20 Ω (3) 15 Ω (4) 10 Ω

Sol: Ans [4]

Total power dissipated is $\frac{(10)^2}{5} + \frac{(10)^2}{k} = 30$ watt

R = 10 Ω

103. If v_e is escape velocity and v_o is orbital velocity of a satellite for orbit close tot he earth's surface, then these are related by

(1) $v_e = \sqrt{2}v_o$ (2) $v_o = \sqrt{2}v_e$ (3) $v_o = v_e$ (4) $v_e = \sqrt{2v_o}$

Sol: Ans [1]

Conceptual Question

104. A stone is dropped from a height *h*. It hits the ground with a certain momentum P. If the same stone is dropped from a height 100% more than the previous height, the momentum when it hits the ground will change by

(1) 100% (2) 68% (3) 41% (4) 200%

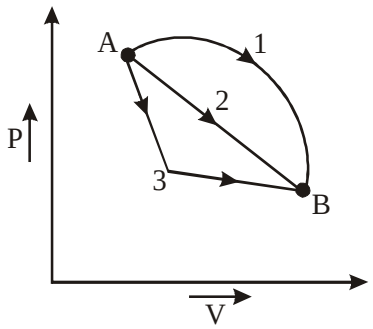
Sol: Ans [3]

Momentum $\alpha\sqrt{height}$

$\frac{P_1}{P_2} = \sqrt{\frac{h_1}{h_2}} \Rightarrow \frac{P}{P'} = \sqrt{\frac{h}{2h}} \qquad P' = P\sqrt{2}$

$\Rightarrow$ Change in momentum is 41%

105. An ideal gas goes from state A to state B via three different processes as indicated in the P-V diagram If Q_1, Q_2, Q_3 indicate the heat absorbed by the gas along the three processes and ΔU_1, ΔU_2, ΔU_3 indicate the change in internal energy along the three processes respectively, then



(1) $Q_3 > Q_2 > Q_1$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$ (2) $Q_1 > Q_2 > Q_3$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

(3) $Q_3 > Q_2 > Q_1$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$ (4) $Q_1 = Q_2 = Q_3$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

Sol: Ans [2]

$$\Delta Q = \Delta U + \Delta W$$

ΔU is same $\quad Q_1 > Q_2 > Q_3$

106. Two radiations of photons energies 1 eV and 25 eV, successively illuminate a photosensitive metallic surface of work function 0.5 eV. The ratio of the maximum speeds of the emitted electrons is

(1) 1 : 5 (2) 1 : 4 (3) 1 : 2 (4) 1 : 1

Sol: Ans [3]

$$\frac{1}{2}mV_{max}^2 = h\nu - W$$

$$\Rightarrow \quad \frac{(V_1)_{max}}{(V_2)_{min}} = \frac{\sqrt{h\nu_1 - W}}{\sqrt{h\nu_2 - W}} = \frac{\sqrt{1-0.5}}{\sqrt{25-0.5}} = \sqrt{\frac{0.5}{2}} = \frac{1}{2}$$

107. For the angle of minimum deviation of a prism to be equal to its refracting angle, the prism must be made of a material whose refractive index

(1) is greater than 2 (2) lies between $\sqrt{2}$ and 1

(3) lies between 2 and $\sqrt{2}$ (4) is less than 1

Sol: Ans [3]

$$\frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \mu \qquad \delta_m = A$$

$$\Rightarrow \quad \mu = 2\cos\left(\frac{A}{2}\right)$$

For $\delta_m = A$

Hence, μ lies between 2 and $\sqrt{2}$

108. If the momentum of an electron is changed by P, then the de Broglie wavelength associated with it changes by 0.5%. The initial momentum of electron will be

(1) 100 P (2) 200 P (3) 400 P (4) $\frac{P}{200}$

Sol: Ans [2]

$P = \frac{h}{\lambda}$ $\frac{\Delta P}{P} = \frac{\Delta h}{\lambda}$ $\Delta P = P$ $\frac{\Delta\lambda}{\lambda} = \frac{0.5}{100}$ $P' = 200P$

109. Three masses the placed on the x-axis 300 g at origin, 500 g at x = 40 cm and 400 g at x = 70 cm. The distance of the centre of mass from the origin is

(1) 30 cm (2) 40 cm (3) 45 cm (4) 50 cm

Sol: Ans [2]

$$\chi_{cm} = \frac{m_1x_1 + m_2x_2 + m_3x_3}{m_1 + m_2 + m_3}$$

$m_1 = 300\,g;\ x_1 = 0;\ m_2 = 500\,g;\ x_2 = 40\,cm;\ m_3 = 400g;\ x_3 = 70\,cm$

$\chi_{cm} = 40\,cm$

110. A car of mass m is moving on a level circular track of radius R. If μ_s represents the static friction between the road and tyres of the car, the maximum speed of the car in circular motion is given by

(1) $\sqrt{\mu_s Rg}$ (2) $\sqrt{\mu_s mRg}$ (3) $\sqrt{Rg/\mu_s}$ (4) $\sqrt{mRg/\mu_s}$

Sol: Ans [1]

Conceptual Question

111. A slab of stone of area 0.36 m^2 and thickness 0.1 m is exposed on the lower surface to steam at 100°C. A block of ice at 0°C rests on the upper surface of the slab. In one hour 4.8 kg of ice is melted. The thermal conductivity of slab is (Given latent heat of fusion of ice = 3.36×10^5 J kg^{-1})

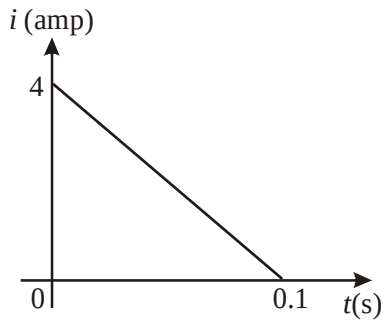
(1) 1.02 J / m / s / °C (2) 1.24 J / m / s / °C (3) 1.29 J / m / s /°C (4) 2.05 J / m / s /°C

Sol: Ans [2]

$$Q = \frac{KA(\Delta T)t}{L} = mL$$

$K = \frac{56}{45} = 1.24$

112. In a coil of resistance of 10 Ω, the induced current developed by changing magnetic flux through it, is shown in figure as a function of time. The magnitude of change in flux through the coil in Weber is



(1) 4 (2) 8 (3) 2 (4) 6

Sol: Ans [3]

$$\left|\frac{d\phi}{dt}\right| = e$$

$$d\phi = (iR)\,dt$$

$$\Delta\phi = \int d\phi = R\int i dt$$

$$\Delta\phi = R \times (\textit{area under } \ i = t \textit{ graph})$$

$$\Delta\phi = 10 \times \frac{1}{2} \times 4 \times 0.1$$

$$\Delta\phi = 2 \ \text{ weber}$$

113. A car of mass m starts from rest and accelerates so that the instantaneous power delivered to the car has a constant magnitude Po. The instantaneous velocity of this car is proportional to

(1) $t/\sqrt{m}$ (2) $t^2 P_o$ (3) $t^{1/2}$ (4) $t^{-1/2}$

Sol: Ans [3]

$$m\left(\frac{dV}{dt}\right)V = P_o$$

$$V\,dV = \left(\frac{P_o}{m}\right)dt$$

On integrating

$$\frac{V^2}{2} = \frac{P_o}{m}t$$

$$V \propto \sqrt{t}$$

114. A train moving at a speed of 220 ms^{-1} towards a stationary object, emits a sound of frequency 1000 Hz. Some of the sound reaching the object gets reflected black to the train as echo. The frequency of the echo as detected by the driver of the train is: (speed of sound in air is 330 ms^{-1})

(1) 3000 Hz (2) 3500 Hz (3) 4000 Hz (4) 5000 Hz

Sol: Ans [4]

$$f' = f\frac{(V+V_o)}{(V-V_s)} = \frac{1000(330+220)}{(330-220)} = 1000 \times \frac{550}{110} = 5000\,\text{Hz}$$

115. The input resistance of a silicon transistor is 100 Ω. Base current is changed by 40 mA, which results in a change in collector current by 2 mA. This transistor is used as a common emitter amplifier with a load resistance of 4 kΩ. The voltage gain of the amplifier is

(1) 1000 (2) 2000 (3) 3000 (4) 4000

Sol: Ans [2]

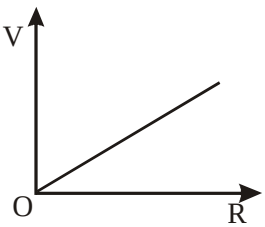
$$R_i = 100i$$

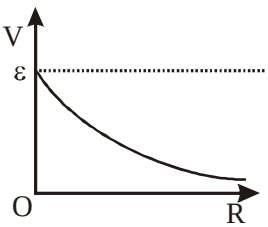
$$\Delta i_B = 40 \times 10^{-6}$$

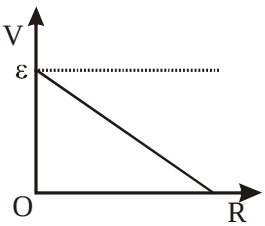
$$\Delta i_C = 2\times10^{-3}$$

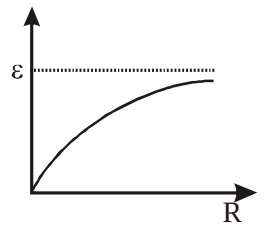
$$A_V = \frac{R_o \times \Delta i_C}{R_i \times \Delta i_B} = \frac{4\times10^3 \times 2\times10^{-3}}{100\times40\times10^{-6}\times10^{-3}} = 2\times10^3 = 2000$$

116. A cell having an emf ε and internal resistance *r* is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by

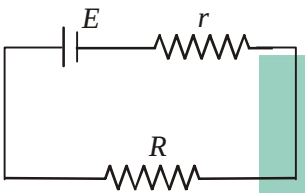
(1) 

(2) 

(3) 

(4) 

Sol: Ans [4]



V = IR $\Rightarrow V = \frac{ER}{R+r}$

117. The dimensions of $(\mu_o\varepsilon_o)^{-1/2}$ are

(1) $[L^{1/2}T^{1/2}]$ (2) $[L^{1/2}T^{-1/2}]$ (3) $[L^{-1}T]$ (4) $[LT^{-1}]$

Sol: Ans [4]

$$C = \frac{1}{\sqrt{\mu_o\varepsilon_o}}$$

$[LT^{-1}]$

118. The half life of a radioactive nucleus is 50 days. The time interval $(t_2 - t_1)$ between the time t_2 when $\frac{2}{3}$ of it has decayed and the time t_1 when $\frac{1}{3}$ of it had decayed is:

(1) 15 days (2) 30 days (3) 50 days (4) 60 days

Sol: Ans [3]

$$\frac{2}{3}N_o = N_o e^{-\lambda t_1} \quad \text{...(i)}$$

$$\frac{1}{3}N_o = N_o e^{-\lambda t_2} \quad \text{...(ii)}$$

eqution (i) and (ii) $2 = e^{-\lambda t_1 + \lambda t_2}$

$2 = e^{\lambda (t_2 - t_1)}$

$\log 2 = \lambda (t_2 - t_1)$

$\frac{\log 2}{\lambda} = t_2 - t_1 = t_{1/2} = 50$ days.

119. The instantaneous values of alternating current and voltages in a circuit are given as

$$i = \frac{1}{\sqrt{2}} \sin(100\pi t) \text{ ampere}$$

$$e = \frac{1}{\sqrt{2}} \sin(100\pi t + \frac{\pi}{3}) \text{ volt}$$

The average power in Watts consumed in the circuit is

(1) $\frac{1}{8}$ (2) $\frac{1}{4}$ (3) $\frac{\sqrt{3}}{4}$ (4) $\frac{1}{2}$

Sol: Ans [1]

$P = V_{rms} . I_{rms} . \cos\phi$

$= \frac{1}{2} V_o I_o . \cos\phi$

$= \frac{1}{2} \times \frac{1}{\sqrt{2}} . \frac{1}{\sqrt{2}} . \cos\frac{\pi}{3}$

$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

120. The transition from the state $n = 3$ to $n = 1$ in a hydrogen like atom results in ultraviolet radiation. Infrared radiation will be obtained in the transition from

(1) $4 \to 3$ (2) $2 \to 1$ (3) $3 \to 2$ (4) $4 \to 2$

Sol: Ans [1]

Conceptual Question.

AIPMT 2013

Q.1 In an experiment four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively. Quantity P is calculated as follows : $P = \frac{a^3b^2}{cd}$. % error in P is -

(1) 14% (2) 10%

(3) 7% (4) 4%

Ans. **[1]**

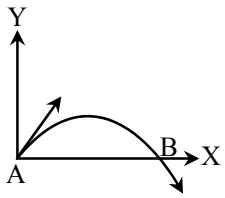
Sol. **Students find this question in CP Class Notes : [Topic : Errors & Measurement]**

$P = \frac{a^3b^2}{cd}$

Error in $\left(\frac{\Delta P}{P}\right) = 3\left(\frac{\Delta a}{a}\right) + 2\left(\frac{\Delta b}{b}\right) + \left(\frac{\Delta c}{c}\right) + \left(\frac{\Delta d}{d}\right)$

= 3(1%) + 2(2%) + 3% + 4% = 14%

Q.2 The velocity of a projectile at the initial point A is $(2\hat{i} + 3\hat{j})$ m/s. It's velocity (in m/s) at point B is -

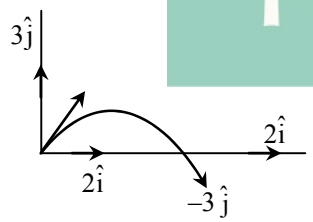


(1) $-2\hat{i} - 3\hat{j}$ (2) $-2\hat{i} + 3\hat{j}$

(3) $2\hat{i} - 3\hat{j}$ (4) $2\hat{i} + 3\hat{j}$

Ans. **[3]**

Sol. **Students find this question in CP Class Notes : [Topic : Projectile Motion]**



So, $v_f = 2\hat{i} - 3\hat{j}$

Q.3 A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. The relation between h_1, h_2 and h_3 is -

(1) $h_1 = 2h_2 = 3h_3$ (2) $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$

(3) $h_2 = 3h_1$ and $h_3 = 3h_2$ (4) $h_1 = h_2 = h_3$

Ans. **[2]**

Sol. **Students find similar question in CP Sheet at : Ex. 1, Q.28 (One dimensional motion).**

Distance covered in first 5 sec.

$$h_1 = 0 + \frac{1}{2}a(5)^2$$

$$h_1 = \frac{25a}{2} \qquad \ldots(1)$$

distance covered in first 10 sec

$$S_2 = 0 + \frac{1}{2}a(10)^2 = \frac{100a}{2}$$

So distance covered in second 5 sec.

$$h_2 = S_2 - h_1 = \frac{100a}{2} - \frac{25a}{2} = \frac{75a}{2} \qquad \ldots(2)$$

distance covered in first 15 sec.

$$S_3 = 0 + \frac{1}{2}a(15)^2 = \frac{225a}{2}$$

so distance covered in last 5 sec.

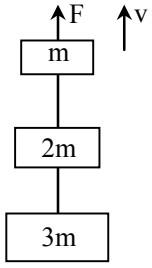
$$h_3 = S_3 - S_2 = \frac{225a}{2} - \frac{100a}{2} = \frac{125a}{2} \qquad \ldots(3)$$

using (1), (2) and (3) equation.

$$\frac{h_1}{\frac{25a}{2}} = \frac{h_2}{\frac{75a}{2}} = \frac{h_3}{\frac{125a}{2}}$$

$$h_1 = \frac{h_2}{3} = \frac{h_3}{5}$$

Q.4 Three blocks with masses m, 2m and 3m are connected by strings, as shown in the figure. After an upward force F is applied on block m, the masses move upward at constant speed v. What is the net force on the block of mass 2m ? (g is the acceleration due to gravity)



(1) zero (2) 2 mg

(3) 3 mg (4) 6 mg

Ans. **[1]**

Sol. **Students find similar question in CP Sheet at : Ex. 1, Q.53 (Newton's Laws of motion).**

Blocks are moving with constant speed so net force on each block will be zero.

Here F = ma a = 0

So F = 0

Q.5 The upper half of an inclined plane of inclination θ is perfectly smooth while lower half is rough. A block starting from rest at the top of the plane will again come to rest at the bottom, if the coefficient of friction between the block and lower half of the plane is given by -

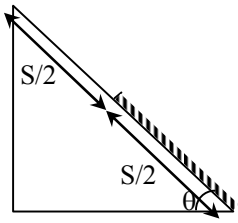
(1) $\mu = \frac{1}{\tan\theta}$ (2) $\mu = \frac{2}{\tan\theta}$

(3) $\mu = 2\tan\theta$ (4) $\mu = \tan\theta$

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : similar Q.8, Ex. 3B, Page. 56 (Laws of motion)**

Gain of kinetic energy = loss of KE due to friction in lower half.



$mg\sin\theta\, S = \mu mg\cos\theta\, S/2$

$\mu = 2\tan\theta$

Q.6 A uniform force of $(3\hat{i}+\hat{j})$ newton acts on a particle of mass 2 kg. Hence the particle is displaced from position $(2\hat{i}+\hat{k})$ meter to position $(4\hat{i}+3\hat{j}-\hat{k})$ meter. The work done by the force on the particle is -

(1) 9 J (2) 6 J

(3) 13 J (4) 15 J

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : similar Q.4, Ex. 1, Page. 90 (Work, Power & Energy)**

Displacement = $\vec{r}_2 - \vec{r}_1 = (4\hat{i}+3\hat{j}-\hat{k}) - (2\hat{i}+\hat{k})$

$= 2\hat{i}+3\hat{j}-2\hat{k}$

Force $\vec{F} = 3\hat{i}+\hat{j}$

Work W = $\vec{F}.\vec{d} = (3\hat{i}+\hat{j}).(2\hat{i}+3\hat{j}-2\hat{k})$

$= 6 + 3 = 9J$

Q.7 An explosion breaks a rock into three parts in a horizontal plane. Two of them go off at right angles to each other. The first part of mass 1 kg moves with a speed of 12 ms^{-1} and the second part of mass 2 kg moves with 8 ms^{-1} speed. If the third part files off with 4 ms^{-1} speed, then its mass is -

(1) 3 kg (2) 5 kg

(3) 7 kg (4) 17 kg

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : similar Q.31, Ex. 3A, Page. 101 (Work, Power & Energy)**

Using law of conservation of linear momentum

$\vec{P}_1 + \vec{P}_2 + \vec{P}_3 = 0$

$m_1\vec{v}_1 + m_2\vec{v}_2 + m_3\vec{v}_3 = 0$

$|m_3\vec{v}_3| = |-(m_1\vec{v}_1 + m_2\vec{v}_2)|$ $\qquad \vec{v}_1 \perp \vec{v}_2$

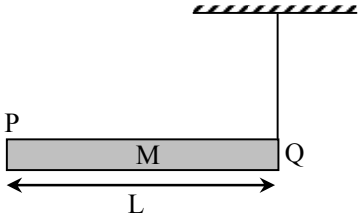
$m_3v_3 = \sqrt{m_1^2v_1^2 + m_2^2v_2^2}$

$m_34 = \sqrt{1^2 \times 12^2 + 2^2 \times 8^2}$

$m_34 = 20$

$m_3 = \frac{20}{4} = 5\text{kg}$

Q.8 A rod PQ of mass M and length L is hinged at end P. The rod is kept horizontal by a massless string tied to point Q as shown in figure. When string is cut, the initial angular acceleration of the rod is -

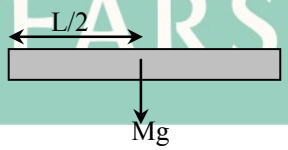


(1) $\frac{3g}{2L}$ (2) $\frac{g}{L}$ (3) $\frac{2g}{L}$ (4) $\frac{2g}{3L}$

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : similar Q.24, Ex. 3A, Page. 160 (Rotational Motion)**

$\tau = I\alpha$



$\frac{L}{2}Mg = \frac{ML^2}{3}\alpha$

$\alpha = \frac{3g}{2L}$

Q.9 A small object of uniform density rolls up a curved surface with an initially velocity 'v'. It reaches upto a maximum height of $\frac{3v^2}{4g}$ with respect to the initial position. The object is -

(1) Ring (2) Solid sphere

(3) Hollow sphere (4) Disc

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : similar Q.32, Ex. 2, Page. 154 (Work, Power & Energy)**

Using mechanical energy conservation

$$\frac{1}{2}mv^2\left(1+\frac{k^2}{R^2}\right)=mg\left(\frac{3v^2}{4g}\right)$$

$$1+\frac{k^2}{R^2}=\frac{3}{2}$$

$$\frac{k^2}{R^2}=\frac{1}{2}$$

So, body is disc or solid cylinder.

Q.10 A body of mass 'm' is taken from the earth's surface to the height equal to twice the radius (R) of the earth. The change in potential energy of body will be -

(1) mg 2R (2) $\frac{2}{3}$ mgR

(3) 3 mgR (4) $\frac{1}{3}$mgR

Ans. **[2]**

Sol. **Students find similar question in CP Sheet at : Ex. 2A, Q.9 (Gravitation).**

$$\Delta U=\frac{mgh}{1+\frac{h}{R}}=\frac{mg2R}{1+2}=\frac{2}{3}mgR$$

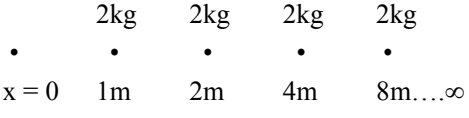
h = 2R

Q.11 Infinite number of bodies, each of mass 2 kg are situated on x-axis at distances 1m, 2m, 4m, 8m, … , respectively, from the origin. The resulting gravitational potential due to this system at the origin will be -

(1) $-G$ (2) $-\frac{8}{3}G$ (3) $-\frac{4}{3}G$ (4) $-4G$

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : [Topic : Gravitation]**



$$V_g=-\frac{G(2)}{1}-\frac{G(2)}{2}-\frac{G(2)}{4}-\frac{G(2)}{8}....\infty$$

$$V_g=-2G\left[1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+....\infty\right]$$

$$=-2G\left[\frac{1}{1-\frac{1}{2}}\right]=-2G(2)=-4G$$

Q.12 The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied ?

(1) length = 50 cm, diameter = 0.5 mm (2) length = 100 cm, diameter = 1 mm

(3) length = 200 cm, diameter = 2 mm (4) length = 300 cm, diameter = 3 mm

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : similar Q.9, CP Study material Sheet (Elasticity)**

$$Y = \frac{MgL}{\Delta L.A}$$

$$\Delta L = \frac{mgL}{Y.A}$$

$$\Delta L \propto \frac{L}{A}$$

Q.13 The wettability of a surface by a liquid depends primarily on -

(1) viscosity

(2) surface tension

(3) density

(4) angle of contact between the surface and the liquid

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : Page no. 195, Theory Notes CP Study material (Surface Tension)**

The wettability of a surface by a liquid depends on angle of contact between the surface and the liquid.

Q.14 The molar specific heats of an ideal gas at constant pressure and volume are denoted by C_p and C_v, respectively. If $\gamma = \frac{C_p}{C_v}$ and R is the universal gas constant, then C_v is equal to -

(1) $\frac{1+\gamma}{1-\gamma}$ (2) $\frac{R}{(\gamma-1)}$ (3) $\frac{(\gamma-1)}{R}$ (4) γR

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : similar Q.9, Ex. 3A (Calorimatry)**

$C_p - C_v = R$

$$\Rightarrow \frac{C_p}{C_v} - \frac{C_v}{C_v} = \frac{R}{C_v}$$

$$\gamma - 1 = \frac{R}{C_v}$$

$$\therefore C_v = \frac{R}{\gamma - 1}$$

Q.15 A piece of iron is heated in a flame. It first becomes dull red then becomes reddish yellow and finally turns to white hot. The correct explanation for the above observation is possible by using -

(1) Stefan's law (2) Wien's displacement law

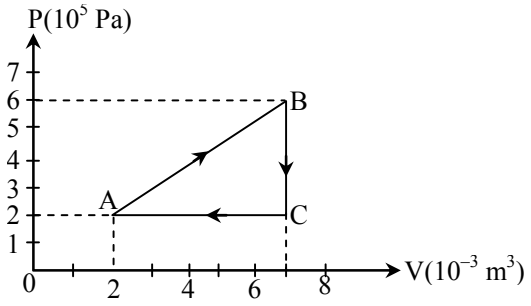
(3) Kirchoff's law (4) Newton's law of cooling

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : [Topic : Radiation]**

We know Wien's displacement law $\lambda_m \propto \frac{1}{T}$

Q.16 A gas is taken through the cycle A → B → C → A, as shown. What is the net work done by the gas ?



(1) 2000 J (2) 1000 J

(3) zero (4) – 2000 J

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : [Topic : Thermodynamics]**

We know work done

= Area under P-V curve.

$= \frac{1}{2} \times 4 \times 10^5 \times 5 \times 10^{-3}$

$= 10 \times 10^5 \times 10^{-3} = 1000$ J

Q.17 During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its temperature. The ratio of $\frac{C_p}{C_v}$ for the gas is -

(1) $\frac{4}{3}$ (2) 2 (3) $\frac{5}{3}$ (4) $\frac{3}{2}$

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : similar Q.25, Ex. 3A, Page. 172 (Thermodynamic)**

In adiabatic process

$P \propto T^{\gamma/\gamma-1}$

and $P \propto T^3$

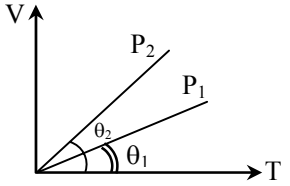
$\frac{\gamma}{\gamma-1} = 3$

$\therefore \gamma = 3\gamma - 3$

$-2\gamma = -3$

$\gamma = 3/2$

Q.18 In the given (V – T) diagram, what is the relation between pressures P_1 and P_2 ?



(1) $P_2 = P_1$ (2) $P_2 > P_1$

(3) $P_2 < P_1$ (4) cannot be predicted

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : similar Q.32, Ex. 2, Page. 133 (K.T.G)**

Ideal gas equation

$PV = nRT$

and $\frac{V}{T} \propto \frac{1}{P}$ by equation

and by graph $\frac{V}{T} = \tan\theta$

$\therefore \frac{1}{P} \propto \tan\theta$

$\theta\uparrow$, $\tan\theta\uparrow$, $P\downarrow$

$\therefore P_1 > P_2$

Q.19 The amount of heat energy required to raise the temperature of 1 g of Helium at NTP, from T_1 K to T_2 K is -

(1) $\frac{3}{8}N_ak_B(T_2 - T_1)$ (2) $\frac{3}{2}N_ak_B(T_2 - T_1)$

(3) $\frac{3}{4}N_ak_B(T_2 - T_1)$ (4) $\frac{3}{4}N_ak_B\left(\frac{T_2}{T_1}\right)$

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at :**

$E = \frac{f}{2}nRT$ OR

$= \frac{f}{2}NkT$

$\because N = n.N_A$

$= \frac{3}{2}.n.N_A.k_B.T$

$= \frac{3}{8}N_A.k_B.T$

$n = \frac{m}{M} = \frac{1}{4}$

where N_A = Avagadro's number

k_B = Boltzmann const.

Q.20 A wave travelling in the +ve x-direction having displacement along y-direction as 1m, wavelength 2πm and frequency of $\frac{1}{\pi}$Hz is represented by -

(1) $y = \sin(x - 2t)$ (2) $y = \sin(2\pi x - 2\pi t)$

(3) $y = \sin(10\pi x - 20\pi t)$ (4) $y = \sin(2\pi x + 2\pi t)$

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : similar Q.29, Ex. 3A, Page. 54 (Wave)**

$y = a \sin(\omega t - kx)$

OR

$y = a \sin(kx - \omega t)$

$\therefore y = \sin[x - 2t]$ …(1)

$k = \frac{2\pi}{\lambda} = \frac{2\pi}{2\pi}$

$\omega = 2\pi.\nu = 2\pi.\frac{1}{\pi} = 2$

$a = 1m$

Q.21 It we study the vibration of a pipe open at both ends, then the following statement is not true -

(1) Open end will be antinode

(2) Odd harmonics of the fundamental frequency will be generated

(3) All harmonics of the fundamental frequency will be generated

(4) Pressure change will be maximum at both ends

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : [Topic : Waves]**

When pipe is open at both ends then ratio of frequency

(i) $\nu : 2\nu : 3\nu : 4\nu : 5\nu$

where $\nu = \frac{v}{2L}$

odd and even both harmonics will present

So, option (1), (2) and (3) are correct.

$\therefore$ pressure variation is minimum at antinode

$\therefore$ (4) is wrong option.

Q.22 A source of unknown frequency gives 4 beats/s, when sounded with a source of known frequency 250 Hz. The second harmonic of the source of unknown frequency gives five beats per second, when sounded with a source of frequency 513 Hz. The unknown frequency is -

(1) 254 Hz (2) 246 Hz

(3) 240 Hz (4) 260 Hz

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : similar Q.26, Ex. 2, Page. 50 (Wave)**

$\nu' = 250 \pm 4 = 254$ OR 246

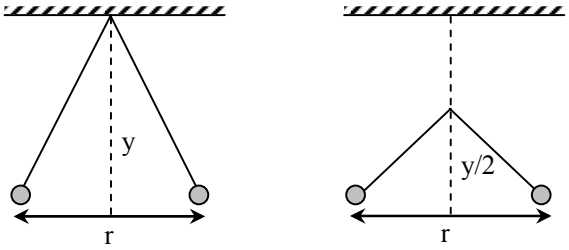
$\nu'' = 2.\ \nu'$ and $\nu'' = 513 \pm 5 = 518$ OR 508

So, $508 = 2.(254)$

OR $\nu'' = 2.(\nu')$

Answer is (254 Hz).

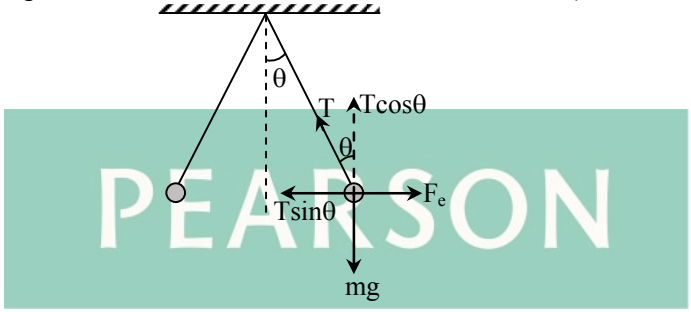
Q.23 Two pith balls carrying equal charges are suspended from a common point by strings of equal length, the equilibrium separation between them is r. Now the strings are rigidly clamped at half the height. The equilibrium separation between the balls now become -



(1) $\left(\frac{1}{\sqrt{2}}\right)^2$ (2) $\left(\frac{r}{\sqrt[3]{2}}\right)$ (3) $\left(\frac{2r}{\sqrt{3}}\right)$ (4) $\left(\frac{2r}{3}\right)$

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Similar to Ex.2, Q.13. (Electrostatics)**



At balance

$T\cos\theta = mg$

$T\sin\theta = F_e = \frac{Kq^2}{r^2}$

$\tan\theta = \frac{Kq^2}{r^2 mg} = \frac{r/2}{y}$

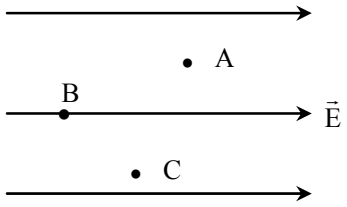
$y = \frac{mgr^3}{2kq^2}$ ….(1)

$y \propto r^3$

$r \propto y^{1/3}$

$r' \propto (y/2)^{1/3} \propto \frac{r}{2^{1/3}}$

Q.24 A, B and C are three points in a uniform electric field. The electric potential is -



(1) maximum at A (2) maximum at B

(3) maximum at C (4) same at all the three points A, B and C

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Q.64, Ex 3B (Electrostatics).**

Electric field is from high potential to low potential.

So, potential is maximum at B.

Q.25 A wire of resistance 4Ω is stretched to twice its original length. The resistance of stretched wire would be -

(1) 2Ω (2) 4Ω (3) 8Ω (4) 16Ω

Ans. **[4]**

Sol. **Students may find similar question in CP Sheet at : Q.7, Ex. 2 (Electrostatics).**

At constant volume

$R \propto \ell^2$

$\Rightarrow R' = 4R = 16\Omega$

Q.26 The internal resistance of a 2.1 V cell which gives a current of 0.2A through a resistance of 10Ω is -

(1) 0.2Ω (2) 0.5Ω (3) 0.8Ω (4) 1.0Ω

Ans. **[2]**

Sol. **Students may find this question in CP Class Notes : [Topic : Current Electricity]**

$I = \frac{E}{R + r}$

$0.2 = \frac{2.1}{10 + r}$

$2 + 0.2\,r = 2.1$

$0.2\,r = 2.1$

$r = 0.5\Omega$

Q.27 The resistances of the four arms P, Q, R and S in a Wheatstone's bridge are 10 ohm, 30 ohm, 30 ohm and 90 ohm, respectively. The e.m.f. and internal resistance of the cell are 7 volt and 5 ohm respectively. If the galvanometer resistance is 50 ohm, the current drawn from the cell will be -

(1) 1.0 A (2) 0.2 A (3) 0.1 A (4) 2.0 A

Ans. **[2]**

Sol. **Students may find similar question in CP Sheet at : Q.22, Ex.3(A) (Current Electricity).**

$\because \frac{P}{Q} = \frac{P}{S} \Rightarrow$ Balanced bridge

Equivalent resistance of bridge

$= \frac{40 \times 120}{40 + 120} = 30\ \Omega$

$\therefore I_{battery} = \frac{7}{30 + 5} = 0.2\ A$

Q.28 When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed v_0 it moves with an initial acceleration $3a_0$ toward west. The electric and magnetic fields in the room are -

(1) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ up

(2) $\frac{ma_0}{e}$ west, $\frac{2ma_0}{ev_0}$ down

(3) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ up

(4) $\frac{ma_0}{e}$ east, $\frac{3ma_0}{ev_0}$ down

Ans. **[2]**

Sol. **Discussed in CP Class Notes : [Topic : Magnetic Effect of Current]**

$\vec{F}_L = \vec{F}_e + \vec{F}_m = q\vec{E} + q(\vec{v} \times \vec{B})$

$ma_0 = qE + 0$ ....(1)

$E = \frac{ma_0}{q}$ so $\vec{E} = \frac{ma_0}{e}$ in west

$\vec{F}_L = \vec{F}_e + \vec{F}_m$

$3\ ma_0 = qE + q(\vec{v} \times \vec{B}) \Rightarrow q(\vec{v} \times \vec{B}) = 2\ ma_0$ (west)

$\vec{F}_m = q\vec{v} \times \vec{B}$

$-\hat{i} = (+\hat{j}) \times$ .....

$B = \frac{2ma_0}{qv}$ in vertically downward

Q.29 A current loop in a magnetic field -

(1) experiences a torque whether the field is uniform or non-uniform in all orientations

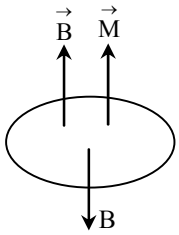
(2) can be in equilibrium in one orientation

(3) can be in equilibrium in two orientations, both the equilibrium states are unstable

(4) can be in equilibrium in two orientations, one stable while the other is unstable

Ans. **[4]**

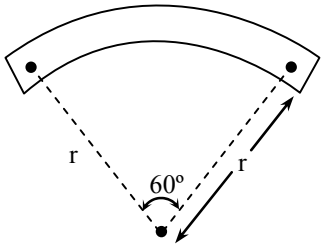
Sol. **Students find this question in CP Class notes : [Topic : Magnetism]**



$\theta = 0^\circ$ stable equilibrium

$\theta = 180^\circ$ unstable equilibrium

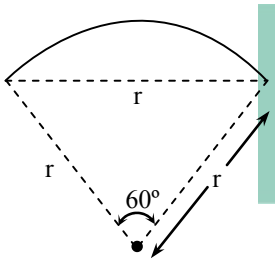
Q.30 A bar magnet of length 'l' and magnetic dipole moment 'M' is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be –



(1) M (2) $\frac{3}{\pi}M$ (3) $\frac{2}{\pi}M$ (4) $\frac{M}{2}$

Ans. **[2]**

Sol. **Students find this question in CP Sheet : Q.10, Ex. 3(B) (Magnetic field).**



$l = \frac{\pi}{3}r$

$r = \frac{3l}{\pi}$

$M' = m(r) = m\left(\frac{3l}{\pi}\right) = \frac{3M}{\pi}$

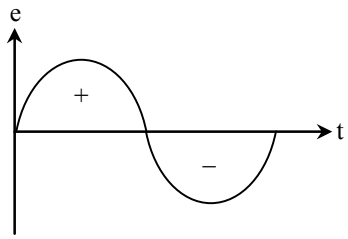
Q.31 A wire loop is rotated in a magnetic field. The frequency of change of direction of the induced e.m.f. is -

(1) once per revolution (2) twice per revolution

(3) four times per revolution (4) six times per revolution

Ans. **[2]**

Sol. **Students find this question in CP Sheet at : Q.15, Ex. 1 (Alternating Current)**



$e = N\omega AB \sin \omega t$

direction of e.m.f. changed two times

Q.32 A coil of self-inductance L is connected in series with a bulb B and an AC source. Brightness of the bulb decreases when -

(1) frequency of the AC source is decreased

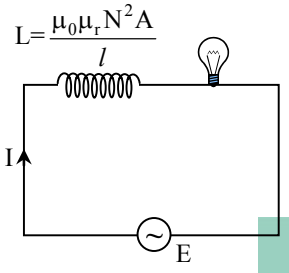
(2) number of turns in the coil is reduced

(3) a capacitance of reactance $X_C = X_L$ is included in the same circuit

(4) an iron rod is inserted in the coil

Ans. **[4]**

Sol. **Students find this question in CP Class notes : [Topic : Alternating Current]**



$$\downarrow I = \frac{E}{\sqrt{\omega^2 L^2 + R^2}} = \frac{E}{\sqrt{\omega^2 L^2 \uparrow + R^2}}$$

$L \propto \mu_r$

L is increased when iron rod inserted

So current decreased

Q.33 The condition under which a microwave oven heats up a food item containing water molecules most efficiently is -

(1) The frequency of the microwaves must match the resonant frequency of water molecules

(2) The frequency of the microwaves has no relation with natural frequency of water molecules

(3) Microwaves are heat waves, so always produce heating

(4) Infra-red waves produce heating in a microwave oven

Ans. **[1]**

Sol. **Students find this question in CP Class notes.**

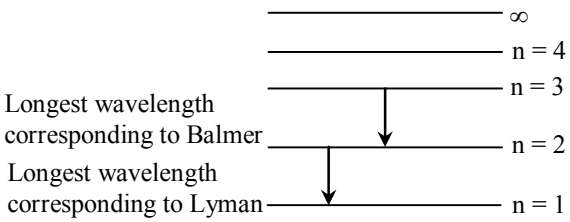
In the presence of microwave water molecules oscillates the frequency of microwave and large heat is developed.

Q.34 Ratio of longest wave lengths corresponding to Lyman and Balmer series in hydrogen spectrum is -

(1) $\frac{5}{27}$ (2) $\frac{3}{23}$ (3) $\frac{7}{29}$ (4) $\frac{9}{31}$

Ans. **[1]**

Sol. **Students find this question in CP Class notes : [Topic : Atomic Structure]**



$$\frac{1}{\lambda_\ell} = R(1)^2\left[\frac{1}{1^2} - \frac{1}{2^2}\right] = \frac{3R}{4}$$

$$\lambda_\ell = \frac{4}{3R} \quad \ldots.(1)$$

$$\frac{1}{\lambda_b} = R(1)^2\left[\frac{1}{2^2} - \frac{1}{3^2}\right] = \frac{5R}{36}$$

$$\lambda_b = \frac{36}{5R} \quad \ldots.(2)$$

$$\frac{\lambda_\ell}{\lambda_b} = \frac{4}{3R} \times \frac{5R}{36} = \frac{5}{3\times 9} = \frac{5}{27}$$

Q.35 The half-life of a radioactive isotope 'X' is 20 years. It decays to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio 1 : 7 in a sample of a given rock. The age of the rock is estimated to be -

(1) 40 years (2) 60 years (3) 80 years (4) 100 years

Ans. **[2]**

Sol. **Students may find similar question in CP Sheet at : Page no. 45, Q.9 (Radioactivity)**

Half-life of X $\Rightarrow T_X = 20$ years

Active Stable

$$\underset{1}{X} \longrightarrow \underset{7}{Y}$$

$$\frac{N}{N_0} = \frac{1}{1+7} = \frac{1}{8} = \frac{1}{2^n} = \frac{1}{2^3}$$

$$n = 3 = \frac{t}{T} = \frac{t}{20}$$

$t = 60$ years

Q.36 A certain mass of Hydrogen is changed to Helium by the process of fusion. The mass defect in fusion reaction is 0.02866 u. The energy liberated per u is – (Given 1 u = 931 MeV)

(1) 2.67 MeV (2) 26.7 MeV (3) 6.675 MeV (4) 13.35 MeV

Ans. **[3]**

Sol. **Students may find similar question in CP Class notes : [Topic : Nuclear Physics]**

$_1H^2 + {}_1H^2 \longrightarrow {}_2He^4$

Mass defect = $\Delta m = 0.02866$ u

Total energy = $E = \Delta mc^2 = 0.02866 \times 931$ MeV

$= 26.68$ MeV

Energy liberated per u = $\frac{E}{A} = \frac{26.68}{4} = 6.678$ MeV

Q.37 For photoelectric emission from certain metal the cutoff frequency is ν. If radiation of frequency 2ν impinges on the metal plate, the maximum possible velocity of the emitted electron will be (m is the electron mass) -

(1) $\sqrt{h\nu/(2m)}$ (2) $\sqrt{h\nu/m}$ (3) $\sqrt{2h\nu/m}$ (4) $2\sqrt{h\nu/m}$

Ans. **[3]**

Sol. **Students may find this question in CP Class notes : [Topic : Photoelectric Effect]**

Cutoff frequency = ν

Work function = $\phi = h\nu$

Use, $E = K.E. + \phi$

$2h\nu = \frac{1}{2}mv^2 + h\nu$

$\frac{1}{2}mv^2 = 2h\nu - h\nu = h\nu$

$v = \sqrt{\frac{2h\nu}{m}}$

Q.38 The wavelength λ_e of an electron and λ_p of a photon of same energy E are related by -

(1) $\lambda_p \propto \lambda_e^2$ (2) $\lambda_p \propto \lambda_e$ (3) $\lambda_p \propto \sqrt{\lambda_e}$ (4) $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$

Ans. **[1]**

Sol. **Students may find similar question in CP Sheet at : Page no. 103, Q.21 (Matter Waves)**

de-Broglie wavelength for an electron

$$\lambda_e = \frac{h}{\sqrt{2mE}} \quad \text{or } \lambda_e \propto \frac{1}{\sqrt{E}}$$

or $\lambda_e^2 \propto \frac{1}{E}$ ….(1)

Wavelength of photon $\Rightarrow \lambda_p = \frac{hc}{E}$

or $\lambda_p \propto \frac{1}{E}$ ….(2)

From equation (1) and (2)

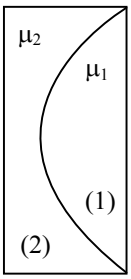
$\lambda_e^2 \propto \lambda_p$

Q.39 A plano convex lens fits exactly into a plano concave lens. Their plane surfaces are parallel to each other. If lenses are made of different materials of refractive indices μ_1 and μ_2 and R is the radius of curvature of the curved surface of the lenses, then the focal length of the combination is -

(1) $\frac{R}{2(\mu_1+\mu_2)}$ (2) $\frac{R}{2(\mu_1-\mu_2)}$ (3) $\frac{R}{(\mu_1-\mu_2)}$ (4) $\frac{2R}{(\mu_2-\mu_1)}$

Ans. **[3]**

Sol. **Students find this question in CP Class notes : [Topic : Ray Optics]**



Focal length of first lens $\frac{1}{f_1} = (\mu_1 - 1)\left(\frac{1}{\infty} - \frac{1}{-R}\right) = \frac{\mu_1 - 1}{R}$

Focal length of second lens $\frac{1}{f_2} = (\mu_2 - 1)\left(\frac{1}{-R} - \frac{1}{\infty}\right) = -\frac{(\mu_2 - 1)}{R}$

So focal length of the combination

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} = \frac{\mu_1 - 1}{R} - \frac{(\mu_2 - 1)}{R}$$

$$\frac{1}{f} = \frac{\mu_1 - \mu_2}{R}$$

$$f = \frac{R}{\mu_1 - \mu_2}$$

Q.40 For a normal eye, the cornea of eye provides a converging power of 40D and the least converging power of the eye lens behind the cornea is 20D. Using this information, the distance between the retina and the cornea-eye lens can be estimated to be -

(1) 5 cm (2) 2.5 cm (3) 1.67 cm (4) 1.5 cm

Ans. **[3]**

Sol. **Students find this question in NCERT and in CP Class notes : [Topic : Ray Optics]**

(lens + cornea) should form image of distance object at retina

Converging power (40 + 20) D = 60 D

Using lens equation

$$\frac{1}{v} - \frac{1}{\infty} = \frac{60}{100}$$

$$v = \frac{5}{3}\text{ cm} = 1.67\text{ cm}$$

So distance between retina and cornea should be 1.67 cm.

Q.41 In Young's double slit experiment, the slits are 2mm apart and are illuminated by photons of two wavelengths λ_1 = 12000 Å and λ_2 = 10000 Å. At what minimum distance from the common central bright fringe on the screen 2m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other ?

(1) 8 mm (2) 6 mm (3) 4 mm (4) 3 mm

Ans. **[2]**

Sol. **Students find this question in CP Class notes : [Topic : Wave Optics]**

d = 2 mm ; D = 2 m

Fringe width for first wave length 12000 Å

$$\beta_1 = \frac{\lambda_1 D}{d} = \frac{12000\times10^{-10}\times2}{2\times10^{-3}} = 1.2 \times 10^{-3}\ \text{m} = 1.2\ \text{mm}$$

For second wave length

$$\beta_2 = \frac{\lambda_2 D}{d} = \frac{10000\times10^{-10}\times2}{2\times10^{-3}} = 1\ \text{mm}$$

At 6 mm distance from center bright fringe 5^{th} fringe of first coincides with 6^{th} of second.

Q.42 A parallel beam of fast moving electrons is incident normally on a narrow slit. A fluorescent screen is placed at a large distance from the slit. If the speed of the electrons is increased, which of the following statements is correct ?

(1) Diffraction pattern is not observed on the screen in the case of electrons

(2) The angular width of the central maximum of the diffraction pattern will increase

(3) The angular width of the central maximum will decrease

(4) The angular width of the central maximum will be unaffected

Ans. **[3]**

Sol. **Students may find this question in CP Class notes : [Topic : Wave Optics]**

As speed of an electron increases.

Its de-Broglie wavelength decreases

$$\left\{\lambda = \frac{h}{mv}\right\}$$

and angular width for central maxima is $\omega = \frac{2\lambda}{d}$

$$\omega \propto \lambda \propto \frac{1}{v}$$

Q.43 In a n-type semiconductor, which of the following statements is true -

(1) Electrons are majority carriers and trivalent atoms are dopants

(2) Electrons are minority carriers and pentavalent atoms are dopants

(3) Holes are minority carriers and pentavalent atoms are dopants

(4) Holes are majority carriers and trivalent atoms are dopants

Ans. **[3]**

Sol. **Students may find similar question in CP Sheet at : Page no. 198, Q.53, Ex. 3(A) (Electronics)**

In n-type – Minority are hole and dopant are pentavalent.

Q.44 In a common emitter (CE) amplifier having a voltage gain G, the transistor used has transconductance 0.03 mho and current gain 25. If the above transistor is replaced with another one with transconductance 0.02 mho and current gain 20, the voltage gain will be -

(1) $\frac{2}{3}$ G (2) 1.5G (3) $\frac{1}{3}$ G (4) $\frac{5}{4}$ G

Ans. **[1]**

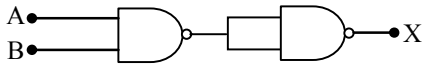
Sol. **Students may find this question in CP Class notes : [Topic : Electronics]**

$$\text{Voltage gain} = \frac{V_o}{V_i} = \frac{I_o R_o}{V_i} = g_m R_0$$

$A \propto g_m$

$$\frac{G}{G'} = \frac{g_{m_1}}{g_{m_2}} \Rightarrow G' = \frac{2}{3}G$$

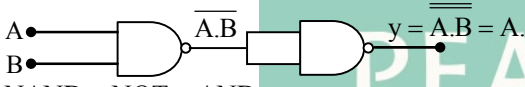
Q.45 The output (X) of the logic circuit shown in figure will be -



(1) $X = \overline{A} . \overline{B}$ (2) $X = \overline{A.B}$ (3) X = A.B (4) $X = \overline{A + B}$

Ans. **[3]**

Sol. **Students may find similar question in CP Sheet at : Page no. 195, Q.16 (Electronics)**



NAND + NOT = AND

Q.46 The value of Planck's constant is 6.63×10^{-34} Js. The speed of light is 3×10^{17} nm s^{-1}. Which value is closest to the wavelength in nanometer of a quantum of light with frequency of 6×10^{15} s^{-1} ?

(1) 10 (2) 25 (3) 50 (4) 75

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Atomic structure- same as to Page 33, Ex.-3(A) Q.27.**

$h = 6.63 \times 10^{-34}$ Js.

$C = 3 \times 10^{17}$ nm/sec.

$\lambda = 6 \times 10^{`15}$ sec^{-1}

$$\lambda = \frac{C}{\nu} = \frac{3 \times 10^{17}}{6 \times 10^{15}} = 50 \text{ nm}$$

Q.47 What is the maximum numbers of electrons that can be associated with the following set of quantum numbers ?

$n = 3$, $\ell = 1$ and $m = -1$.

(1) 10 (2) 6 (3) 4 (4) 2

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : Atomic structure- similar to Page 22, Ex.-1 Q.42.**

$n = 3 \quad \ell = 1 \quad m = -1$

$3p_x$ or $3p_y$ no of $e^{-1} = 2$

Q.48 What is the activation energy for a reaction if its rate doubles when the temperature is raised from 20ºC to 35ºC ? ($R = 8.314$ J mol^{-1} K^{-1})

(1) 342 kJ mol^{-1} (2) 269 kJ mol^{-1} (3) 34.7 kJ mol^{-1} (4) 15.1 kJ mol^{-1}

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Chemical kinetics- similar to Page 186, Ex.-1 Q.93.**

$$\log \frac{k_2}{k_1} = \frac{Ea}{2.303 \times R}\left(\frac{1}{293} - \frac{1}{308}\right)$$

$$\log 2 = \frac{Ea}{2.303R}\left(\frac{308 - 293}{293 \times 308}\right)$$

$E_a = 34673$ J $= 34.67$ kJ

Q.49 A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl of pH = 10 and by passing hydrogen gas around the platinum wire at one atm pressure. The oxidation potential of electrode would be ?

(1) 0.059 V (2) 0.59 V (3) 0.118 V (4) 1.18 V

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Electrochemistry- similar to Page 26, Ex.-2 Q.19.**

$H_2 \longrightarrow 2H^+ + 2e^-$

$$E_{oxi} = E^o_{oxi} - \frac{0.059}{2}\log\frac{[H^+]^2}{P_{H_2}}$$

$$= 0 - \frac{0.059}{2}\log\frac{[10^{-10}]^2}{1}$$

$$= -\frac{0.059}{2} \times (-20)$$

$= 0.59$ V

Q.50 A reaction having equal energies of activation for forward and reverse reactions has -

(1) $\Delta S = 0$ (2) $\Delta G = 0$ (3) $\Delta H = 0$ (4) $\Delta H = \Delta G = \Delta S = 0$

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Chemical kinetics- similar to Page 184, Ex.-1 Q.77.**

$\Delta H = (E_a)_f - (E_a)_b$

Given $(E_a)_f = (E_a)_b$

so $\Delta H = 0$

Q.51 At 25ºC molar conductance of 0.1 molar aqueous solution of ammonium hydroxide is 9.54 ohm^{-1} cm^2 mol^{-1} and at infinite dilution its molar conductance is 238 ohm^{-1} cm^2 mol^{-1}. The degree of ionisation of ammonium hydroxide at the same concentration and temperature is -

(1) 2.080 % (2) 20.800 % (3) 4.008 % (4) 40.800 %

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Electrochemistry- similar to Page 15, Ex.-1 Q.24.**

$$\alpha = \frac{\pi_m}{\pi_m^\infty} = \frac{9.54}{238} = 0.04008$$

or 4.008 %

Q.52 Based on equation $E = -2.178 \times 10^{-18}\ J \left(\frac{Z^2}{n^2}\right)$, certain conclusions are written. Which of them is not correct ?

(1) The negative sign in equation simply means that the energy of electron bound to the nucleus is lower than it would be if the electrons were at the infinite distance from the nucleus.

(2) Larger the value of n, the larger is the orbit radius.

(3) Equation can be used to calculate the change in energy when the electron changes orbit.

(4) For n = 1, the electron has a more negative energy that it does for n = 6 which means that the electron is more loosely bound in the smallest allowed orbit.

Ans. **[4]**

Sol. **Same discussed in CP Class Theory Notes.**

As we move nearer to the nucleus e^- are more strongly bonded.

Q.53 A button cell used in watches functions as following

$Zn(s) + Ag_2O(s) + H_2O(\ell) \rightleftharpoons 2Ag(s) + Zn^{2+}(aq) + 2OH^-(aq)$

If half cell potentials are

$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$; $E^o = -0.76$ V

$Ag_2O(s) + H_2O(l) + 2e^- \rightarrow 2Ag(s) + 2OH^-(aq)$, $E^o = 0.34$ V

The cell potential will be -

(1) 1.10 V (2) 0.42 V (3) 0.84 V (4) 1.34 V

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : Electrochemistry, Page 20, Ex.-1 Q.87.**

Cell rep $Zn/Zn^{+2} \,||\, Ag^+ \,|\, Ag$

$E^o_{Cell} = 0.76 + (0.34) = 1.1$ V

Q.54 How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0 M HNO_3 ? The concentrated acid is 70 % HNO_3.

(1) 45.0 g conc. HNO_3 (2) 90.0 g conc. HNO_3 (3) 70.0 conc. HNO_3 (4) 54.0 g conc. HNO_3

Ans. **[1]**

Sol. **Similar Question discussed in CP Class Theory Notes.**

$$\frac{w}{E} = NV$$

$$\frac{w}{63} = 2 \times \frac{250}{1000}$$

$$w = \frac{63}{2} = 31.5 \text{ g}$$

but 70 % solution

70 g is used the wt. of solution is 100 g

31.5 g is used the wt. of solution is ?

$$\frac{100}{70} \times 31.5 = 45 \text{ g}$$

Q.55 The number of carbon atoms per unit cell of diamond unit cell is -

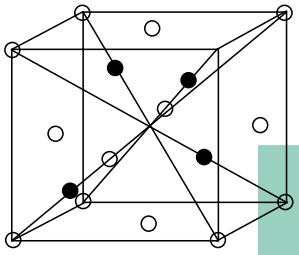
(1) 4 (2) 8 (3) 6 (4) 1

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Solid state- similar to Page 123, Ex.-3(A) Q.26.**

Effective atoms

$$= \frac{1}{8} \times 8 + \frac{1}{2} \times 6 + 4 = 8$$



Q.56 Maximum deviation from ideal gas is expected from :

(1) $H_2(g)$ (2) $N_2(g)$ (3) $CH_4(g)$ (4) $NH_3(g)$

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : Gaseous state- similar to Page 115, Ex.-2 Q.25.**

NH_3 is polar molecule

$\therefore$ intermolecular force of attraction are very high

$\therefore$ a is maximum and deviation is maximum.

Q.57 A metal has a fcc lattice. The edge length of the unit cell is 404 pm. The density of the metal is 2.72 g cm^{-3}. The molar mass of the metal is :

[N_A Avogadro's constant = 6.02×10^{23} mol^{-1}]

(1) 40 g mol^{-1} (2) 30 g mol^{-1} (3) 27 g mol^{-1} (4) 20 g mol^{-1}

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Solid state- similar to Page 116, Ex.-1 Q.24.**

$$\rho = \frac{Z \times M_w}{N_A \times V} \qquad V = a^3$$

$$2.72 = \frac{4 \times M_w}{6.02 \times 10^{23} \times 6.6 \times 10^{-23}} \qquad V = (404 \times 10^{-10})^3$$

$$M_w = \frac{2.72 \times 6.023 \times 6.6}{4} \qquad = 6.6 \times 10^{-23}$$

$= 27$ g/mol.

Q.58 Dipole - induced dipole interactions are present in which of the following pairs :

(1) H_2O and alcohol (2) Cl_2 and CCl_4 (3) HCl and He atoms (4) SiF_4 and He atoms

Ans. **[3]**

Sol. **Students may find similar question in CP Sheet at : Chemical bonding-Page 238-Q.95).**

Dipole - induced dipole interaction present in HCl & He atom. Because HCl molecule is polar and induces dipole in He atom.

Q.59 A magnetic moment of 1.73 BM will be shown by one among the following -

(1) $[Cu(NH_3)_4]^{2+}$ (2) $[Ni(CN)_4]^{2-}$ (3) $TiCl_4$ (4) $[CoCl_6]^{4-}$

Ans. **[1]**

Sol. **Students may find similar question in CP Sheet at : Coordination Compound-Page 77-Q.129).**

$[Cu(NH_3)_4]^{2+}$

$Cu^{+2} = [Ar]\ 3d^9$ $n = 1$

$\mu = \sqrt{n(n+2)}$ B.M.

$\mu = \sqrt{1(1+2)}$

$\mu = \sqrt{3}$

$\mu = 1.73$ B.M.

Q.60 Roasting of sulphides gives the gas X as a byproduct. This is colorless gas with choking smell of burnt sulphur and causes great damage to respiratory organs as a result of acid rain. Its aqueous solution is acidic, acts as a reducing agent and its acid has never been isolated. The gas X is -

(1) H_2S (2) SO_2 (3) CO_2 (4) SO_3

Ans. **[2]**

Sol. **Students may find this question in CP Class Notes.**

Roasting process carried out in reverberatory furnace. It is used for sulphide ore's to convert in metal oxide.

$$MS + O_2 + \xrightarrow{\Delta} MO + \underset{\text{Colourless gas}}{SO_2}$$

Q.61 Which is the strongest acid in the following ?

(1) H_2SO_4 (2) $HClO_3$ (3) $HClO_4$ (4) H_2SO_3

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Acid-Base- similar to Page 157, Ex.-1(B) Q.120.**

According to relative acid base strength, $HClO_4$ has maximum acidic strength.

Q.62 Which of the following is paramagnetic ?

(1) CO (2) O_2^- (3) CN^- (4) NO^+

Ans. **[2]**

Sol. **Students may find similar question in CP Sheet at : Chemical Bonding -Page 239-Q.113).**

$O_2^- \Rightarrow \sigma 1s^2\ \sigma^*\ 1s^2\ \sigma 2s^2\ \sigma^* 2s^2\ \sigma 2p_z^2\ (\pi 2p_x^2 = \pi 2p_y^2)$

$(\pi^* 2p_x^2 = \pi^* 2p_y^1)$

One unpaired electron present in π^* abmo.

Q.63 Which of the following structure is similar to graphite ?

(1) BN (2) B (3) B_4C (4) B_2H_6

Ans. **[1]**

Sol. **Similar question discussed in CP Class Notes.**

BN(Inorganic graphite) and graphite have hexagonal structure (sp^2)

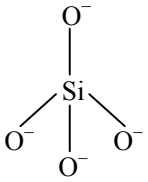
Q.64 The basic structural unit of silicates is -

(1) SiO^- (2) SiO_4^{4-} (3) SiO_3^{2-} (4) SiO_4^{2-}

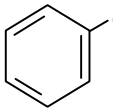
Ans. **[2]**

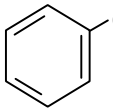
Sol. **Student can find similar question in CP class Theory Notes.**

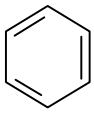
Basic unit of silicate is tetrahedral SiO_4^{-4}

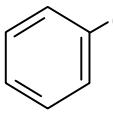


Q.65 Reaction by which Benzaldehyde cannot be prepared-

(1)  + CrO_2Cl_2 in CS_2 followed by H_3O^+

(2)  + H_2 in presence of $Pd\text{-}BaSO_4$

(3)  + CO + HCl in presence of anhydrous $AlCl_3$

(4)  + Zn/Hg and conc. HCl

Ans. **[4]**

Sol. **Students may find this question in CP Class Theory Notes.**

Zn-Hg/conc.HCl is Clemmenson reduction. It can be used for $-\overset{\overset{O}{\|}}{C}-$ only.

Q.66 Which of the following does not give oxygen on heating ?

(1) $KClO_3$ (2) $Zn(ClO_3)_2$ (3) $K_2Cr_2O_7$ (4) $(NH_4)_2Cr_2O_7$

Ans. **[4]**

Sol. **Similar Questions from CP Class Theory Notes.**

$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2 + Cr_2O_3 + 2H_2O$

$2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

$Zn(ClO_3)_2 \xrightarrow{\Delta} ZnCl_2 + 3O_2$

$K_2Cr_2O_7 \xrightarrow{\Delta} 2\,K_2CrO_4 + Cr_2O_3 + \frac{3}{2}O_2$

Q.67 Which of the following lanthanoid ions is diamagnetic ? (At. No. Ce = 58, Sm = 62, Eu = 63, Yb = 70)

(1) Ce^{2+} (2) Sm^{2+} (3) Eu^{2+} (4) Yb^{2+}

Ans. **[4]**

Sol. **Similar Questions from CP Class Theory Notes.**

$_{70}Yb = [Xe]\ \ 4f^{14}5d^0\ 6s^2$

$Yb^{+2} = [Xe]\ \ 4f^{14}$

$n = 0\ \ \therefore$ Diamagnetic

Q.68 Identify the correct order of solubility in aqueous medium-

(1) $CuS > ZnS > Na_2S$ (2) $ZnS > Na_2S > CuS$ (3) $Na_2S > CuS > ZnS$ (4) $Na_2S > ZnS > CuS$

Ans. **[4]**

Sol. **Similar concept discussed in CP Class Theory Notes.**

IA group elements sulphide are highly soluble, Zn^{+2} is IV group radical and Cu^{+2} is II group radical

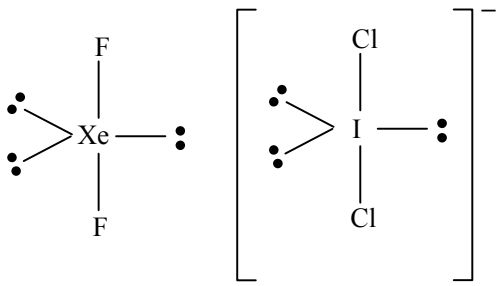
$\therefore\ Na_2S > ZnS > CuS$

Q.69 XeF_2 is isostructural with-

(1) TeF_2 (2) ICl_2^- (3) $SbCl_3$ (4) $BaCl_2$

Ans. **[2]**

Sol. **Students may find this question in CP Sheet : Topic-Chemical bonding at Page no.230, Q.No.48**



sp^3d linear

Q.70 An excess of $AgNO_3$ is added to 100 mL of a 0.01 M solution of dichlorotetraaquachrominum (III) chloride. The number of moles of AgCl precipitated would be-

(1) 0.001 (2) 0.002 (3) 0.003 (4) 0.01

Ans. **[1]**

Sol. **Similar Question in CP Class Theory Notes.**

$AgNO_3 + [Cr(H_2O)_4Cl_2]Cl \rightarrow AgCl$

Excess mole $= MV_{(lit)}$

$$= 0.01 \times \frac{100}{1000}$$

$$= 0.001$$

Q.71 Which of these is least likely to act as a Lewis base ?

(1) CO (2) F^- (3) BF_3 (4) PF_3

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : Topic-Acid-Base at Page no.158, Ex.1(B) Q.No.122**

BF_3 is electron deficient so act as Lewis acid.

Q.72 $KMnO_4$ can be prepared from K_2MnO_4 as per the reaction : $3MnO_4^{2-} + 2H_2O \rightleftharpoons 2MnO_4^- + MnO_2 + 4OH^-$. The reaction can go to completion by removing OH^- ions by adding-

(1) HCl (2) KOH (3) CO_2 (4) SO_2

Ans. **[3]**

Sol. **Students may find this question in CP Class Notes.**

MnO_4^- oxidizes HCl and SO_2 to Cl_2 and SO_3 respectively.

MnO_4^- does not oxidizes H_2CO_3 (maximum oxidation state of C)

Q.73 Which of the following is electron-deficient ?

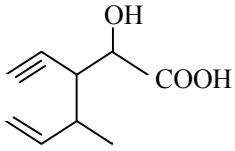
(1) $(CH_3)_2$ (2) $(SiH_3)_2$ (3) $(BH_3)_2$ (4) PH_3

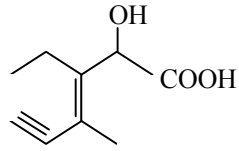
Ans. **[3]**

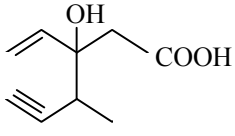
Sol. **Students may find this question in CP Sheet : Topic-Chemical bonding at Page no.229, Q.No.37**

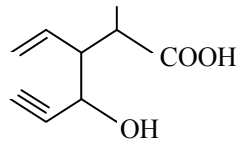
$CH_3 - CH_3$, $SiH_3 - SiH_3$ and PH_3 contain eight electron in valence shell. In B_2H_6 molecule sufficient electron are not available for bonding and it contain tricentric bond. So B_2H_6 molecule is electron deficient.

Q.74 Structure of the compound whose IUPAC name is 3-Ethyl-2-hydroxy-4-methylhex-3-en-5-ynoic acid is-

(1) 

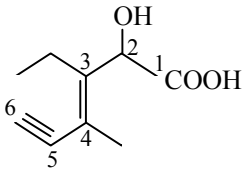
(2) 

(3) 

(4) 

Ans. **[2]**

Sol. **Students may find similar question in CP Class Theory Notes at GOC-I**



3-Ethyl-2-hydroxy-4-methyl hex-3-en-5-ynoic acid

Q.75 Which of these is not a monomer for a high molecular mass silicone polymer ?

(1) $MeSiCl_3$ (2) Me_2SiCl_2 (3) Me_3SiCl (4) $PhSiCl_3$

Ans. **[3]**

Sol. **Similar question from CP Class Theory Notes.**

Linear chain silicone form by hydrolysis of Me_2SiCl_2 followed by condensation.

Cross link silicone form by hydrolysis of $MeSiCl_3$.

Me_3SiCl is used to stop chain length

$$Me_3SiCl \xrightarrow{HOH} Me_3SiOH$$

$$Me_3SiOH + HOSiMe_3 \rightarrow Me_3Si - O - OSiMe_3$$

Q.76 Which of the following statements about the interstitial compounds is incorrect ?

(1) They retain metallic conductivity

(2) They are chemically reactive

(3) They are much harder than the pure metal

(4) They have higher melting points than the pure metal

Ans. **[2]**

Sol. **Similar question from CP Class Theory Notes.**

Interstitial compound are chemically inert.

Q.77 Which one of the following molecules contains no π bond ?

(1) CO_2 (2) H_2O (3) SO_2 (4) NO_2

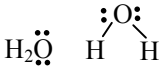
Ans. **[2]**

Sol. **Similar question from CP Class Theory Notes.**

CO_2 O = C = O

SO_2 O = S = O

NO_2 



H_2O molecule does not contain π bond.

Q.78 Antiseptics and disinfectants either kill or prevent growth of microrganisms. Identify which of the following statements is not true-

(1) A 0.2 % solution of phenol is an antiseptic while 1 % solution acts as a disinfectant

(2) Chlorine and Iodine are used as strong disinfectants

(3) Dilute solutions of boric acid and hydrogen peroxide are strong antiseptics

(4) Disinfectants harm the living tissues

Ans. **[2]**

Sol. **Students may find theory of this question in CP Sheet at Page No.201 of Topic-Chemistry in everyday life.**
Chlorine is disinfectants but Iodine is antiseptics.

Q.79 Among the following ethers, which one will produce methyl alcohol on treatment with hot concentrated HI ?

(1) $CH_3 - CH_2 - CH_2 - CH_2 - O - CH_3$

(2) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - O - CH_3$

(3) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - O - CH_3$

(4) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CH_2 - O - CH_3$

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Topic Ether (page no.56)**

$$CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - O - CH_3 \xrightarrow[SN^1]{HI} CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} - I + CH_3 - OH$$

Q.80 Nylon is an example of-

(1) Polyester (2) Polysaccharide (3) Polyamide (4) Polythene

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Topic-Polymers (page no.194)**
Nylon is polyamide.

Q.81 The structure of isobutyl group in an organic compound is-

(1) $\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!>\!CH - CH_2 -$

(2) $CH_3 - \underset{\displaystyle |}{CH} - CH_2 - CH_3$

(3) $CH_3 - CH_2 - CH_2 - CH_2 -$

(4) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} -$

Ans. **[1]**

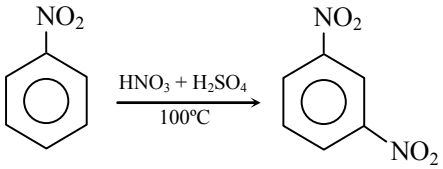
Sol. **Students may find this question in CP Class Theory Notes at GOC-I**

$CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CH_2 -$ is isobutyl group.

Q.82 Nitrobenzene on reaction with conc. HNO_3/H_2SO_4 at 80 – 100ºC forms which one of the following products?
(1) 1,2-Dinitrobenzene (2) 1,3-Dinitrobenzene
(3) 1,4-Dinitrobenzene (4) 1,2,4-Trinitrobenzene

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Topic-Nitrogen compounds (Page no.121)**



$\because$ $-NO_2$ group is meta directing group.

Q.83 Some meta - directing substitution in aromatic substitution are given. Which one is most deactivating ?
(1) $-C\equiv N$ (2) $-SO_3H$ (3) $-COOH$ (4) $-NO_2$

Ans. **[4]**

Sol. **Students may find this question in CP Class Theory Notes at GOC-II**
$-NO_2$ is strong deactivating group.

Q.84 6.02×10^{20} molecules of urea are present in 100 mL of its solution. The concentration of solution is-
(1) 0.02 M (2) 0.01 M (3) 0.001 M (4) 0.1 M

Ans. **[2]**

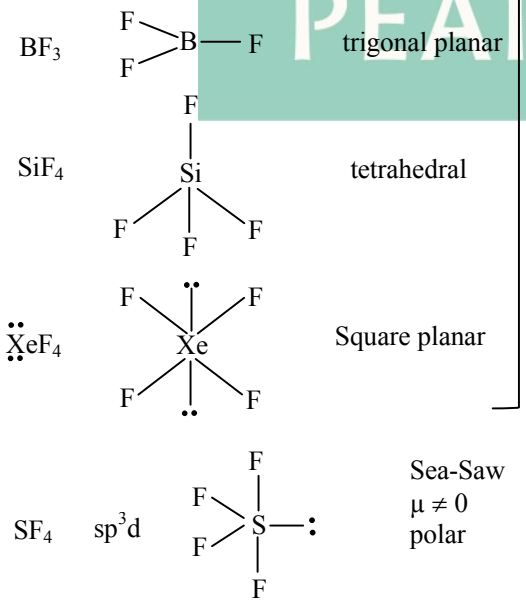
Sol. **Similar Question in CP Class Theory Notes.**

$$M = \frac{\text{mole}}{V_{(ml)}} \times 1000 = \frac{0.001}{100} \times 1000 = 0.01 \text{ M}$$

Q.85 Which of the following is a polar molecule ?
(1) BF_3 (2) SF_4 (3) SiF_4 (4) XeF_4

Ans. **[2]**

Sol. **Students may find this question in CP Sheet : Topic-Chemical bonding at Page no.229, Q.No.35**



Q.86 Which is the monomer of Neoprene in the following ?

(1) $CH_2 = CH - CH = CH_2$

(2) $CH_2 = \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} - CH = CH_2$

(3) $CH_2 = \underset{\displaystyle Cl}{\overset{\displaystyle |}{C}} - CH = CH_2$

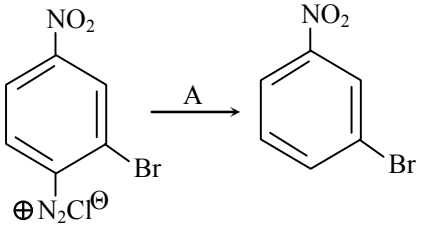
(4) $CH_2 = CH - C \equiv CH$

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Topic-Polymer (Page no.192)**

$$n\left[CH_2 = \underset{\displaystyle Cl}{\overset{\displaystyle |}{C}} - CH = CH_2\right] \xrightarrow{\text{Polymerisation}} \left[CH_2 - \underset{\displaystyle Cl}{\overset{\displaystyle |}{C}} = CH - CH_2\right]_n$$

chloroprene (monomer) → Neoprene (polymer)

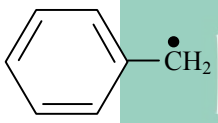
Q.87 In the reaction  ; A is-

(1) $HgSO_4/H_2SO_4$ (2) Cu_2Cl_2 (3) H_3PO_2 and H_2O (4) H^+/H_2O

Ans. **[3]**

Sol. **Students may find similar question in CP Sheet at : Topic-Nitrogen compounds (Page no. 139)**

H_3PO_2 and H_2O works as a reducing agent.

Q.88 The radical,  is aromatic because it has-

(1) 6 p-orbitals and 6 unpaired electrons (2) 7 p-orbitals and 6 unpaired electrons

(3) 7 p-orbitals and 7 unpaired electrons (4) 6 p-orbitals and 6 unpaired electrons

Ans. **[1]**

Sol. **Students may find similar question in CP Sheet at : Topic-GOC-II (Exercise-II)**

Only benzene is considered in aromatic.

$\therefore$ 6p-orbitals (π-electrons) and 6 unpaired electrons are present.

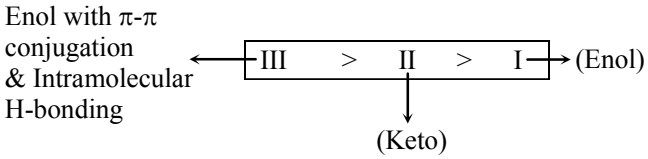
Q.89 The order of stability of the following tautomeric compounds is-

$$\underset{\text{(I)}}{CH_2 = \overset{\displaystyle OH}{\overset{\displaystyle |}{C}} - CH_2 - \overset{\displaystyle O}{\overset{\displaystyle ||}{C}} - CH_3} \rightleftharpoons \underset{\text{(II)}}{CH_3 - \overset{\displaystyle O}{\overset{\displaystyle ||}{C}} - CH_2 - \overset{\displaystyle O}{\overset{\displaystyle ||}{C}} - CH_3} \rightleftharpoons \underset{\text{(III)}}{CH_3 - \overset{\displaystyle OH}{\overset{\displaystyle |}{C}} = CH - \overset{\displaystyle O}{\overset{\displaystyle ||}{C}} - CH_3}$$

(1) I > II > III (2) III > II > I (3) II > I > III (4) II > III > I

Ans. **[2]**

Sol. **Students may find similar question in CP Sheet at : GOC-I (Page no. 51)**



Q.90 Which of the following compounds will not undergo Friedal-Craft reaction easily-

(1) Cumene (2) Xylene (3) Nitrobenzene (4) Toluene

Ans. **[3]**

Sol. **Students may find this question in CP Class Theory Notes at GOC-II.**

$-NO_2$ group is strong deactivating.

$\therefore$ It inhibits F.C.R.

Q.91 Select the **wrong** statement :

(1) Isogametes are similar in structure, function and behavior

(2) Anisogametes differ either in structure, function of behaviour

(3) In Oomycetes female gamete is smaller and motile, while male gamete is larger and non-motile

(4) *Chlamydomonas* exhibits both isogamy and anisogamy and *Fucus* shows oogamy

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Plant diversity page no. 80**

In oomycetes sexual reproduction occur by Isogamy or Oogamy. In isogamy both the fusing gametes are similar in structure, while in oogamy in oomycetes male gamete and female gamete both are nonmotile and female gamete is large while male gamete is small.

Q.92 Which one of the following is not a correct statement ?

(1) Herbarium houses dried, pressed and preserved plant specimens

(2) Botanical gardens have collection of living plants for reference

(3) A museum has collection of photographs of plants and animals

(4) Key is a taxonomic aid for identification of specimens

Ans. **[3]**

Sol. **Students may find this question in NCERT page no. 12 (XIth Class)**

Museum is the collection of dead and preserved specimen of animals generally.

Q.93 Isogamous condition with non-flagellated gametes is found in:

(1) *Chlamydomonas* (2) *Spirogyra* (3) *Volvox* (4) *Fucus*

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Lower Plant page no. 19**

In spirogyra isogamy occur by nonomotile gametes.

Q.94 Besides paddy fields, cyanobacteria are also found inside vegetative part of :

(1) *Pinus* (2) *Cycus* (3) *Equisetum* (4) *Psilotum*

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Plant Diversity page no. 47**

Coralloid root of cycas plant possess cyanobacteria

Q.95 Megasporangium is equivalent to :

(1) Embryo sac (2) Fruit (3) Nucellus (4) Ovule

Ans. **[4]**

Sol. **Students may find this question in CP Sheet : Reproduction in flowering plants page no. 15**

Ovule is megasporangium and have sporogenous cells which produce megaspore by meiosis

Q.96 Read the following statements (A– E) and answer the question which follows them :

(A) In liverworts, mosses and ferns gametophytes are free-living

(B) Gymnosperms and some ferns are heterosporous

(C) Sexual reproduction in *Fucus*, *Volvox* and *Albugo* is oogameous

(D) The sporophytes in liverworts is more elaborate than that in mosses

(E) Both, *Pinus* and *Marchentia* are dioecious

How many of the above statements are correct ?

(1) One (2) Two (3) Three (4) Four

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Plant Diversity**

Statement A, B and C are correct

Q.97 Among bitter gourd, mustard, brinjal, pumpkin, china rose, lupin, cucumber, sunnhemp, gram, guava, bean, chilli, plum, petunia, tomato, rose, withania, potato, onion, aloe and tulip how many plants have hypogynous flower ?

(1) Six (2) Ten (3) Fifteen (4) Eighteen

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Structural organization in plant at page no. 134, 137, 140, 143.**

Mustard, brinzal, chinarose, chili, petunia, tomato, withania, Potato, onion, aloe, tulip, lupin, sunnhemp, gram and bean. Fifteen plant have hypogynous flower.

Q.98 Interfascicular cambium develops from the cells of :

(1) Medullary rays (2) Xylem parenchyma (3) Endodermis (4) Pericycle

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : Structural organization in plant at page no. 36**

Interfascicular cambium is developed from the cells of medullary ray

Q.99 In china rose the flowers are :

(1) Actinomorphic, hypogynous with twisted aestivation

(2) Actinomorphic, epigynous with valvate aestivation

(3) Zygomorphic, hypogynous with imbricate aestivation

(4) Zygomorphic, epigynous with twisted aestivation

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : Structural organization in plant at page no. 137**

Malvaceae family

Q.100 Lenticels are involved in

(1) Transpiration (2) Gaseous exchange (3) Food transport (4) Photosynthesis

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Structural organization in plant at page no. 40.**

Lenticels are involved in gaseous exchange of tree trunk and environment

Q.101 Age of a tree can be estimated by :

(1) Its height and girth

(2) Biomass

(3) Number of annual rings

(4) Diameter of its heartwood

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Structural organization in plant at page no. 39**

Generally one annual ring is formed in one year due to secondary growth. Thus by counting annual ring, age of tree can be determined

***Q.102** Seed coat is not thin membranous in :

(1) Maize (2) Coconut (3) Groundnut (4) Gram

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : Structural organization in plant at page no. 14**

Seed coat of legume (gram) is hard and thick due to presence of sclereids

Q.103 Transition state structure of the substate formed during an enzymatic reaction is

(1) Transient but stable

(2) Permanent but unstable

(3) Transient and unstable

(4) Permanent and stable

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Plant physiology Eng. page no. 117**

Transition state is intermediate state produced during enzymatic biochemical reaction which is transition state and unstable state

Q.104 A phosphoglyceride is always made up of :

(1) Only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

(2) Only an unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

(3) A saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached

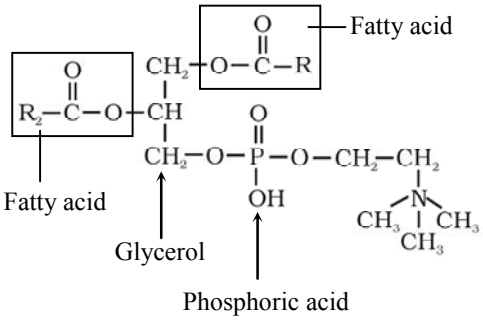
(4) A saturated or unsaturated fatty acid esterified to a phosphate group which is also attached to a glycerol molecule

Ans. **[3]**

Sol. **Students may find this question in NCERT page 144**

Fatty acid can be saturated or unsaturated. Here fatty acid are found esterified with glycerol which is attached with phosphate group

Ex. Lecithin



Q.105 Pigment-containing membranous extensions in some cyanobacteria are

(1) Heterocysts (2) Basal bodies (3) Pneumatophores (4) Chromatophores

Ans. **[4]**

Sol. **Students may find this question in NCERT page no 129 XI class**

Photosynthetic pigment are present in membranous extension chromatophore in cyanobacteria

Q.106 A major site for synthesis of lipids is :

(1) RER (2) SER (3) Symplast (4) Nucleoplasm

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Cell biology page no. 36**

The site for lipid synthesis is SER

Q.107 The complex formed by a pair of synapsed homologous chromosomes is called :

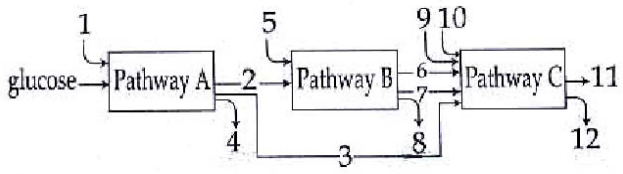
(1) Equatorial plate (2) Kinetochore (3) Bivalent (4) Axoneme

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Cell biology page no. 54**

Homologous chromosome are paired and synapsed during zygotene stage of meiosis-I and known as bivalent

Q.108 The three boxes in this diagram represent the three major biosynthetic pathways in aerobic respiration. Arrows represent net reactants or products



Arrows numbered 4, 8, and 12 can all be

(1) NADH (2) ATP (3) H_2O (4) FAD^+ or $FADH_2$

Ans. **[2]**

Sol. Pathway-A is glycolysis

Pathway-B is Krebs cycle

Pathway-C is Electron transport system

1, 5 are respiratory substrates like protein and fats

6,7,3,9,10 are $NADH_2$, $FADH_2$

*** 4, 8, 12 are ATP produced**

Q.109 The most abundant intracellular cation is :

(1) Na^+ (2) Ca^{++} (3) H^+ (4) K^+

Ans. **[4]**

Sol. **Students may find this question in CP Sheet : Animal physiology-II page no. 202**

K^+ is most abundant ion of intracellular fluid while Na+ is extra cellular fluid.

Q.110 During seed germination its stored food is mobilized by :

(1) Ethylene (2) Cytokinin (3) ABA (4) Gibberellin

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : Plant physiology English page no 147**

Gibberellin have characteristic function breaking of seed dormancy by activating stored food hydrolyzing enzymes amylase, lipase, protease.

Q.111 Which of the following criteria does not pertain to facilitated transport ?

(1) Requirement of special membrane proteins

(2) High selectivity

(3) Transport saturation

(4) Uphill transport

Ans. **[4]**

Sol. **Students may find this question in CP class notes plant physiology (mineral nutrition)**

NCERT Bio 11th English page no. 178 table 11.1

Facilitated transport means transport with help of carrier proteins which may be both uphill i.e. against the concentration gradient and down hill i.e. in order of concentration gradient which is also called as facilitated diffusion or passive facilitated transport

Q.112 The first stable product of fixation of atmospheric nitrogen in leguminous plants is :

(1) NO_2^- (2) Ammonia (3) NO_3^- (4) Glutamate

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Plant physiology English page no. 224**

NCERT 11th class English page no 202

Product of fixation of N_2 in leguminous plants by it's symbiotic associate Rhizobium bacteria, in root nodules is NH_3 (ammonia)

***Q.113** Which of the metabolites is common to respiration mediated breakdown of fats, carbohydrates and proteins ?

(1) Glucose-6-phosphate (2) Fructose1, 6-bisphosphate

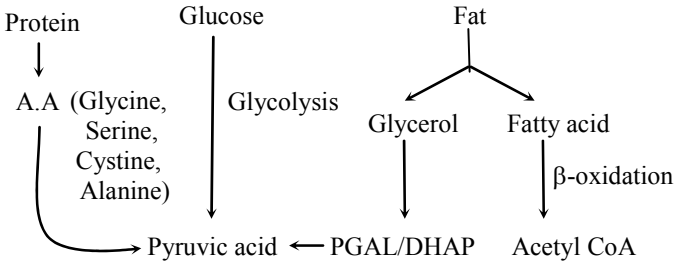
(3) Pyruvic acid (4) Acetyl CoA

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Plant physiology English page no. 68**

NCERT XIth class English page no. 235

Pyruvic acid is intermediate compound which is produced during oxidation of all types of respiratory substrates carbohydrates, fats, proteins



* option (4) Acetyl CoA may also be answer but more appropriate is pyruvic acid as it formed directly by all these respiratory substrates.

Q.114 Which one of the following statements is correct ?

(1) Hard outer layer of pollen is called intine

(2) Sporogenous tissue is haploid

(3) Endothecium produces the microspores

(4) Tapetum nourishes the developing pollen

Ans. **[4]**

Sol. **Students may find this question in CP Sheet at : Reproduction in Flowering plant English page no. 7**

Tapetum is innermost layer of anther provide nutrition to developing microspore / pollens.

Q.115 Product of sexual reproduction generally generates :

(1) Longer viability of seeds

(2) Prolonged dormancy

(3) New genetic combination leading to variation

(4) Large biomass

Ans. **[3]**

Sol. Sexual reproduction leads to new genetic combination leading to variation as it involves mixing of gametes to two different parents which are produced (gametes) by meiosis

Q.116 Meiosis takes place in :

(1) Meiocyte (2) Conidia (3) Gemmule (4) Megaspore

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : Cell biology page no. 56**

Meiocyte are the cells in which meiosis occur

Q.117 Advantage of cleistogamy is :

(1) Higher genetic variability (2) More vigorous offspring

(3) No dependence on pollinators (4) Vivipary

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Reproduction in flowering plant English page no. 23**

Cleistogamy means closed flower which are bisexual does not requires pollinator still have assured seed set.

Q.118 Monoecious plant of *Chara* shows occurrence of :

(1) Antheridiophore and archegoniophore on the same plant

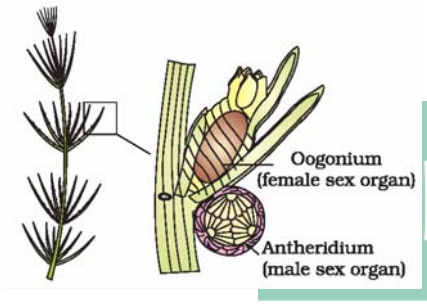
(2) Stamen and carpel on the same plant

(3) Upper antheridium and lower oogonium on the same plant

(4) Upper oogonium and lower antheridium on the same plant

Ans. **[4]**

Sol. **Students may find this question in NCERT fig 1.6 XII class**



Q.119 Perisperm differs from endosperm in :

(1) Being a haploid tissue

(2) Having no reserve food

(3) Being a diploid tissue

(4) Its formation by fusion of secondary nucleus with several sperms

Ans. **[3]**

Sol. Perisperm is persistent nucellus within seeds. It is not common as nucellus is nutritive tissue provide nutrition to embryosac. Nucellus is diploid tissue. In Beet, Piper it is persists within seed so it is diploid (2n) while endosperm is a triploid (3n) tissue

Q.120 Which of the following statements is not true of two genes that show 50% recombination frequency ?
(1) The genes may be on different chromosomes
(2) The genes are tightly linked
(3) The genes show independent assortment
(4) If the genes are present on the same chromosome, they undergo more than one crossovers in every meiosis.

Ans. **[2]**

Sol. **Students may find this question in NCERT page 83**
If gene are present on same chromosome and tightly linked they show very few recombinant so they show 50% recombinant is wrong statement.

Q.121 Variation in gene frequencies within populations can occur by chance rather than by natural selection. This is referred to as :
(1) Genetic flow (2) Genetic drift (3) Random mating (4) Genetic load

Ans. **[2]**

Sol. **Students may find this question in NCERT page 137**
If gene migration due to gene flow happens multiple times this variation in gene frequency change occurs by chance is genetic drift.

Q.122 If two persons with 'AB' blood group marry and have sufficiently large number of children, these children could be classified as 'A' blood group : 'AB' blood group : 'B' blood group in 1 : 2 : 1 ratio. Modern technique of protein electrophoresis reveals presence of both 'A' and 'B' type proteins in 'AB' blood group individuals. This is an example of :
(1) Codominance (2) Incomplete dominance (3) Partial dominance (4) Complete dominance

Ans. **[1]**

Sol. **Students may find this question in NCERT page 77**
I^A and I^B present together they both express their own type of sugar on the surface of RBC is codominance

Q.123 The process by which organisms with different evolutionary history evolve similar phenotypic adaptations in response to a common environmental challenge is called :
(1) Natural selection (2) Convergent evolution (3) Non-random evolution (4) Adaptive radiation

Ans. **[2]**

Sol. Due to common environmental changes different animals develop similar looking feature. This phenomenon is known as convergent evolution.

Q.124 The tendency of population to remain in genetic equilibrium may be disturbed by :
(1) random mating (2) lack of migration (3) lack of mutations (4) lack of random mating

Ans. **[4]**

Sol. **Students may find this question in NCERT page 136**
Gene frequency remain stable or constant from generation to generation in a random mating population is Hardy weinberg principle if population lack random mating than

Q.125 Which of the following Bt crops is being grown in India by the farmers ?

(1) Maize (2) Cotton (3) Brinjal (4) Soybean

Ans. **[2]**

Sol. Bt cotton is commonly grown Bt crop of India.

Q.126 A good product of citric acid is :

(1) *Aspergillus* (2) *Pseudomonas* (3) *Clostridium* (4) *Saccharomyces*

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Plant Diversity**

Aspergilus niger is used in formation of citric acid

Q.127 DNA fragments generated by the restriction endonucleases in a chemical reaction can be separated by :

(1) Centrifugation (2) Polymerase chain reaction

(3) Electrophoresis (4) Restriction mapping

Ans. **[3]**

Sol. **Students may find this question in NCERT page 198**

DNA fragment generated by restriction endonuclease is separated by Gel-electrophoresis.

Q.128 Which of the following is not corretly matched for the organism and its cell wall degrading enzyme ?

(1) Bacteria-Lysozyme (2) Plant cells- Cellulase (3) Algae-Methylase (4) Fungi - Chitinase

Ans. **[3]**

Sol. Methylase enzyme is used for methylation.

Q.129 The colonies of recombinat bacteria appear white in contrast to blue colonies of non-recombinant bacteria because of :

(1) Non-recombinant bacteria containing betagalactosidase

(2) Insertional inactivation of alphagalactosidase in non-recombinant bacteria

(3) Insertional inactivation of alphagalactosidase in recombinant bacteria

(4) Inactivation of glycosidase enzyme in recombinant bacteria

Ans. **[3]**

Sol. **Students may find this question in NCERT page 200**

If insertion inactivation of α-galactosidase or z-gene of lac-operon in plasmid of E.Coli take place then it will not produce α-galactosidase or lactase enzyme (this enzyme convert x-gel chromogen into blue colour) due to lack of this enzyme this reaction does not take place so recombinant bacteria appears white in contrast to blue colonies.

Q.130 Which of the following are likely to be present in deep sea water ?

(1) Archaebacteria (2) Eubacteria (3) Blue-green algae (4) Saprophytic fungi

Ans. **[1]**

Sol. In deep sea water no light is reach the archaebacteria like sulphur bacteria methanomonas are present and their nutritional category is chemoautotrophs or chemosynthetic bacteria.

Q.131 Natural reservoir of phosphorus is :

(1) Sea water (2) Animal bones (3) Rock (4) Fossils

Ans. **[3]**

Sol. **Students may find this question in CP Sheet Ecology Eng. Page No. 104**

Phosphorous cycle is sedimentary cycle whose reservoir lies in Rocks and Sediments

Q.132 Secondary productivity is rate of formation of new organic matter by :

(1) Producer (2) Parasite (3) Consumer (4) Decomposer

Ans. **[3]**

Sol. **Students may find this question in CP Sheet Ecology Page NO. 95**

Secondary productivity is biomass assimilated by consumers.

Q.133 Which one of the following is not used for *ex situ* plant conservation?

(1) Field gene banks (2) Seed banks (3) Shifting cultivation (4) Botanical Gardens

Ans. **[3]**

Sol. **Students may find this question in CP Sheet Ecology Eng. Page No. 96**

Shifting cultivation or Jhum cultivation is a kind of deforestation not conservation.

Q.134 Kyoto-Protocol was endorsed at :

(1) CoP-3 (2) CoP-5 (3) CoP-6 (4) CoP-4

Ans. **[1]**

Sol. Kyoto protocol was endorsed at CoP-3

CoP – Confrence of Parties occurs before and after the endorsement of kyoto protocol.

CoP-1 : held at Berlin (Germany) also known as Berlin mendeate in 1995.

CoP-2 : held at Geneva (Switzerland) also known as Ministerial Declaration.

Cop-3 : held at kyoto, (Japan) in 1997 endorsed kyoto protocol.

Q.135 Which of the following represent maximum number of species among global biodiversity ?

(1) Algae (2) Lichens (3) Fungi (4) Mosses and Ferns

Ans. **[3]**

Sol. **Students may find this question in CP Sheet Ecology English Page No. 140**

Fungi has highest species diversity among all plant groups.

Q.136 Match the name of the animal (Column I), with one characteristics (Column II), and the phylum/class (column III) to which it belongs :

	Column I	**Column II**	**Column III**
(1)	*Petromyzon*	ectoparasite	Cyclostomata
(2)	*Ichthyophis*	terrestrial	Reptilia
(3)	*Limulus*	body covered by chitinous exoskeleton	Pisces
(4)	*Adamsia*	radially symmetrical	Porifera

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Page 104-105**

Petromyzone is a vertebrate belonging to cyclostomata (cyclo = Rounded, Stoma = mouth) They remain as an ectoparasite on merine fishes & turtles.

Q.137 Which of the following are correctly matched with respect of their taxonomic classification ?

(1) Flying fish, cuttlefish, silverfish – Pisces

(2) Centipede, millipede, spider, scorpion-Insecta

(3) House fly, butterfly, tsetsefly, silverfish-Insecta

(4) Spiny anteater, sea urchin, sea cucumber-Echinodermata

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : Page 37**

House fly, butterfly, tsetse fly, silverfish, all are Insects

Q.138 Which group of animals belong to the same phylum ?

(1) Malarial parasite, *Amoeba*, Mosquito (2) Earthworm, Pinworm, Tapeworm

(3) Prawn, Scorpion, *Locusta* (4) Sponge, Sea anemone, Starfish

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : Page 36-37**

Prawn, Scorpion & *Locusta all belong to phylum Arthropoda*

Q.139 One of the representatives of Phylum Arthropoda is :

(1) cuttlefish (2) silverfish (3) pufferfish (4) flying fish

Ans. **[2]**

Sol. **Students may find this question in CP Sheet : Page 36-37**

Silverfish (Book-worm) belongs is phylum arthropoda

Q.140 The H-zone in the skeletal muscle fibre is due to -

(1) the absence of myofibrils in the central portion of A-band

(2) the central gap between myosin filaments in the A-band

(3) the central gap between actin filaments extending through myosin filaments in the A-band

(4) extension of myosin filaments in the central portion of the A-band.

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : animal physiology-I on Page 43**

The edges of thin filament (Actin) on either side of thick filaments (myosin) partially overlap the free ends of the thick filaments (myosin) leaving the centralpart of thick filament (myosin). This central part of thick filament (myosin),not overlapped by thin filaments (Actin) is called the 'H'-zone.

Q.141 What external changes are visible after the last moult of a cockroach nymph ?

(1) Mandibles become harder (2) Anal cerci develop

(3) Both fore wings and hind wings develop (4) Labium develops

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : lower animal on page No. 101**

The next to last nymphal stage has wing pads but only adult cockroaches have wings.

Q.142 The Golgi complex plays a major role :

(1) in trapping the light and transforming it into chemical energy

(2) in digensting proteins and carbohydrates

(3) as energy transferring organelles

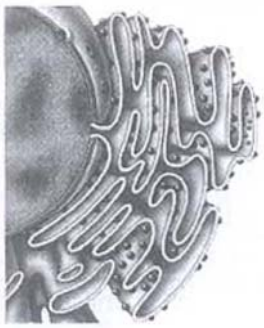
(4) in post translational modification of proteins and glycosidation of lipids

Ans. **[4]**

Sol. **Students may find this question in CP Sheet : Cell Biology**

Golgi complex is involved in glycosidation of protein and lipid and formation of glycolipid and glycoprotein.

Q.143 Which one of the following organelle in the figure correctly matches with its function ?



(1) Rough endopolasmic reticulum, formation of glycoproteins

(2) Golgi apparatus, protein synthesis

(3) Golgi apparatus, formation of glycolipids

(4) Rough endoplasmic reticulum, protein synthesis

Ans. **[4]**

Sol. **Students may find this question in CP Sheet : Cell Biology page no. 24 & 26**

Given figure is RER, which is involved in protein synthesis

Q.144 Macro molecule chitin is :

(1) nitrogen containing polysaccharide

(2) phosphorus containing polysaccharide

(3) sulphur containing polysaccharide

(4) simple polysaccharide

Ans. **[1]**

Sol. **Students may find this question in NCERT XIth Class page 149**

Chitin is polymer of N-acetyl galactosamine (NAGA) so it is Nitrogen containing polysaccharide

Q.145 The essential chemical components of many coenzymes are :

(1) Proteins (2) Nucleic acids (3) Carbohydrates (4) Vitamins

Ans. **[4]**

Sol. **Students may find this question in CP Sheet : Plant physiology page no. 119**

Coenzymes are loosely attached organic parts of conjugated enzymes which are generally derivatives of vitamins.

Q.146 A stage in cell division is shown in the figure. Select the answer which gives correct identification of the stage with its characteristics.

(1)	Telophase	nuclear envelop reforms, golgi complex reforms
(2)	Late anaphase	chromosomes move away from equatorial plate, golgi complex not present
(3)	Cytokinesis	cell plate formed, mitochondria distributed between two daughter cells
(4)	Telophase	endoplasmic reticulum and nucleolus not reformed yet

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Cell Biology page no. 55**

Given figure is telophase stage in which nuclear envelope and golgi complex is reformed.

Q.147 Select the correct match of the digested products in humans given in colum I with their absorption site and mechanism in column II.

	Column I	**Column II**
(1)	Glycine, glucose	small intestine, active
(2)	Fructose, Na^+	small intestine, passive absorption
(3)	Glycerol, fatty acids	duodenum, move as chilomicrons
(4)	Cholesterol, maltose	large intestine, active absorption

Ans. **[1]**

Sol. **Reference - CP Study material Animal physiology-I on page no. 156**

Various nutrients like amino acids, glucose, electrolytes like Na^+ are absorbed into the blood by Active transport.

Q.148 A pregnant female delivers a baby who suffers from stunted growth, mental retardation, low intelligence quotient and abnormal skin.

This is the result of :

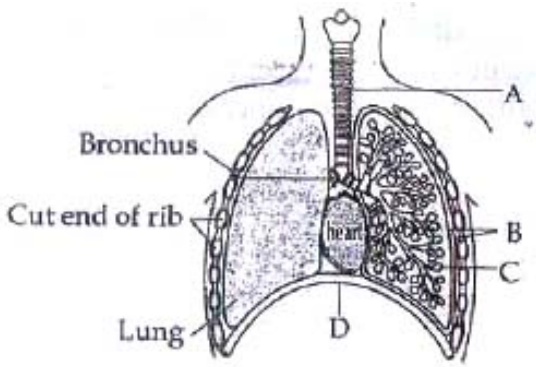
(1) Deficiency of iodine in diet
(2) Low secretion of growth hormone
(3) Cancer of the thyroid gland
(4) Over secretion of pars distalis

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Animal physiology-II on page no. 152**

Hypothyroidism during pregnancy causes defective development and maturation of the growing baby leading to stunted growth, mental retardation low intelligence quotient abnormal skin.

Q.149 The figure shows a diagrammatic view of human respiratory system with labels A, B, C and D. Select the option which gives correct identification and main function and / or characteristic.



(1) A-trachea long tube supported by complete cartilaginous rings for conducting inspired air

(2) B-pleural membrane – surround ribs on both sides to provide cushion against rubbing.

(3) C-Alveoli – thin walled vascular bag like structures for exchange of gases.

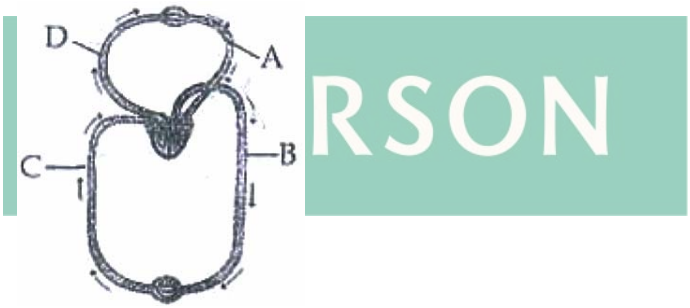
(4) D-Lower end of lungs – diaphragm pulls it down during inspiration.

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : Page 54-55**

Alveoli in lungs are thin walled air sacs where gaseous exchange takes place

Q.150 Figure shows schematic plant of blood circulation in humans with labels A to D. Identify the label and give its function/s.



(1) A-Pulmonary vein-takes impure blood from body parts, PO_2 = 60 mm Hg

(2) B-Pulmonary artery – takes blood from heart to lungs, PO_2 = 90 mm Hg

(3) C-Vena Cava-takes blood from body parts to right auricle, PCO_2 = 45 mm Hg

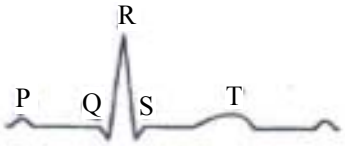
(4) D-Dorsal aorta – takes blood from heart to body parts, PO_2 = 95 mm Hg

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : Page No. 88**

Vena Cava takes blood from to body parts to right auricle. Partial pressure of CO_2 is 45 mmHg Hg under which CO_2 is taken form tissues.

Q.151 The diagram given here is the standard ECG of a normal person. The P-wave represents the :



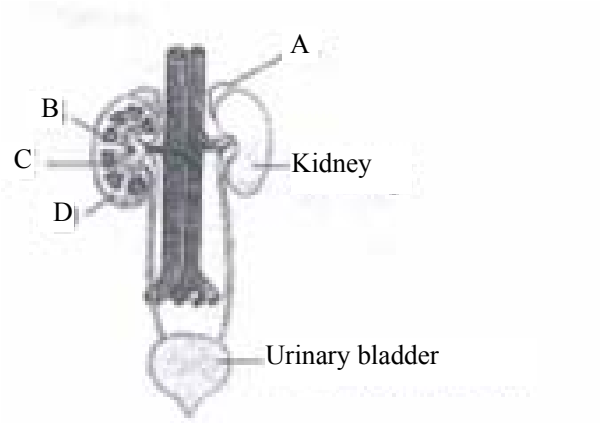
(1) Contraction of both the atria
(2) Initiation of the ventricular contraction
(3) Beginning of the systole
(4) End of systole

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Animal physiology Page - 102**

P wave in an ECG shows contraction of both the atria

Q.152 Figure shows human urinary system with structures labeled A to D. Select option which correctly identifies them and gives their characteristics and/or functions.



(1) A-Adrenal gland-located at the anterior part of Kidney. Secrete Catecholamines which stimulate glycogen breakdown
(2) B-Pelvis-broad funnel shaped space inner to hilum, directly connected to loops of Henle.
(3) C-Medulla-inner zone of kidney and contains complete nephrons.
(4) D-Cortex-outer part of kidney and do not contain any part of nephrons.

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Animal physiology Page – 159**

In the given answer function of adrenal gland is correctly given that it releases adrenaline & nor adrenaline (collectively known as catecholamine) that stimulates glycogen breakdown during emergencies.

Q.153 Select the correct statement with respect to locomotion in humans :

(1) A decreased level of progesterone causes osteoporosis in old people.
(2) Accumulation of uric acid crystals in joints causes their inflammation.
(3) The vertebral column has 10 thoracic vertebrae.
(4) The joint between adjacent vertebrae is a fibrous joint.

Ans. **[2]**

Sol. **Students may find this question in CP Sheet : Animal physiology-IPage – 119**

Gouty arthritis is cansed by excessive formation of uric acid. It gets deposited in joints as monosodium salts.

Q.154 The characteristics and an example of a synovial joint in humans is :

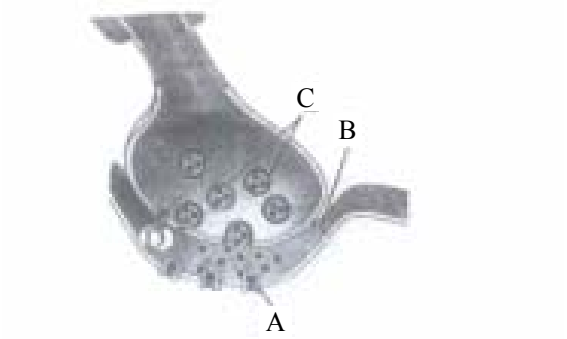
	Characteristics	Examples
(1)	Fluid cartilage between two bones, limited movements	Knee joint
(2)	Fluid filled between two joints, provides cushion	Skull bones
(3)	Fluid filled synovial cavity between two bones	Joint between atlas and axis
(4)	Lymph filled between two bones, limited movement	Gliding joint between carpals

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : Animal physiology-I Page – 115**

In between two bones a space is found called synovial space or cavity this space provides free movement to the bone.

Q.155 A diagram showing axon terminal and synapse is given. Identify correctly at least two of A-D.



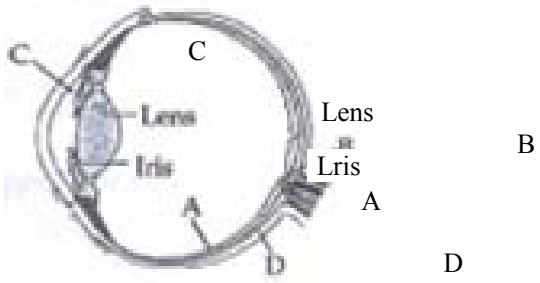
(1) A-Receptor ; C-Synaptic vesicles
(2) B-Synaptic connection ; D-K^+
(3) A-Neurotransmitter ; B- Synaptic cleft
(4) C-Neurotransmitter ; D-Ca^{++}

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : Animal Physiology-II on page no 205**

In this diagramatic question 'A' label is correct which represent receptor of neurotrans mitter and C lable represent synaptic vesicle

Q.156 Parts A, B, C and D of the human eye are shown in the diagram. Select the option which gives correct identification along with its functions/characteristics :



(1) A-Retina-contains photo receptors-rods and cones.
(2) B-Blind spot-has only a few rods and cones
(3) C-Aqueous chamber- reflects the light which does not pass through the lens
(4) D-choroid – its anterior part forms ciliary body

Ans. **[1]**

Sol. **Students may find this question in CP Sheet at : Animal physiology-II on page no 263**

In this diagramatic question 'A' label is correct with its function / Character because of Retina contain photosensory receptor – rod and cones

Q.157 Which of the following statements is correct in relation to the endocrine system ?

(1) Adenohypophysis is under direct neural regulation of the hypothalamus

(2) Organs in the body like gastrointestinal tract, heart, kidney and liver do not produce any hormones

(3) Non-nutrient chemicals produced by the body in trace amount that act as intercellular messenger are known as hormones

(4) Releasing and inhibitory hormones are produced by the pituitary gland

Ans. **[3]**

Sol. **Students may find this question in CP Sheet at : Animal physiology-II on page no. 134**

Hormones are non-nutritional chemical substances which produced by body / glands in tracess

Q.158 Select the answer which correctly matches the endocrine gland with the hormone it secretes and its function/deficiency symptom :

	Endocrine gland	**Hormone**	**Function/deficiency symptoms**
(1)	Anterior pituitary	Oxytocin	Stimulates uterus contraction during child birth
(2)	Posterior pituitary	Growth Hormone (GH)	Oversecretion stimulates abnormal growth
(3)	Thyroid gland	Thyroxine	Lack of iodine in diet results in goitre
(4)	Corpus luteum	Testosterone	stimulates spermatogenesis

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : Animal physiology-II Page – 148**

Thyroid gland synthesis thyroxine with the help of iodine and lack of iodine in diet results in goitre

Q.159 What is the correct sequence of sperm formation ?

(1) Spermatid, spermatocyte, spermatogonia, spermatozoa

(2) Spermatogonia, spermatocyte, spermatozoa, spermatid

(3) Spermatogonia, spermatozoa, spermatocyte, spermatid

(4) Spermatogonia, spermatocyte, spermatid, spermatozoa

Ans. **[4]**

Sol. **Students may find this question in CP Sheet : Reproductive system Page – 49**

The correct sequence of spermatogenesis is spermatogonia, spermatocyte, spermatid & spermatozoa

Q.160 Menstrual flow occurs due to lack of :

(1) Progesterone (2) FSH (3) Oxytocin (4) Vasopressin

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Reproductive system Page – 20-21**

Fall in the level of progesterone results in meustrual flow due to breaking of the blood vessels of uterine wall

Q.161 Which one of the following is not the function of placenta ? it :
(1) facilitates supply of oxygen and nutrients to embryo
(2) secretes estrogen
(3) Facilitates removal of carbon dioxide and waste material from embryo
(4) Secretes oxytocin during parturition

Ans. **[4]**

Sol. **Students may find this question in CP Sheet : Reproductive system Page – 28**
Oxytocin is released from the neurohypophysis of pituitary gland at the time of child birth

***Q.162** One of the legal methods of birth control is :
(1) abortion by taking an appropriate medicine
(2) by abstaining from coitus from day 10 to 17 of the menstrual cycle
(3) by having coitus at the time of day break
(4) by a premature ejaculation during coitus

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Reproductive system Page – 94**
MTP can be non surgically performed on prescription of mifepristone+Prostaglandins on the prescription of registered medical practitioner under his supervision.
This is legal method of termination of pregnancy.
Duration of menstrual cycle in all female is not fixed hence ovulation can occur anytime between 8 to 19th day hence this method of abstinence is not practically possible for birth control.

Q.163 Which of the following cannot be detected in a developing foetus by amniocentesis ?
(1) Klinefelter syndrome
(2) Sex of the foetus
(3) Down syndrome
(4) jaundice

Ans. **[4]**

Sol. Jaundice cant be detected by amniocentesis.

Q.164 Artificial insemination means :
(1) transfer of sperms of a healthy donor to a test tube containing ova
(2) transfer of sperms of husband to a test tube containing ova
(3) artificial introduction of sperms of a healthy donor into the vagina
(4) introduction of sperms of a healthy donor directly into the ovary

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : Reproductive system Page – 96**
Artificial insemination means artificially introduction of sperms of a healthy donor into the vagina.

Q.165 Which mendelian idea is depicted by a cross in which the F_1 generation resembles both the parents ?
(1) incomplete dominance
(2) law of dominance
(3) inheritance of one gene
(4) co-dominance

Ans. **[2]**

Sol. This is codominace but question is concern with mendel idea so it depicted with mendel idea of law of dominance.

Q.166 The incorrect statement with regard to Haemophilia is :
(1) It is a sex-linked disease
(2) It is a recessive disease
(3) It is a dominant disease
(4) A single protein involved in the clotting of blood is affected

Ans. **[3]**

Sol. **Students may find this question in NCERT Page No. 89**
Haemophilia is sex linked recessive disease

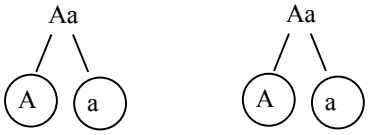
Q.167 If both parents are carriers for thalessemia, which is an autosomal recessive disorder, what are the chances of pregnancy resulting in an affected child ?

(1) no chance (2) 50% (3) 25% (4) 100%

Ans. **[3]**

Sol. Thalessemia is autosomal recessive disease if both parent are carrier then their genotype will be

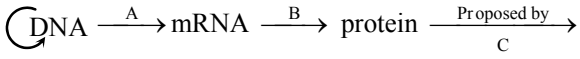
Carrier × Carrier



	A	a
A	AA Normal	Aa Carrier
a	Aa Carrier	aa Thalessemic

So probability is 1/4 or 25%

Q.168 The diagram shows an important concept in the genetic implication of DNA. Fill in the blanks A to C.



(1) A-transcription B-replication C-James Watson

(2) A-translation B-transcription C-Erevin Chargaff

(3) A-transcription B-translation C-Francis Crick

(4) A-translation B-extension C-Rosalind Franklin

Ans. **[3]**

Sol. **Students may find this question in NCERT Page No. 98**

This is central dogma in molecular biology proposed by Francis Crick

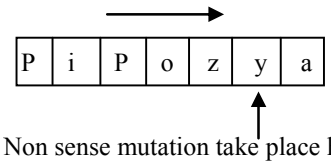
Q.169 Which enzyme/s will be produced in a cell in which there is a non-sense mutation in the *lac* Y gene ?

(1) b-galactosidase (2) Lactose permease

(3) Transacetylase (4) Lactose permease and transacetylase

Ans. **[1]**

Sol. Non sense mutation is point mutation which result in premature stop codon so transcription stop there.



Non sense mutation take place here then y and a gene will not transcribe so only β-galactosidase gene (z-gene) will transcribe.

Q.170 According to Darwin, the organic evolution is due to -
(1) Intraspecific competition
(2) Interspecific competition
(3) Competition within closely related species
(4) Reduced feeding efficiency in one species due to the presence of interfering species.

Ans. **[2]**

Sol. **Students may find this question in CP Sheet at : Origin & Evolution of Life Page - 31**
According to Darwinism competition between two different species is the key factor for organic evolution Since it results in divergent evolution.

Q.171 The eye of octopus and eye of cat show different patterns of structure, yet they perform similar function, This is an example of :
(1) Homologous organs that have evolved due to convergent evolution
(2) Homologous organs that have evolved due to divergent evolution
(3) Analogous organs that have evolved due to convergent evolution
(4) Analogous organs that have evolved due to divergent evolution

Ans. **[3]**

Sol. **Students may find this question in CP Sheet : Ecology Page No. – 31**
Eye of octopus & cat are analogous organs since they are different in structure but perform same function.

Q.172 Infection of *Ascaris* usually occurs by :
(1) drinking water containing eggs of *Ascaris* (2) eating imperfectly cooked pork
(3) Tse-tse fly (4) mosquito bite

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Lower Animals Page No. 38**
Contaminated water and soil (with eggs of *Ascaris*) is the source of infection with *Ascasis*

Q.173 The cell-mediated immunity inside the human body is carried out by :
(1) T- lymphocytes (2) B-lymphocytes (3) Thrombocytes (4) Erythrocytes

Ans. **[1]**

Sol. **Students may find this question in NCERT Page No. 151**
T-Lymphocytes mddiate C.M.I (cell-mediated immunity.)

Q.174 In plant breeding programmes, the entire collection (of plants/seeds) having all the diverse alleles for all genes in a given crop is called :
(1) selection of superior recombinants (2) cross-hybridisation among the selected parents
(3) evaluation and selection of parents (4) germplasm collection

Ans. **[4]**

Sol. **Students may find this question in CP Sheet : Reproduction in flowering plant and Economic Botany Eng. Page – 84**
Entire collection of plants / seeds having all diverse alleles for all genes in a given crop is called as germplasm collection.

Q.175 During sewage treatment, biogases are produced which include :
(1) methane, hydrogensulphide, carbon dioxide (2) methane, oxygen, hydrogensulphide
(3) hydrogensulphide, methane, sulphur dioxide (4) hydrogensulphide, nitrogen, methane

Ans. **[1]**

Sol. **Students may find this question in CP Class notes : Ecology**
During sewage treatment in secondary treatment the biogas is produced in anaerotric sludge digestor have anaerobic bacteria which produce gases like CO_2, H_2S, CH_4

Q.176 A biologist studied the population of rats in a barn, He found that the average natality was 250, average mortality 240, immigration 20 and emigration 30. The net increase in population is :
(1) 10 (2) 15 (3) 05 (4) zero

Ans. **[4]**

Sol. **Students may find this question in CP Sheet : Ecology Eng. Md Page – 52**
Natality = 250, Immigration = 20
Mortality = 240, Emigration = 30
Increase in Popolution size
P.D = [(Natality + Immigration) – (Mortality + Emigration)]
= [(250 + 20) – (240 + 30)]
= 0

Q.177 Which one of the following processes during decomposition is correctly described ?
(1) Fragmentation –Carried out by organisms such as earthworm
(2) Humification – Leads to the accumulation of a dark coloured substance humus which undergoes microbial action at a very fast rate
(3) Catabolism – Last step in the decomposition under fully anaerobic condition
(4) Leaching – Water soluble inorganic nutrients rise to the top layers of soil

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Ecology Eng. Md. Page No. 96**
Fragmentation is break down of detritous into small fragments by detrivores like earthworm.

Q.178 A sedentary sea anemone gets attached to the shell lining of hermit crab. The association is :
(1) Ectoparasitism (2) Symbiosis (3) Commensalism (4) Amensalism

Ans. **[2]**

Sol. **Students may find this question in CP Sheet : Ecology Eng. Md. Page – 69**
The association between sea anemone and hermit crab is symbiosis as both live together for very long duration

Q.179 Global warming can be controlled by :
(1) Reducing deforestation, cutting down use of fossil fuel
(2) Reducing reforestation, increasing the use of fossil fuel
(3) Increasing deforestation, slowing down the growth of human population
(4) Increasing deforestation, reducing efficiency of energy usage

Ans. **[1]**

Sol. **Students may find this question in CP Sheet : Ecology Eng. Md. Page – 180**
Global warming can be controlled by reducing the concentration of green house gases which can be achived by decreasing deforestation and reducing the use of fossil fuels.

Q.180 The Air Prevention and control of pollution Act came into force in :
(1) 1975 (2) 1981 (3)1985 (4) 1990

Ans. **[2]**

Sol. **Students may find this question in CP Sheet : Ecology Eng. Md. Page – 185**
Air prevention and control of pollution act came into existence in 1981

AIPMT 2014

Q.1 If force (F), velocity (V) and time (T) are taken as fundamental units, then the dimensions of mass are -

(1) $[FVT^{-1}]$ (2) $[FVT^{-2}]$

(3) $[FV^{-1}T^{-1}]$ (4) $[FV^{-1}T]$

Ans. **[4]**

Sol.

Assuming

$$M = F^aV^bT^c$$

Here we have to calculate value of a, b, c

Dimension of L.H.S. = R.H.S.

$M^1 L^0 T^0 = (M^1L^1T^{-2})^a(L^1T^{-1})^b(T^1)^c$

$M^1 L^0 T^0 = M^aL^aT^{-2a} L^bT^{-b}T^c$

$M^1 L^0 T^0 = M^aL^{a+b}T^{-2a-b+c}$

Comparing power of M

$$a = 1 \quad \ldots(1)$$

Comparing power of L

$$a + b = 0$$

$$1 + b = 0$$

$$b = -1$$

Comparing power of T

$$0 = -2a - b + c$$

Putting value of 'a' and 'b'

$$0 = -2(1) - (-1) + c$$

$$0 = -1 + c$$

$$c = 1$$

So $M = F^1V^{-1}T^1$

Q.2 A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} and angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms^{-1}) - (given g = 9.8 ms^{-2})

(1) 3.5 (2) 5.9

(3) 16.3 (4) 110.8

Ans. **[1]**

Sol. Here range should be same

$$R_1 = R_2$$

$$\frac{u_e^2 \sin 2\theta}{2g_e} = \frac{u_p^2 \sin 2\theta}{2g_p}$$

$$\frac{5^2 \times \sin 2\theta}{2 \times 9.8} = \frac{3^2 \times \sin 2\theta}{2 \times g_p}$$

$$g_p = \frac{9.8 \times 9}{25} = 3.52 \text{ m/s}^2$$

Q.3 A particle is moving such that its position coordinates (x, y) are

(2m, 3m) at time t = 0.

(6m, 7m) at time t = 2 s and

(13m, 14m) at time t = 5s.

Average velocity vector $\left(\vec{V}_{av}\right)$ from t = 0 to t = 5 s is -

(1) $\frac{1}{5}(13\hat{i}+14\hat{j})$ (2) $\frac{7}{3}(\hat{i}+\hat{j})$

(3) $2(\hat{i}+\hat{j})$ (4) $\frac{11}{5}(\hat{i}+\hat{j})$

Ans. **[4]**

Sol. Average velocity = $\frac{\text{displacement}}{\text{time taken}}$

$$= \frac{\vec{r}_2-\vec{r}_1}{t_2-t_1}$$

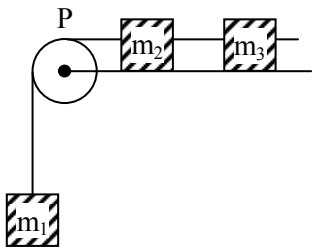
$$= \frac{(13\hat{i}+14\hat{j})-(2\hat{i}+3\hat{j})}{5-0}$$

$$= \frac{11\hat{i}+11\hat{j}}{5}$$

$$= \frac{11}{5}(\hat{i}+\hat{j})$$

Q.4 A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction = μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is –

(Assume $m_1 = m_2 = m_3 = m$)

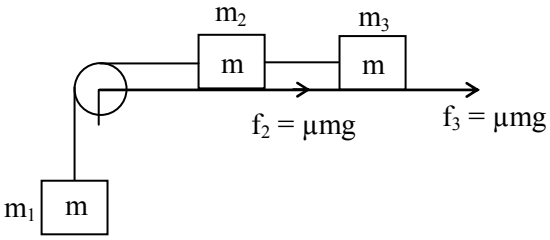


(1) $\frac{g(1-g\mu)}{9}$ (2) $\frac{2g\mu}{3}$

(3) $\frac{g(1-2\mu)}{3}$ (4) $\frac{g(1-2\mu)}{2}$

Ans. **[3]**

Sol.



Here friction f_2 and f_3 will oppose the motion and weight (m_1g = mg) will support the motion

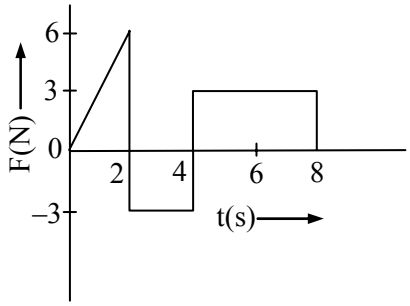
so acceleration (a) = $\frac{\text{Net force}}{\text{Total mass}}$

$$a = \frac{mg-\mu mg-\mu mg}{3m}$$

$$a = \frac{mg(1-2\mu)}{3m}$$

$$a = \frac{g(1-2\mu)}{3}$$

Q.5 The force 'F' acting on a particle of mass 'm' is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from zero to 8 s is -



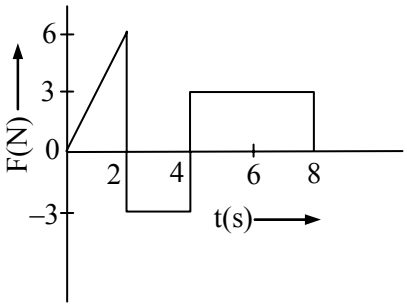
(1) 24 Ns (2) 20 Ns

(3) 12 Ns (4) 6 Ns

Ans. **[3]**

Sol.

Change in momentum will be equal to the area between F- t curve and time axis



Area $\Delta p = 6 - 6 + 12 = 12$ Ns

Q.6 A balloon with mass 'm' is descending down with an acceleration 'a' (where a < g). How much mass should be removed from it so that it starts moving up with an acceleration 'a' ?

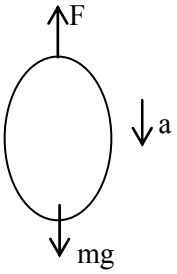
(1) $\frac{2ma}{g+a}$ (2) $\frac{2ma}{g-a}$

(3) $\frac{ma}{g+a}$ (4) $\frac{ma}{g-a}$

Ans. **[1]**

Sol.

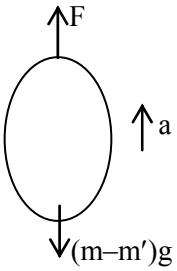
When balloon is descending



F is thrust force

$$mg - F = ma \quad \ldots(i)$$

When m′ mass is removed ballon start moving up



so

$$F - (m - m')g = (m - m')a \quad \ldots(ii)$$

From (i) + (ii)

$$mg - (m - m')g = ma + (m - m')a$$

$$m'g = ma + ma - m'a$$

$$m'(g + a) = 2ma$$

$$m' = \frac{2ma}{g + a}$$

Q.7 A body of mass (4m) is lying in x-y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is -

(1) mv^2 (2) $3/2\ mv^2$

(3) $2\ mv^2$ (4) $4\ mv^2$

Ans. **[2]**

Sol.

Using law of conservation of linear momentum

momentum before explosion = after explosion

$$0 = \vec{p}_1 + \vec{p}_2 + \vec{p}_3$$

$$\vec{p}_3 = -(\vec{p}_1 + \vec{p}_2)$$

$$|\vec{p}_3| = |-(\vec{p}_1 + \vec{p}_2)| = \sqrt{p_1^2 + p_2^2} \quad \because p_1 \perp p_2$$

$$m_3v_3 = \sqrt{(m_1v_1)^2 + (m_2v_2)^2}$$

[given $m_1 = m_2 = m$; $v_1 = v_2 = v$; $m_3 = 2m$]

$$2mv_3 = \sqrt{(mv)^2 + (mv)^2}$$

$$v_3 = \frac{\sqrt{2}mv}{2m} = \frac{v}{\sqrt{2}}$$

so total kinetic energy generated in the explosion

$$\Delta K = \frac{1}{2}mv^2 + \frac{1}{2}mv^2 + \frac{1}{2}2m\left(\frac{v}{\sqrt{2}}\right)^2$$

$$= \frac{3}{2}mv^2$$

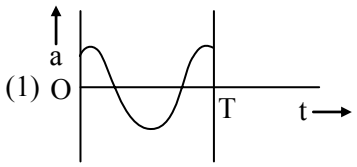
Q.8 The oscillation of a body on a smooth horizontal surface is represents by the equation

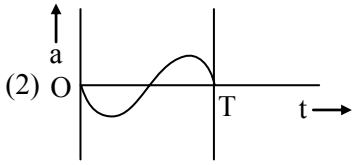
$$X = A\cos(\omega t)$$

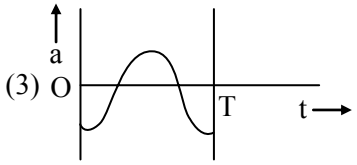
where X = displacement at time t

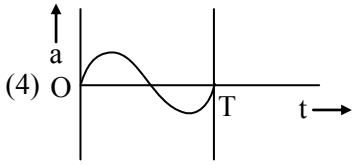
ω = frequency of oscillation

Which one of the following graph shows correctly the variation 'a' with 't' ?

(1) 

(2) 

(3) 

(4) 

Here a = acceleration at time t

T = time period

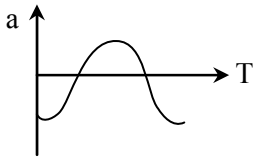
Ans. **[3]**

Sol.

$X = A \cos \omega t$

$V = \frac{dX}{dt} = -A\omega \sin \omega t$

$a = \frac{dV}{dt} = -A\omega^2 \cos \omega t$



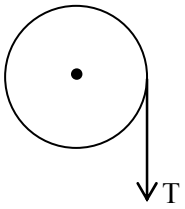
Q.9 A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate about the horizontal axis. A massless string is wound round the cylinder with one end attached to it and other hanging freely. Tension in the string required to produce an angular acceleration of 2 revolutions s^{-2} is -

(1) 25 N (2) 50 N

(3) 78.5 N (4) 157 N

Ans. **[4]**

Sol.



given m = 50 kg, R = 0.5m

$\alpha = 2$ rev./$s^2 = 2 \times 2\pi$ rad/s^2

here tension will produce the torque

$\tau = I\alpha$

$TR = \frac{MR^2}{2}\alpha$

$T(0.5) = \frac{50 \times (0.5)^2}{2} \times 2 \times 2\pi$

T = 157 N

Q.10 The ratio of the accelerations for a solid sphere (mass 'm' and radius 'R') rolling down an incline of angle 'θ' without slipping and slipping down the incline without rolling is -

(1) 5 : 7 (2) 2 : 3

(3) 2 : 5 (4) 7 : 5

Ans. **[1]**

Sol.

When sphere is rolling

$$a_r = \frac{g\sin\theta}{1+k^2/R^2}$$

when sphere is sliding

$$a_s = \frac{g\sin\theta}{1+0} \qquad [\text{for sliding } \frac{k^2}{R^2} = 0]$$

$$\frac{a_r}{a_s} = \frac{\frac{g\sin\theta}{1+\frac{2}{5}}}{g\sin\theta} = \frac{5}{7}$$

Q.11 A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass = 5.98×10^{24} kg) have to be compressed to be a black hole ?

(1) 10^{-9} m (2) 10^{-6} m

(3) 10^{-2} m (4) 100 m

Ans. **[3]**

Sol.

Escape velocity on a black hole should be more or equal to speed of light

$$c \le v_{es}$$

$$c \le \sqrt{\frac{2GM}{R}}$$

$$3 \times 10^8 \le \sqrt{\frac{2\times 6.67\times 10^{-11}\times 5.98\times 10^{24}}{R}}$$

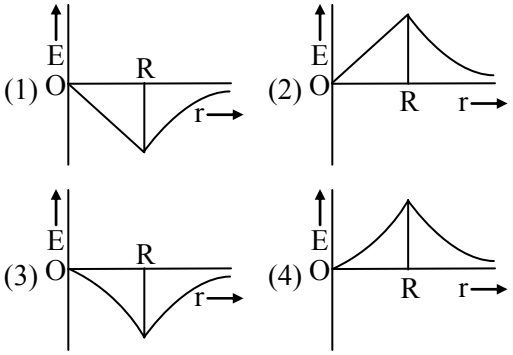
$$9 \times 10^{16} \le \frac{2\times 6.67\times 10^{-11}\times 5.98\times 10^{24}}{R}$$

$$R \le \frac{2\times 6.67\times 5.98\times 10^{13}}{9\times 10^{16}}$$

$$R \le 8.86 \times 10^{-3}$$

$$R \simeq 10^{-2}\ \text{m}$$

Q.12 Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by -



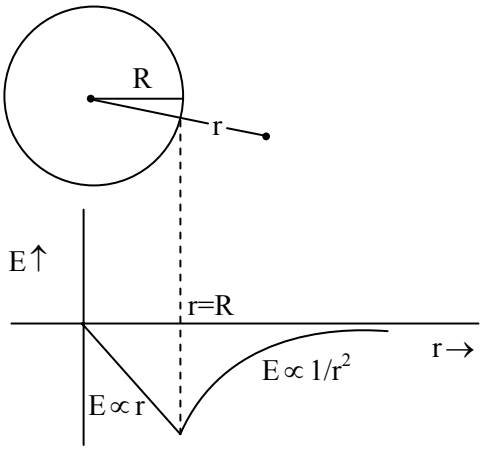
Ans. **[1]**

Sol. For solid sphere gravitational intensity

When $r > R$ $E = -\frac{GM}{R^3}r$

$r = R$ $E = -\frac{GM}{R^2}$

$r > R$ $E = -\frac{GM}{r^2}$



Q.13 Copper of fixed volume 'V' is drawn into wire of length 'l'. When this wire is subjected to a constant force 'F', the extension produced in the wire is 'Δl'. Which of the following graphs is a straight line ?

(1) Δl versus $1/l$ (2) Δl versus l^2

(3) Δl versus $1/l^2$ (4) Δl versus l

Ans. **[2]**

Sol. $Y = \dfrac{\text{stress}}{\text{strain}} = \dfrac{F/A}{\dfrac{\Delta\ell}{\ell}} = \dfrac{F\ell}{\Delta\ell A}$

$$\boxed{\Delta\ell = \left(\frac{F}{YA}\right)\ell}$$

Here F = constant ; Y = constant

$V = A\ell$ = constant

$$A \propto \frac{1}{\ell}$$

$$\Delta\ell \propto \frac{A}{\ell} \propto \ell^2$$

$$\boxed{\Delta\ell \propto \ell^2}$$

Graph between $\Delta\ell$ and ℓ^2 is straight line.

Q.14 A certain number of spherical drops of a liquid of radius 'r' coalesce to form a single drop of radius 'R' and volume 'V'. If 'T' is the surface tension of the liquid, then -

(1) energy = $4VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released

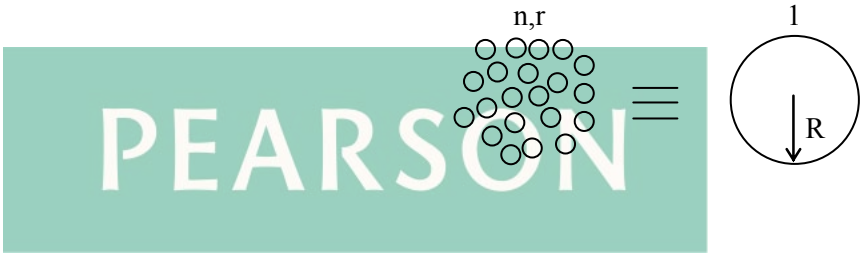
(2) energy = $3VT\left(\frac{1}{r}+\frac{1}{R}\right)$ is absorbed

(3) energy = $3VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released

(4) energy is neither released nor absorbed

Ans. **[3]**

Sol.



Volume same $\Rightarrow n\left(\frac{4}{3}\pi r^3\right) = \frac{4}{3}\pi R^3$

$\boxed{R = (n)^{1/3} r}$

$n = \frac{R^3}{r^3}$

$U = T\Delta A$

$= T[4\pi R^2 - n4\pi r^2]$

$= 4\pi T[R^2 - nr^2]$

$= 4\pi T\left[R^2 - \frac{R^3}{r^3}r^2\right]$

$= 4\pi R^3 T\left[\frac{1}{R} - \frac{1}{r}\right]$

$= 3\left(\frac{4}{3}\pi R^3\right)T\left(\frac{1}{R} - \frac{1}{r}\right)$

$\boxed{U = 3VT\left(\frac{1}{R} - \frac{1}{r}\right)}$ $(R > r)$

$\boxed{U = 3VT\left(\frac{1}{r} - \frac{1}{R}\right)}$ is released

Q.15 Steam at 100ºC is passed into 20 g of water at 10ºC. When water acquires a temperature of 80ºC, the mass of water present will be -

[Take specific heat of water = 1 cal $g^{-1}{}^oC^{-1}$ and latent heat of steam = 540 cal g^{-1}]

(1) 24 g (2) 31.5 g

(3) 42.5 g (4) 22.5 g

Ans. **[4]**

Sol.

$\Delta Q_{gain} = M_w C_w(80 - 10)$

$\Delta Q_{loss} = M_s L_v + M_s C_w(100 - 80)$

$\Delta Q_{gain} = \Delta Q_{loss}$

$20 \times 1 \times 70 = M_s(540) + M_s(1)(80)$

$M_s = \frac{1400}{620}$ gm = 2.2580 gm

$M_{net} = M_w + M_s$

$= 20 + 2.25$

$= 22.5$ gm

Q.16 Certain quantity of water cools from 70ºC to 60ºC in the first 5 minutes and 60ºC to 54ºC in the next 5 minutes. The temperature of the surroundings is -

(1) 45ºC (2) 20ºC

(3) 42ºC (4) 10ºC

Ans. **[1]**

Sol. From Newtons law of cooling

$\left(\frac{T_1 - T_2}{t}\right) = C_1\left(\frac{T_1 + T_2}{2} - T_0\right)$

$\left(\frac{70 - 60}{5}\right) = C_1\left(\frac{70 + 60}{2} - T_0\right)$ ...(1)

$\left(\frac{60 - 54}{5}\right) = C_1\left(\frac{60 + 54}{5} - T_0\right)$ ...(2)

$\frac{\frac{10}{5}}{\frac{6}{5}} = \frac{C_1(65 - T_0)}{C_1(57 - T_0)}$

$10(57 - T_0) = 6(65 - T_0)$

$570 - 10T_0 = 390 - 6T_0$

$4T_0 = 570 - 390$

$T_0 = 45$ºC

Q.17 A monoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2V and then adiabatically to a volume 16V. The final pressure of the gas is – (take $\gamma = 5/3$)

(1) 64 P (2) 32 P

(3) P/64 (4) 16 P

Ans. **[3]**

Sol. I.T Process :- $P_1V_1 = P_2V_2$

$$P_2 = P_1\left(\frac{V}{2V}\right) = \frac{P_1}{2}$$

A.D process:- $P_2V_2^{\gamma} = P_3V_3^{\gamma}$

$$P_3 = P_2\left(\frac{V_2}{V_3}\right)^{\gamma}$$

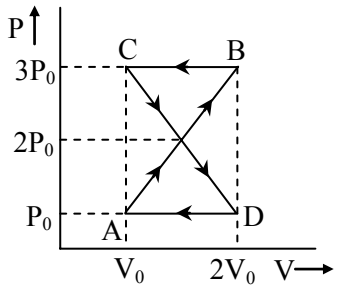
$$= \frac{P_1}{2}\left(\frac{2V}{10V}\right)^{5/3}$$

$$= \frac{P}{2}\left(\frac{1}{2^3}\right)^{5/3}$$

$$= \frac{P}{2}\left(\frac{1}{2^5}\right)$$

$$P_3 = \frac{P}{64}$$

Q.18 A thermodynamic system undergoes cyclic process ABCDA as shown in figure. The work done by the system in the cycle is -

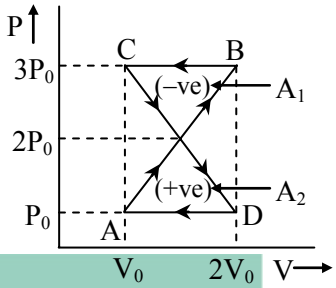


(1) P_0V_0 (2) $2P_0V_0$

(3) $\frac{P_0V_0}{2}$ (4) Zero

Ans. **[4]**

Sol.



$|A_1| = |A_2|$

$W_{net} = A_1 - A_2 = 0$

Q.19 The mean free path of molecules of a gas, (radius 'r') is inversely proportional to -

(1) r^3 (2) r^2

(3) r (4) $\sqrt{r}$

Ans. **[2]**

Sol. $\lambda_M = \frac{1}{\sqrt{2}\pi d^2 n}$ $\left[\begin{matrix} d = \text{diameter of gas} \\ \text{molecule} = r/2 \end{matrix}\right]$

$$\lambda_M \propto \frac{1}{d^2} \propto \frac{1}{r^2}$$

Q.20 If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by -

(1) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

(2) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

(3) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

(4) $n = n_1 + n_2 + n_3$

Ans. **[1]**

Sol.

$l = l_1 + l_2 + l_3$

$n_{string} = \frac{1}{2l}\sqrt{\frac{T}{m}} \propto \frac{1}{l}$

$l \propto \frac{1}{n}$

$\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

Q.21 The number of possible natural oscillations of air column in a pipe closed at one end of length 85 cm whose frequencies lie below 1250 Hz are - (velocity of sound = 340 ms^{-1})

(1) 4 (2) 5 (3) 7 (4) 6

Ans. **[4]**

Sol. $n_{fundamental} = \frac{V}{4l} = \frac{340}{4\times\frac{85}{100}} = 100$ Hz

Possible frequency of C.O.P. = 1 : 3 : 5 : 7 : 9 : 11 ….

$n_1 = 100 < 1250$

$n_2 = 300 < 1250$

$n_3 = 500 < 1250$

$n_4 = 700 < 1250$

$n_5 = 900 < 1250$

$n_6 = 1100 < 1250$

$n_7 = 1300 > 1250$

Now possible frequencies = 6.

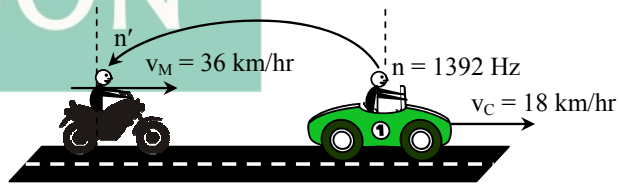
Q.22 A speeding motorcyclist sees traffic jam ahead of him. He slows down to 36 km/hour. He finds that traffic has eased and a car moving ahead of him at 18 km/hour is honking at a frequency of 1392 Hz. If the speed of sound is 343 m/s, the frequency of the honk as heard by him will be -

(1) 1332 Hz (2) 1372 Hz

(3) 1412 Hz (4) 1454 Hz

Ans. **[3]**

Sol.



$n' = n\left(\frac{v + v_0}{v + v_s}\right) = n\left(\frac{v + v_M}{v + v_C}\right)$

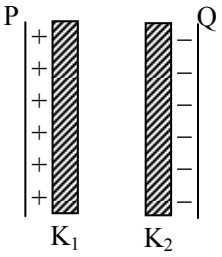
$v_C = 18 \times \frac{5}{18} = 5$ m/s

$v_M = 36 \times \frac{5}{18} = 10$ m/s

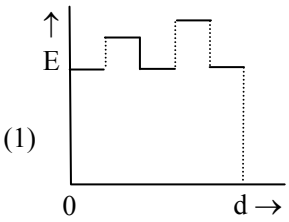
$= 1392\left(\frac{343 + 10}{343 + 5}\right)$

$= 1392\left(\frac{353}{348}\right) = 1412$ Hz

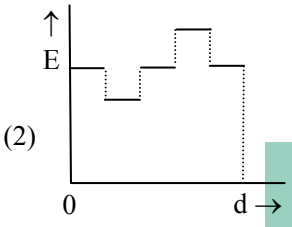
Q.23 Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by :



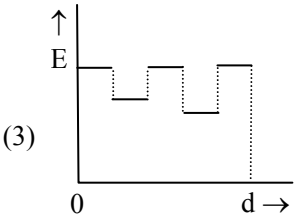
(1)



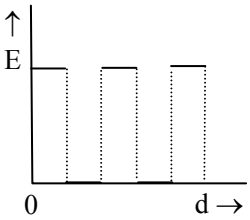
(2)



(3)



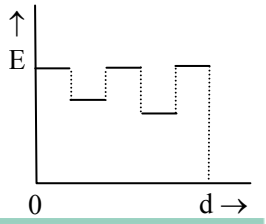
(4)



Ans. **[3]**

Sol. $E = \frac{\sigma}{\epsilon_0 \epsilon_r} = \frac{Q}{A \epsilon_0 \epsilon_r} \propto \frac{1}{\epsilon_r}$

$E_{air} > E_1 > E_2$



Q.24 A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere respectively are :

(1) Zero and $\frac{Q}{4\pi\in_0 R^2}$

(2) $\frac{Q}{4\pi\in_0 R}$ and Zero

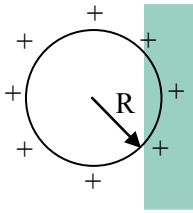
(3) $\frac{Q}{4\pi\in_0 R}$ and $\frac{Q}{4\pi\in_0 R^2}$

(4) Both are zero

Ans. **[2]**

Sol.

In conducting sphere there no charge in sphere



$E_{in} = E_{centre} = 0$

$V_{in} = V_{centre} = \text{constant} = \frac{KQ}{R} = \frac{Q}{4\pi\in_0 R}$

Q.25 In a region the potential is represented by V(x, y, z) = 6x – 8xy – 8y + 6yz, where V is in volts and x, y, z are in meters. The electric force experienced by a charge of 2 coulomb situated at point (1, 1, 1) is

(1) $6\sqrt{5}$N (2) 30N

(3) 24 N (4) $4\sqrt{35}$N

Ans. **[4]**

Sol.

$V = 6x - 8xy - 8y + 6yz$

$\vec{E} = -\frac{\partial V}{\partial x}\hat{i} - \frac{\partial V}{\partial y}\hat{j} - \frac{\partial V}{\partial z}\hat{k}$

$\frac{\partial V}{\partial x} = \frac{\partial}{\partial x}(6x - 8xy - 8y + 6yz)$

$= (6 - 8y - 0 + 0)_{1,1,1} = -2$

$\frac{\partial V}{\partial y} = \frac{\partial}{\partial y}(6x - 8xy - 8y + 6yz)$

$= (0 - 8x - 8 + 6z)_{1,1,1} = -10$

$\frac{\partial V}{\partial z} = \frac{\partial}{\partial z}6x - 8xy - 8y + 6yz)$

$= (0 - 0 - 0 + 6y)_{1,1,1} = 6$

$\vec{E} = 2\hat{i} + 10\hat{j} - 6\hat{k}$

$E = \sqrt{(2)^2 + (10)^2 + (6)^2} = \sqrt{4 + 100 + 36}$

$= \sqrt{140}$

$E = 2\sqrt{35}$

$F_e = qE = 2 \times 2\sqrt{35} = 4\sqrt{35}$

Q.26 Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fall of potential per km is 8 volt and the average resistance per km is 0.5Ω. The power loss in the wire is :

(1) 19.2 W (2) 19.2 kW

(3) 19.2 J (4) 12.2 kW

Ans. **[2]**

Sol. **CP Students may find similar question in CP Exercise Sheet: [Chapter : EMI, Exercise # 2, Page No. 174, Q. 87]**

Total voltage drop across wire = 150 × 8

= 1200 volt

Total resistance of wire

= 150 × 0.5 = 75 Ω

∴ current through wire

$$I = \frac{V}{R} = \frac{1200}{75} = 16 \text{ Ampere}$$

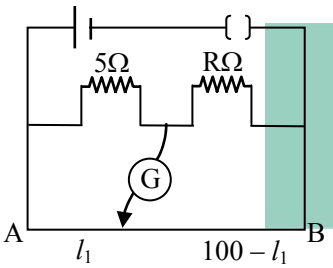
∴ Power loss $= I^2R$

$= (16)^2 \times 75$

$= 19200$ W

$= 19.2$ kW

Q.27 The resistance in the two arms of the meter bridge are 5 Ω and R Ω, respectively. When the resistance R is shunted with an equal resistance, the new balance points is at 1.6 l_1. The resistance 'R', is :



(1) 10 Ω (2) 15 Ω

(3) 20 Ω (4) 25 Ω

Ans. **[2]**

Sol.

From balanced wheat stone bridge

$$\frac{P}{Q} = \frac{R}{S}$$

$$\frac{5}{R} = \frac{\ell_1}{100 - \ell_1} \quad ...(1)$$

$$\frac{5}{R/2} = \frac{1.6\ell_1}{100 - 1.6\ell_1} \quad ...(2)$$

by dividing (1) by (2)

$$\frac{1}{2} = \frac{100 - 1.6\ell_1}{1.6(100 - \ell_1)}$$

$160 - 1.6\ell_1 = 200 - 3.2\ \ell_1$

$\ell_1 = 25$ cm

put that value in equation (1)

$$\frac{5}{R} = \frac{25}{100 - 25} \Rightarrow R = 15\ \Omega$$

Q.28 A potentiometer circuit has been set up for finding the internal resistance of a given cell. The main battery, used across the potentiometer wire, has an emf of 2.0 V and a negligible internal resistance. The potentiometer wire itself is 4m long. When the resistance, R, connected across the given cell, has values of.

(i) infinity (ii) 9.5 Ω

the 'balancing lengths', on the potentiometer wire are found to be 3 m and 2.85 m, respectively. The value of internal resistance of the cell is

(1) 0.25 Ω (2) 0.95 Ω

(3) 0.5 Ω (4) 0.75 Ω

Ans. **[3]**

Sol.

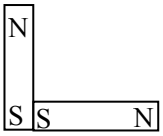
Internal resistance of cell

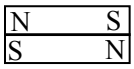
$$r = \left(\frac{\ell_1 - \ell_2}{\ell_2}\right)(R)$$

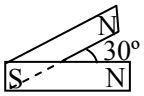
$$= \left(\frac{3-2.85}{2.85}\right)(9.5)$$

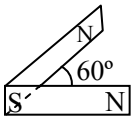
$$= 0.5\ \Omega$$

Q.29 Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment $\vec{m}$. Which configuration has highest net magnetic dipole moment ?

(a) 

(b) 

(c) 

(d) 

(1) (a) (2) (b)

(3) (c) (4) (d)

Ans. **[3]**

Sol. $M_{net} = \sqrt{M_1^2 + M_2^2 + 2M_1M_2\cos\theta}$

when angle (θ) between two vector increases. Resultant vector (M_{net}) decreases so M_{net} is max. when angle (θ) is minimum.

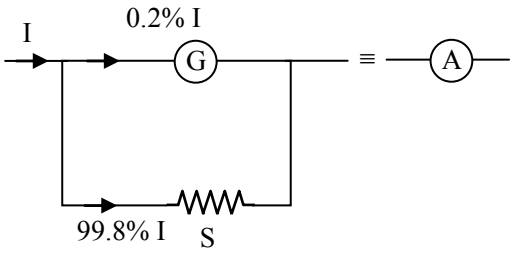
Q.30 In an ammeter 0.2% of main current passes through the galvanometer. If resistance of galvanometer is G, the resistance of ammeter will be :

(1) $\frac{1}{499}G$ (2) $\frac{499}{500}G$

(3) $\frac{1}{500}G$ (4) $\frac{500}{499}G$

Ans. **[3]**

Sol.



In parallel

$$I \propto \frac{1}{R}$$

$$\frac{G}{S} = \frac{99.8}{0.2} \Rightarrow S = \frac{G}{499}$$

$$\therefore R_{(A)} = S \parallel R_g$$

$$= \frac{G}{500}$$

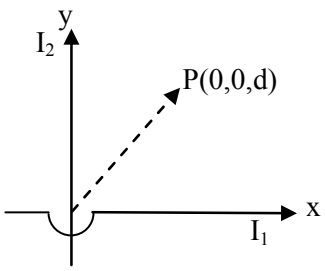
Q.31 Two identical long conducting wires AOB and COD are placed at right angle to each other, with one above other such that 'O' is their common point for the two. The wires carry I_1 and I_2 currents, respectively. Point 'P' is lying at distance 'd' from 'O' along a direction perpendicular to the plane containing the wires. The magnetic field at the point 'P' will be :

(1) $\frac{\mu_0}{2\pi d}\left(\frac{I_1}{I_2}\right)$ (2) $\frac{\mu_0}{2\pi d}(I_1 + I_2)$

(3) $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)$ (4) $\frac{\mu_0}{2\pi d}(I_1^2 + I_2^2)^{1/2}$

Ans. **[4]**

Sol.

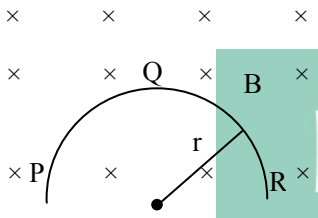


$$\vec{B}_1 = \frac{\mu_0 I_1}{2\pi d}(-\hat{j})$$

$$\vec{B}_2 = \frac{\mu_0 I_2}{2\pi d}(+\hat{i})$$

$$B = \sqrt{B_1^2 + B_2^2} = \frac{\mu_0}{2\pi d}\sqrt{I_1^2 + I_2^2}$$

Q.32 A thin semicircular conducting ring (PQR) of radius 'r' is falling with its plane vertical in a horizontal magnetic field B, as shown in figure. The potential difference developed across the ring when its speed is v, is :



(1) Zero

(2) $Bv\pi r^2/2$ and P is at higher potential

(3) πrBv and R is at higher potential

(4) $2rBv$ and R is at higher potential

Ans. **[4]**

Sol.

$e = B\, v(\ell_i - \ell_f)$

where $(\ell_i - \ell_f)$ is displacement between end of semicircular ring

$e = B\, v(2R)$

Q.33 A transformer having efficiency of 90% is working on 200 V and 3 kW power supply. If the current in the secondary coil is 6A, the voltage across the secondary coil and the current in the primary coil respectively are :

(1) 300 V, 15 A (2) 450 V, 15 A

(3) 450 V, 13.5 A (4) 600 V, 15 A

Ans. **[2]**

Sol.

Power of primary = $V_P I_P = 3kW$

$$\Rightarrow I_P = \frac{3000}{V_p} = \frac{3000}{200} = 15A$$

$$\% \eta = \frac{V_S I_S}{V_P I_P} \times 100$$

$$\frac{90}{100} = \frac{V_S I_S}{V_P I_P}$$

$$\Rightarrow V_S = \frac{0.9 V_P I_P}{I_S} = \frac{0.9 \times 3000}{6}$$

$$= 450 \text{ V}$$

Q.34 Light with an energy flux of 25×10^4 Wm^{-2} falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2, the average force exerted on the surface is

(1) 1.25×10^{-6} N (2) 2.50×10^{-6} N

(3) 1.20×10^{-6} N (4) 3.0×10^{-6} N

Ans. **[2]**

Sol. $I = 25 \times 0^4 \frac{w}{m^2}$

$A = 15 \text{ cm}^2$

Pressure exerted on surface if it is perfectly reflecting

$$Pr = 2\left(\frac{I}{C}\right) = \frac{F}{A}$$

$$F = \frac{2IA}{C} = \frac{2 \times 25 \times 10^4}{3 \times 10^8} \times 15 \times 10^{-4}$$

$$= 2.50 \times 10^{-6} \text{ N}$$

Q.35 A beam of light of $\lambda = 600$ nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2m away. The distance between first dark fringes on either side of the central bright fringe is :

(1) 1.2 cm (2) 1.2 mm

(3) 2.4 cm (4) 2.4 mm

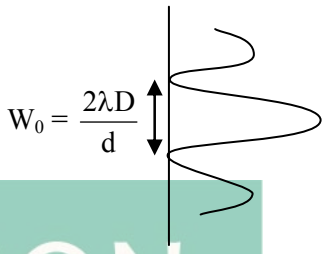
Ans. **[4]**

Sol.

given $\lambda = 600 \times 10^{-9}$ m

D = 2m

d = 1 mm = 10^{-3} m



$$W_0 = \frac{2\lambda D}{d}$$

width of the central maxima

$$W_0 = \frac{2\lambda D}{d} = \frac{2 \times 600 \times 10^{-9} \times 2}{10^{-3}}$$

$$= 2.4 \times 10^{-3} \text{ m}$$

$$= 2.4 \text{ mm}$$

Q.36 In the Young's double-silt experiment, the intensity of light at a point on the screen where the path difference is λ is K, (λ being the wave length of light used). The intensity at a point where the path difference is $\lambda/4$, will be

(1) K (2) K/4

(3) K/2 (4) Zero

Ans. **[3]**

Sol. $\Delta\phi = \frac{2\pi}{\lambda}(\Delta x) = \frac{2\pi}{\lambda}(\lambda) = 2\pi$

* $I = I_0 + I_0 + 2\sqrt{I_0 I_0}\cos 2\pi$

$I = 4I_0 = k$

* $\Delta\phi = \frac{2\pi}{\lambda}\left(\frac{\lambda}{4}\right) = \frac{\pi}{2}$

$I = I_0 + + I_0 + 2\sqrt{I_0 I_0}\cos \pi/2$

$I = 2I_0 = k/2$

Q.37 If the focal length of objective lens is increased then magnifying power of :

(1) microscope will increase but that of telescope decrease

(2) microscope and telescope both will increase

(3) microscope and telescope both will decrease

(4) microscope will decrease but that of telescope will increase

Ans. **[4]**

Sol. * For telescope M.P. $= \frac{f_o}{f_e}$ ($f_0 \uparrow \Rightarrow$ M.P. $\uparrow$)

on increasing f_0, M.P is $\uparrow$

* For microscope M.P. $\approx \frac{v_0}{u_0}\left(1+\frac{D}{f_e}\right)$

$\approx \frac{L}{f_0}\left(1+\frac{D}{f_e}\right)$

on increasing f_0, M.P. is $\downarrow$

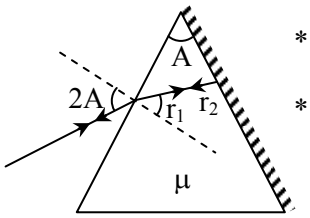
Q.38 The angle of a prism is 'A'. One of its refracting surfaces is silvered. Light rays falling at an angle of incident 2A on the first surface returns back through the same path after suffering reflection at the silvered surface. The refractive index μ, of the prism is

(1) 2 sin A (2) 2 cos A

(3) $\frac{1}{2}$ cos A (4) tan A

Ans. **[2]**

Sol.



* $r_2 = 0$
$r_1 + r_2 = A$
* $r_1 = A$

(1) $\sin 2A = \mu \sin A$

$2 \sin A \cos A = \mu \sin A$

$\mu = 2 \cos A$

Q.39 When the energy of the incident radiation is increased by 20%, the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is

(1) 0.65 eV (2) 1.0 eV

(3) 1.3 eV (4) 1.5 eV

Ans. **[2]**

Sol. $K.E_{e^-} = E_{Ph} - W$

$0.5 = E - W$ ….(i) × 1.20

$0.8 = 1.20E - W$ ….(ii) × 1

$0.6 = 1.2E - 1.2W$

$0.8 = 1.2E - W$

– – +

$-0.2 = -0.2W$

$W = 1$ eV

Q.40 If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de-Broglie wavelength of the particle is :

(1) 25 (2) 75

(3) 60 (4) 50

Ans. **[2]**

Sol. $\lambda = \frac{h}{\sqrt{2m_0 K.E}} \propto \frac{1}{\sqrt{K.E}}$

$K.E_1 = E$ | $\frac{\lambda_2}{\lambda_1} = \sqrt{\frac{E}{16E}}$

$K.E_2 = 16E$ | $\lambda_2 = \frac{\lambda_1}{4}$

$$\% \text{ change} = \frac{\lambda_2 - \lambda_1}{\lambda_1} \times 100\%$$

$$= \frac{\frac{\lambda_1}{4} - \lambda_1}{\lambda_1} \times 100\% = -75\%$$

Q.41 Hydrogen atom in ground state is excited by a monochromatic radiation of λ = 975 Å. Number of spectral lines in the resulting spectrum emitted will be

(1) 3 (2) 2

(3) 6 (4) 10

Ans. **[3]**

Sol. $E_{Ph} = \frac{12448}{975}$ eV

$E_{Ph} = 12.75$ \V

* In hydrogen atom energy level of e^- is = 4

* If e^- comes from higher energy level n to ground state possible value of spectrum line is $= \frac{n(n-1)}{2}$

$= \frac{4(4-1)}{2} = 6$

Q.42 The Binding energy per nucleon of ^7_3Li and ^4_2He nuclei are 5.60 MeV and 7.06 MeV, respectively. In the nuclear reaction $^7_3Li + ^1_1H \rightarrow ^4_2He + ^4_2He + Q$, the value of energy Q released is

(1) 19.6 MeV

(2) –2.4 MeV

(3) 8.4 MeV

(4) 17.3 MeV

Ans. **[4]**

Sol. $_3Li^7 + _1H^1 \rightarrow _2He^4 + _2He^4 + Q$

$Q = 2B.E_{He} - (B.E_H + B.E_{Li})$

$= 2(4 \times 7.06) - (0 + 7 \times 5.60)$

$Q = 17.28$ MeV

Q.43 A radio isotope 'X' with a half life 1.4×10^9 years decays to 'Y' which is stable. A sample of the rock from a cave was found to contain 'X' and 'Y' in the ratio 1 : 7. The age of the rock is

(1) 1.96×10^9 years (2) 3.92×10^9 years

(3) 4.20×10^9 years (4) 8.40×10^9 years

Ans. **[3]**

Sol. X : Y = 1 : 7

↑ ↑

Active stable

Active part of sample A.P. $= \frac{X}{X+Y} = \frac{1}{8}$

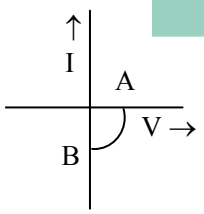
* A.P $= \frac{1}{8} = \frac{1}{2^n}$

* n = 3

* $t = nT_{1/2} = 3 \times 1.4 \times 10^9$

$= 4.2 \times 10^9$ year

Q.44 The given graph represents V-I characteristic for a semiconductor device.



Which of the following statement is correct?

(1) It is V-I characteristic for solar cell where, point A represents open circuit voltage and point B short circuit current

(2) It is for a solar cell and points A and B represent open circuit voltage and current, respectively

(3) It is for a photodiode and points A and B represent open circuit voltage and current, respectively

(4) It is for a LED and points A and B represent open circuit voltage and short circuit current, respectively

Ans. **[1]**

Sol. In p-n junction barrier potential is n to p → so it is open circuit voltage when length incident on depletion layer in solar cell then extra charge carrier are generated which flow current p to n. (so it is short circuit current)

Q.45 The barrier potential of a p-n junction depends on :

(a) type of semiconductor material

(b) amount of doping

(c) temperature

Which one of the following is correct?

(1) (a) and (b) only

(2) (b) only

(3) (b) and (c) only

(4) (a), (b) and (c)

Ans. **[4]**

Sol. (a) Potential barrier for Ge p-n junction is 0.3 V

Potential barrier for Si p-n junction is 0.7 V

(b) doping increase potential barrier (depletion width) decreases

(c) temperature increase potential barrier (depletion width) increases

Q.46 What is the maximum number of orbitals that can be identified with the following quantum numbers n = 3, ℓ = l, $m_\ell = 0$

(1) 1 (2) 2 (3) 3 (4) 4

Ans. **[1]**

Sol.

n = 3 means 3rd shell

ℓ = 1 means p-subshell

$m_\ell = 0$ means orbital of p-subshell

$\therefore$ Answer is one orbital

Q.47 Calculate the energy in joule corresponding to light of wavelength 45 nm: (Planck constant $h = 6.63 \times 10^{34}$ Js, speed of light $c = 3 \times 10^8$ ms^{-1})

(1) 6.67×10^{15} (2) 6.67×10^{11}

(3) 4.42×10^{-15} (4) 4.42×10^{-18}

Ans. **[4]**

Sol.

$$\text{Energy}(E) = \frac{hc}{\lambda}$$

$$\therefore E = \left(\frac{6.63\times10^{-34}\times3\times10^{8}}{45\times10^{-9}}\right) J$$

$$E = 4.42 \times 10^{-18} \text{ J}$$

Q.48 Equal masses of H_2,O_2 and methane have been taken in a container of volume V at temperature 27ºC in identical conditions. The ratio of the volumes of gases H_2 : O_2 : methane would be:

(1) 8 : 16 : 1 (2) 16 : 8 : 1

(3) 16 : 1 : 2 (4) 8 : 1 : 2

Ans. **[3]**

Sol.

	H_2	:	O_2	:	CH_4
Assuming weight	w		w		w
$\therefore$ moles	$\frac{w}{2}$		$\frac{w}{32}$		$\frac{w}{16}$

So mole ratio or volume ratio $\frac{w}{2} : \frac{w}{32} : \frac{w}{16}$

means 16 : 1 : 2

Q.49 If a is the length of the side of a cube, the distance between the body centred atom and one corner atom in the cube will be:

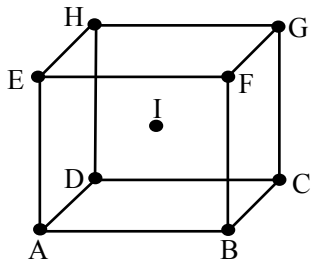
(1) $\frac{2}{\sqrt{3}}a$ (2) $\frac{4}{\sqrt{3}}a$

(3) $\frac{\sqrt{3}}{4}a$ (4) $\frac{\sqrt{3}}{2}a$

Ans. **[4]**

Sol.

BCC unit cell:



According to ΔABC

$AC^2 = AB^2 + BC^2$

$AC^2 = a^2 + a^2$

$AC = \sqrt{2}a$

According to ΔACG $AG^2 = AC^2 + CG^2$

$AG^2 = 2a^2 + a^2$

$\therefore AG = \sqrt{3}a$

$\therefore$ AI distance $= \frac{AG}{2} = \frac{\sqrt{3}a}{2}$

Q.50 Which property of colloids is not dependent on the charge on colloidal particles ?

(1) Coagulation (2) Electrophoresis

(3) Electro-osmosis (4) Tyndall effect

Ans. **[4]**

Sol.

Theory problem

Q.51 Which of the following salts will give highest pH in water ?

(1) KCl (2) NaCl

(3) Na_2CO_3 (4) $CuSO_4$

Ans. **[3]**

Sol. **CP Students may find same question in CP Exercise Sheet: [Chapter : Ionic Equilibrium, Level # 3(B)-, Page No.167, Q. 9]**

Na_2CO_2 is a salt of weak acid and strong base.

So its pH will be maximum

Q.52 Of the following 0.10m aqueous solutions, which one will exhibit the largest freezing point depression ?

(1) KCl (2) $C_6H_{12}O_6$

(3) $Al_2(SO_4)_3$ (4) K_2SO_4

Ans. **[3]**

Sol.

Colligative properties $\propto$ Net molality

(1) for KCl Net molality $= 0.1 \times 2 = 0.2$

(2) for Glucose Net molality $= 0.1 \times 1 = 0.1$

(3) for $Al_2(SO_4)_3$ Net molality $= 0.1 \times 5 = 0.5$

(4) for K_2SO_4 Net molality $= 0.1 \times 3 = 0.3$

Q.53 When 22.4 litres of $H_2(g)$ is mixed with 11.2 litres of $Cl_2(g)$, each at S.T.P., the moles of HCl(g) formed is equal to:

(1) 1 mole of HCl(g) (2) 2 mole of HCl(g)

(3) 0.5 mol of HCl(g) (4) 1.5 mol of HCl(g)

Ans. **[1]**

Sol.

$H_2 + Cl_2 \rightarrow 2HCl$

$n_{H_2} = \frac{22.4}{22.4} = 1$; $n_{Cl_2} = \frac{11.2}{22.4} = \frac{1}{2}$

$\therefore$ To find L.R.

H_2	Cl_2
$\frac{1}{1}$	$\frac{\left(\frac{1}{2}\right)}{1} = \frac{1}{2}$

$\therefore$ Cl_2 is L.R.

& by stoichiometric ratio

$\frac{n_{HCl}}{2} = \frac{n_{Cl_2}}{1}$

$n_{HCl} = 2 \times \frac{1}{2} = 1$ mol.

Q.54 When 0.1 mol MnO_4^{2-} is oxidized the quantity of electricity required to completely oxidize MnO_4^{2-} to MnO_4^- is:

(1) 96500 C (2) 2×96500 C

(3) 9650 C (4) 96.50 C

Ans. **[3]**

Sol.

$$MnO_4^{-2} \rightarrow MnO_4^{-1}$$

Oxidation no. +6 +7

$\therefore$ change in oxidation number no = 1

So equivalent = mole $\times$ v.f

$= 0.1 \times 1$

$= 0.1$

$\therefore$ Charge $= 0.1 \times F$

$= 0.1 \times 96500$

$= 9650$ C

Q.55 Using the Gibbs energy change, $\Delta G^\circ = +63.3$ kJ, for the following reaction,

$Ag_2CO_3(s) \rightleftharpoons 2Ag^+(aq) + CO_3^{2-}(aq)$

The K_{sp} of $Ag_2CO_3(s)$ in water at 25°C is:

($R = 8.314$ J K^{-1} mol^{-1})

(1) 3.2×10^{-26} (2) 8.0×10^{-12}

(3) 2.9×10^{-3} (4) 7.9×10^{-2}

Ans. **[2]**

$\Delta G^o = -2.303\ RT \log K_{sp}$

$63.3 \times 1000 = -2.303 \times 8.314 \times 298 \times \log K_{SP}$

$$\log K_{SP} = \frac{-63.3 \times 1000}{2.303 \times 8.314 \times 298}$$

$\log K_{SP} = -11.09$

$\therefore K_{SP} = \text{anti log } (-11.09)$

$K_{SP} = 8.0 \times 10^{-12}$

Q.56 The weight of silver (at. wt. = 108) displaced by a quantity of electricity which displaces 5600 mL of O_2 at STP will be:

(1) 5.4 g (2) 10.8 g

(3) 54.0 g (4) 108.0 g

Ans. **[4]**

Sol.

Equivalent volume of $O_2$is 5.6 lit

$\therefore$ 5.6 lit of O_2 means 1 equivalent of oxygen

& 1 equivalent of any species is displaced by 1 faraday charge

& $\therefore$ 1 equivalent i.e. 108g of Ag is deposited by 1 faraday of charge

Q.57 Which of the following statements is correct for the spontaneous adsorption of a gas ?

(1) ΔS is negative and, therefore, ΔH should be highly positive.

(2) ΔS is negative and therefore, ΔH should be highly negative

(3) ΔS is positive and, therefore, ΔH should be negative

(4) ΔS is positive and, therefore, ΔH should also be highly positive.

Ans. **[2]**

Sol.

$A_{(g)} + X_{(s)} \rightarrow AX_{(s)}$; $\Delta n_g < 0$

$\therefore$ As $\Delta n_g < 0$; then, $\Delta S < 0$

but $\Delta H < 0$ because process of adsorption is always exothermic

$\therefore\ \Delta S < O$ & $\Delta H < 0$

& for spontaneous process

$$\Delta G < 0$$

There fore : $|T\Delta S| < |\Delta H|$

Q.58 For the reversible reaction:

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + \text{heat}$

The equilibrium shifts in forward direction:

(1) by increasing the concentration of $NH_3(g)$

(2) by decreasing the pressure

(3) by decreasing the concentrations of $N_2(g)$ and $H_2(g)$

(4) by increasing pressure and decreasing temperature

Ans. **[4]**

Sol.

$N_2 + 3H_2 \rightleftharpoons 2NH_3$

it is an exothermic reaction so decreasing temperature is favorable because

$$\text{dissociation (x)} \propto \frac{1}{T}$$

& dissociation $x \propto \left(\frac{1}{P}\right)^{\frac{-2}{2}}$

$\therefore x \propto P$

So increasing pressure is favorable for forward reaction

Q.59 For the reaction:

$X_2O_4(\ell) \rightarrow 2XO_2(g)$

$\Delta U = 2.1$ k cal, $\Delta S = 20$ cal K^{-1} at 300 K

Hence, ΔG is:

(1) 2.7 k cal (2) – 2.7 k cal

(3) 9.3 k cal (4) – 9.3 k cal

Ans. **[2]**

Sol.

$X_2O_4 \rightarrow 2XO_2$

(ℓ) (g) $\Delta n_g = 2 - 0$

$\Delta n_g = 2$

$\Delta G = \Delta H - T\Delta S$

So first of all we will calculate ΔH

$\Delta H = \Delta U + \Delta n_g RT$

$\Delta H = 2.1 + (2) \times \frac{2}{1000} \times 300$

$\Delta H = 3.3$ kcal

Now

$\Delta G = \Delta H - T\Delta S$

$= 3.3 - 300 \times \frac{20}{1000}$ (in kcal)

$= -2.7$ kcal

Q.60 For a given exothermic reaction, K_P and K'_P are the equilibrium constant at temperatures T_1 and T_2, respectively. Assuming that heat of reaction is constant in temperature range between T_1 and T_2, it is readily observed that-

(1) $K_P > K'_P$ (2) $K_P < K'_P$

(3) $K_P = K'_P$ (4) $K_P = \frac{1}{K'_P}$

Ans. **[1]**

Sol.

According to Vant Hoff equation

$$\log \frac{K'_P}{K_P} = \frac{\Delta H}{2.303R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$$

for exothermic reaction on increasing temperature equilibrium constant decreases

means $T_2 > T_1$ then $K'_P < K_P$

Q.61 Which of the following orders of ionic radii is correctly represented ?

(1) $H^- > H^+ > H$ (2) $Na^+ > F^- > O^{2-}$

(3) $F^- > O^{2-} > Na^+$ (4) $Al^{3+} > Mg^{2+} > N^{3-}$

Ans. **[Bonus]**

Sol.

All option are incorrect order of ionic radius

Ionic radius $H^- > H^+ > H$

$Na^+ > F^- > O^{-2}$

$F^- > O^{-2} > Na^+$

$Al^{+3} > Mg^{+2} > N^{-3}$

Correct order of ionic radius are

(1) $H^- > H > H^+$

(2) $O^{-2} > F^- > Na^+$

(3) $O^{-2} > F^- > Na^+$

(4) $N^{-3} > Mg^{+2} > Al^{+3}$

Q.62 1.0 g of magnesium is burnt with 0.56g O_2 in a closed vessel. Which reactant is left in excess and how much ?

(At. wt. Mg = 24; O = 16)

(1) Mg, 0.16g (2) O_2, 0.16 g

(3) Mg, 0.44 g (4) O_2, 0.28 g

Ans. **[1]**

Sol.

$2Mg + O_2 \rightarrow 2MgO$

$n_{Mg} = \frac{1}{24} \cong 0.042$ & $n_{O_2} = \frac{0.56}{32} = 0.0175$

To find L.R.

Mg	O_2
$\frac{0.042}{2} = 0.021$	$\frac{0.0175}{1} = 0.0175$

$\therefore$ O_2 is LR & Mg is in excess

Now $n_{Mg,\ reacted} = 0.0175 \times 2$

$= 0.035$

$\therefore$ $n_{Mg,\ unreacted} = 0.007$

$\therefore$ $n_{Mg,\ remained} = 0.007 \times 27$

$= 0.16g$

Q.63 The pair of compounds that can exist together is:

(1) $FeCl_3$, $SnCl_2$ (2) $HgCl_2$, $SnCl_2$

(3) $FeCl_2$, $SnCl_2$ (4) $FeCl_3$, KI

Ans. **[3]**

Sol. $FeCl_3 + SnCl_2 \longrightarrow SnCl_4 + FeCl_2$

OA RA

$HgCl_2 + SnCl_2 \longrightarrow SnCl_4 + Hg_2Cl_2$

OA RA

$FeCl_3 + KI \longrightarrow I_2 + FeCl_2$

OA RA

$FeCl_2$ and $SnCl_2$ pair can exist together because $FeCl_2$ and $SnCl_2$ both are act as reducing agent.

Q.64 Be^{2+} is isoelectronic with which of the following ions ?

(1) H^+ (2) Li^+ (3) Na^+ (4) Mg^{2+}

Ans. **[2]**

Sol. Isoelectonic species have same number of total electron

Be^{+2} and Li^+ contain two electron

Q.65 Which of the following molecules has the maximum dipole moment ?

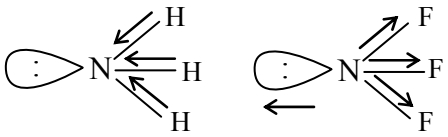
(1) CO_2 (2) CH_4 (3) NH_3 (4) NF_3

Ans. **[3]**

Sol.

$$\mu = \frac{:NH_3 > :NF_3}{\mu \neq 0} > \frac{CH_4 = CO_2}{\mu = 0}$$

$\mu = \ddot{N}H_3 \quad : \quad > \quad :NF_3$



atomic dipole & bond dipole are in same direction

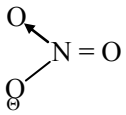
atomic dipole & bond dipole are in opposite direction

Q.66 Which one of the following species has plane triangular shape ?

(1) N_3^- (2) NO_3^- (3) NO_2^- (4) CO_2

Ans. **[2]**

Sol.

NO_3^- 

Hybridisation : sp^2

shape :- plane triangular

Q.67 Acidity of diprotic acids in aqueous solutions increases in the order:

(1) $H_2S < H_2Se \ H_2Te$

(2) $H_2Se < H_2S < H_2Te$

(3) $H_2Te < H_2S < H_2Se$

(4) $H_2Se < H_2Te < H_2S$

Ans. **[1]**

Sol.

Acidic strength of chalcogen hydride increase down the group because bond length increases and dissociation energy decreases

Acidic strength $H_2S < H_2Se < H_2Te$

Bond length ↑

Bond dissociation energy ↓

acidic strength ↑

Q.68 (a) $H_2O_2 + O_3 \rightarrow H_2O + 2O_2$

(b) $H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

Role of hydrogen peroxide in the above reactions is respectively:

(1) oxidizing in (a) and reducing in (b)

(2) reducing in (a) and oxidizing in (b)

(3) reducing in (a) and (b)

(4) oxidizing in (a) and (b)

Ans. **[3]**

Sol. Hydrogen peroxide generally act as an oxidising agent but. In the presence of strong oxidising agent like $KMnO_4$, $Kr_2Cr_2O_7$, Halogen's and ozone, tollens reagent. It is act as a reducing agent.

(A) $H_2O_2 + O_3 \longrightarrow H_2O + 2O_2$

H_2O [O] [O] O_2

R.A. O.A.

(B) $H_2O_2 + Ag_2O \longrightarrow H_2O + 2Ag + O_2$

H_2O [O] 2Ag [O]

R.A. O.A.

Q.69 Artificial sweetner which is stable under cold conditions only is:

(1) Saccharine (2) Sucralose

(3) Aspartame (4) Alitame

Ans. **[3]**

Sol.

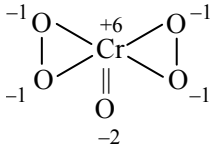
Aspartame is artificial sweetener which is stable only at cold condition because it is unstable at cooking temperature.

Q.70 In acidic medium, H_2O_2 changes $Cr_2O_7^{-2}$ to CrO_5 which has two (–O–O–) bonds. Oxidation state of Cr in CrO_5 is:

(1) +5 (2) +3 (3) +6 (4) –10

Ans. **[3]**

Sol. CrO_5 molecule contain two (– O — O –) bond



So oxidation state of Cr in CrO_5 is +6

Q.71 The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives:

(1) Mn^{4+} and O_2 (2) Mn^{2+} and O_2

(3) Mn^{2+} and O_3 (4) Mn^{4+} and MnO_2

Ans. **[2]**

Sol. When acidic $KMnO_4$ react with H_2O_2 purple colour decolourises due to formation of Mn^{+2}

acidic $KMnO_4 + H_2O_2 \longrightarrow Mn^{+2} + O_2$

(purple) (colourless)

Q.72 Among the following complexes the one which shows **Zero** crystal field stabilisation energy (CFSE) is:

(1) $[Mn(H_2O)_6]^{3+}$ (2) $[Fe(H_2O)_6]^{3+}$

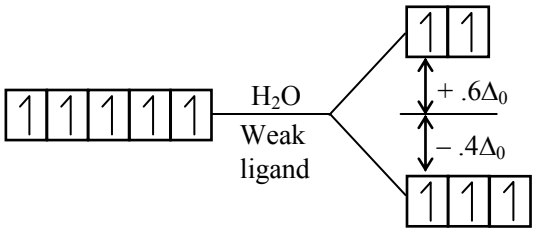
(3) $[Co(H_2O)_6]^{2+}$ (4) $[Co(H_2O)_6]^{3+}$

Ans. **[2]**

Sol.

$[Fe(H_2O)_6]^{+3}$

$Fe^{+3} = [Ar]\ 3d^5$



Configuration $\Rightarrow t_2g^3eg^2$

C.F.S.E. $= (-.4\Delta_0 \times 3) + (+.6\Delta_0 \times 2)$

$= -1.2\Delta_0 + 1.2\Delta_0$

C.F.S.E $= 0\ \Delta_0$

Q.73 Magnetic moment 2.83 BM is given by which of the following ions?

(At. no. Ti = 22, Cr = 24, Mn = 25, Ni = 28)

(1) Ti^{3+}

(2) Ni^{2+}

(3) Cr^{3+}

(4) Mn^{2+}

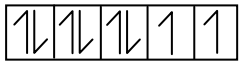
Ans. **[2]**

Sol.

$\mu = \sqrt{n(n+2)}$ B.M.

$\mu = 2.83 \quad \therefore n = 2$

$_{28}Ni = [Ar]\ 3d^8\ 4s^2$

$Ni^{+2} = [Ar]\ 3d^8$ 

3d

$n = 2$

$\mu = \sqrt{n(n+2)}$

$\mu = \sqrt{2(2+2)}$

$\mu = \sqrt{8}$

$\mu = 2.83$

Q.74 Which of the following complexes is used to be as an anticancer agent ?

(1) mer – $[Co(NH_3)_3Cl_3]$

(2) cis – $[PtCl_2(NH_3)_2]$

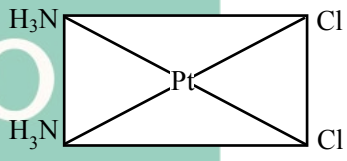
(3) cis – $K_2[Pt\ Cl_2Br_2]$

(4) Na_2CoCl_4

Ans. **[2]**

Sol.

Cis – $[Pt\ Cl_2\ (NH_3)_2]$



cis-platin used as anticancer agent

Q.75 Reason of lanthanoid contraction is :

(1) Negligible screening effect of 'f' orbitals

(2) Increasing nuclear charge

(3) Decreasing nuclear charge

(4) Decreasing screening effect

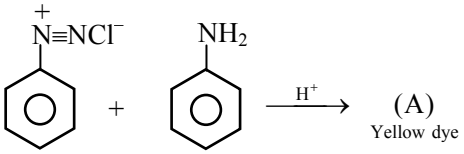
Ans. **[1]**

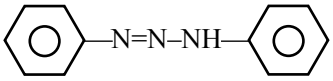
Sol.

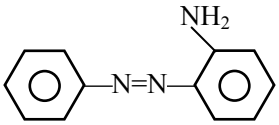
Lanthaoid contraction is due to negligible schielding effect of f-orbitals.

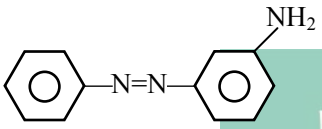
Order of schielding effect = s > p > d > f

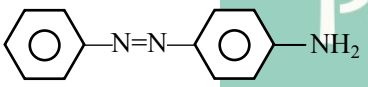
Q.76 In the following reaction, the product (A) is :



(1) 

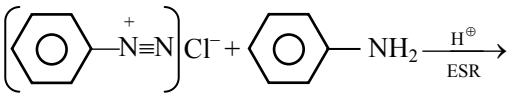
(2) 

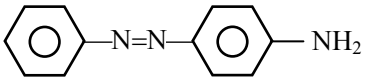
(3) 

(4) 

Ans. **[4]**

Sol.





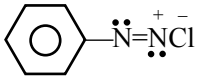
(Yellow Dye)

Q.77 Which of the following will be most stable diazonium salt $RN_2^+X^-$?

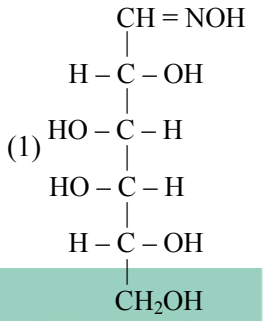
(1) $CH_3N_2^+X^-$ (2) $C_6H_5N_2^+X^-$

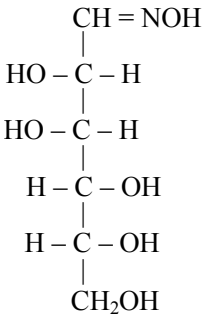
(3) $CH_3CH_2N_2^+X^-$ (4) $C_6H_5CH_2N_2^+X^-$

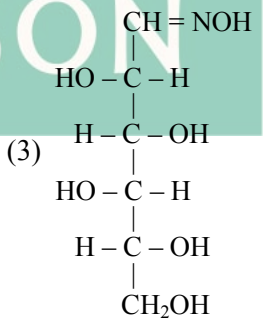
Ans. **[2]**

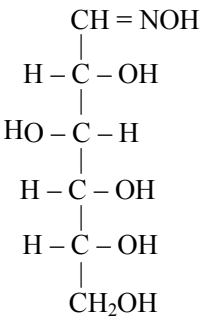
Sol.  is most stable because benzene ring is involve in resonance.

Q.78 D(+) glucose reacts with hydroxyl amine and yields an oxime. The structure of the oxime would be :

(1) 

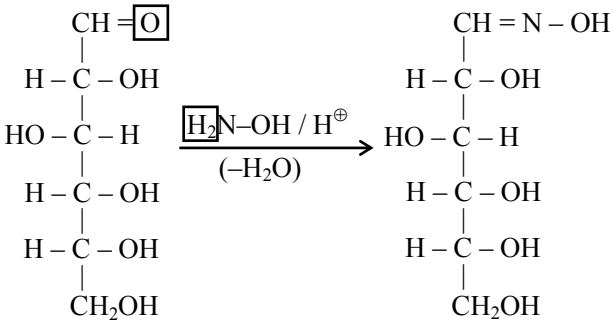
(2) 

(3) 

(4) 

Ans. **[4]**

Sol.



D(+) glucose D(+) glucoxime

Q.79 Which of the following hormones is produced under the condition of stress which stimulates glycogenolysis in the liver of human beings?

(1) Thyroxin (2) Insulin

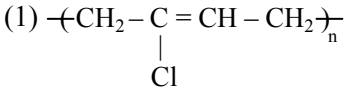
(3) Adrenaline (4) Estradiol

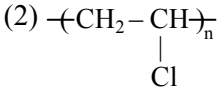
Ans. **[3]**

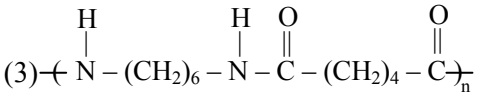
Sol.

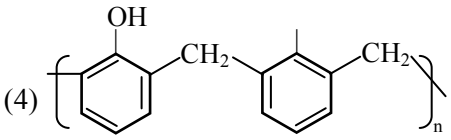
Adrenaline is produced under the condition of stress which stimulates glycogenolysis in the liver of human beings.

Q.80 Which one of the following is an example of a thermosetting polymer ?

(1) 

(2) 

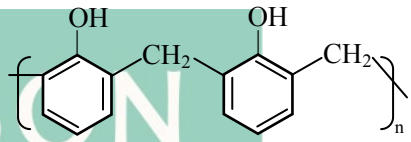
(3) 

(4) 

Ans. **[4]**

Sol.

Bakelite is a thermosetting polymer which have following structure.



Q.81 Which of the following organic compounds polymerizes to form the polyester Dacron?

(1) Propylene and para HO – (C_6H_4) – OH

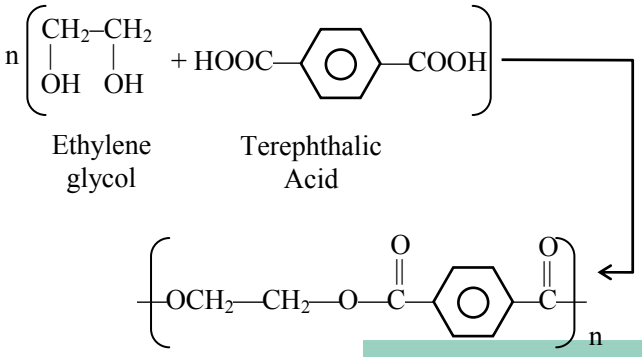
(2) Benzoic acid and ethanol

(3) Terephthalic acid and ethylene glycol

(4) Benzoic acid and para HO – (C_6H_4) – OH

Ans. **[3]**

Sol.



Dacron or Terylene

Q.82 Which one of the following is not a common component of Photochemical Smog?

(1) Ozone

(2) Acrolein

(3) Peroxyacetyl nitrate

(4) Chlorofluorocarbons

Ans. **[4]**

Sol.

Ozone, Acrolein & PAN are the common components of photo chemical smog. So CFC (Freon) is the answer.

Q.83 In the Kjeldahl's method for estimation of nitrogen present in a soil sample, ammonia evolved from 0.75 g of sample neutralized 10 mL of 1M H_2SO_4. The percentage of nitrogen in the soil is :

(1) 37.33 (2) 45.33

(3) 35.33 (4) 43.33

Ans. **[1]**

Sol.

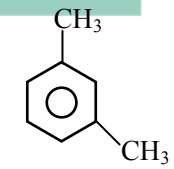
Kjeldahl's method

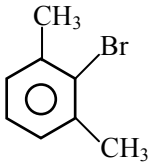
1 M of 10 ml H_2SO_4 = 1M of 20 ml NH_3. 1000 ml of 1M ammonia contains 14 gm nitrogen.

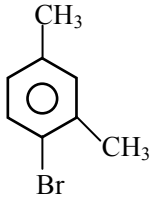
20 ml of 1M ammonia contains $\frac{14\times 20}{1000}$ gm nitrogen

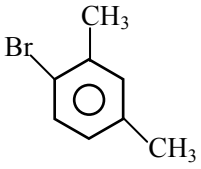
% of nitrogen = $\frac{14\times 20\times 100}{1000\times 0.75} = 37.33\%$

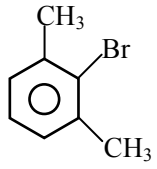
Q.84 What products are formed when the following compound is treated with Br_2 in the presence of $FeBr_3$?

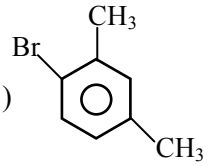
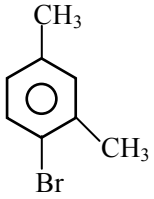


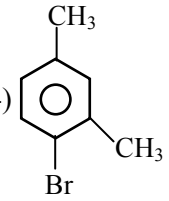
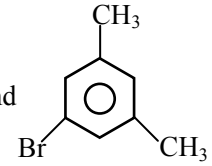
(1) 

and 

(2) 

and 

(3)  and 

(4)  and 

Ans. **[3]**

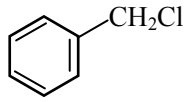
Sol.

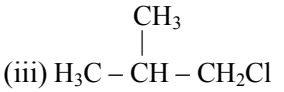
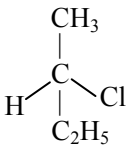
Both methyl are o/p – directing groups and at para-position steric hinderance is not applicable therefore 1-bromo-2,4-dimethyl is **exclusive** product.

Remember 2-bromo-1,3-dimethyl benzene is obtained less than 1%.

Hence options (3) is the most appropriate answer.

Q.85 Which of the following compounds will undergo racemisation when solution of KOH hydrolyses?

(i)  (ii) $CH_3CH_2CH_2Cl$

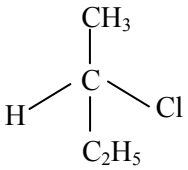
(iii)  (iv) 

(1) (i) and (ii) (2) (ii) and (iv)

(3) (iii) and (iv) (4) (i) and (iv)

Ans. **[Bonus]**

Sol. Wrong framing of questions.

Only  by reaction with KOH undergo reacemisation. But suitable option is absent therefore BONUS.

Q.86 Among the following sets of reactants which one produces anisole ?

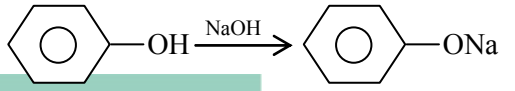
(1) CH_3CHO ; RMgX

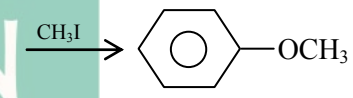
(2) C_6H_5OH ; NaOH ; CH_3I

(3) C_6H_5OH ; neutral $FeCl_3$

(4) $C_6H_5 – CH_3$; CH_3COCl ; $AlCl_3$

Ans. **[2]**

Sol. 



(Anisole)

Q.87 Which of the following will not be soluble in sodium hydrogen carbonate ?

(1) 2, 4, 6 – trinitrophenol

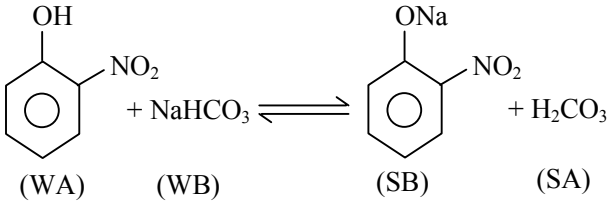
(2) Benzoic acid

(3) o – Nitrophenol

(4) Benzenesulphonic acid

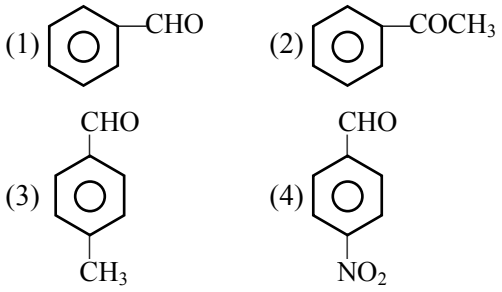
Ans. **[3]**

Sol.



Therefore this reaction is not possible in forward direction.

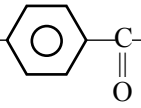
Q.88 Which one is most reactive towards Nucleophilic addition reaction ?



Ans. **[4]**

Sol.

N.A.R. $\propto \oplus$ve charge on sp^2 carbon $\propto \frac{-I,-M}{+I,+M}$

In O_2N—  —H, NO_2 group shows –M effect so it is max. reactive.

Q.89 Identity Z in the sequence of reactions :

$$CH_3CH_2CH=CH_2 \xrightarrow{HBr/H_2O_2} Y \xrightarrow{C_2H_5ONa} Z$$

(1) $CH_3-(CH_2)_3-O-CH_2CH_3$

(2) $(CH_3)_2CH_2-O-CH_2CH_3$

(3) $CH_3(CH_2)_4-O-CH_3$

(4) $CH_3CH_2-CH(CH_3)-O-CH_2CH_3$

Ans. **[1]**

Sol.

$$CH_3CH_2CH=CH_2 \xrightarrow{HBr/H_2O_2}$$

$$\underset{(Y)}{CH_3-CH_2-CH_2-\underset{Br}{\underset{|}{CH}}-CH_2} \xrightarrow[S_N2]{C_2H_5ONa}$$

$$\underset{(Z)}{CH_3(CH_2)_3-O-CH_2CH_3}$$

Q.90 Which of the following organic compounds has same hybridization as its combustion product – (CO_2)?

(1) Ethane (2) Ethyne

(3) Ethene (4) Ethanol

Ans. **[2]**

Sol.

$O=C=O$ and $HC\equiv CH$

sp-hybridization sp-hybridization

Q.91 Which one of the following shows isogamy with non-flagellated gametes ?

(1) *Sargassum* (2) *Ectocarpus*

(3) *Ulothrix* (4) *Spirogyra*

Ans. **[4]**

Sol.

In spirogyra, non-motile gametes are present, both of the gamete are morphologically same.

Q.92 Five kingdom system of classification suggested by R.H. Whittaker is not based on -

(1) Presence or absence of a well defined nucleus

(2) Mode of reproduction

(3) Mode of nutrition

(4) Complexity of body organisation

Ans. **[1]**

Sol.

Whittaker five kingdom classification is mainly based on following character

1. Cell structure
2. Thallus organization
3. Mode of Nutrition
4. Mode of reproduction
5. Phylogenetic relationship

Q.93 Which one of the following fungi contains hallucinogens ?

(1) *Morchella esculenta*

(2) *Amantia muscaria*

(3) *Neurospora* sp.

(4) *Ustilago* sp.

Ans. **[2]**

Sol. *Amanita muscaria* is a hallucinogenic fungi *Amanita muscaria* have pschycoactive agent muscimol.

Q.94 Archaebacteria differ from eubacteria in -

(1) Cell membrane structure

(2) Mode of nutrition

(3) Cell shape

(4) Mode of reproduction

Ans. **[1]**

Sol.

In archaebacteria cell membrane is made up of singe layer of branched chain lipid molecule, while in eubacteria it is made up of unbranched phospholipids bilayer

Q.95 Which one of the following is **wrong** about *Chara* ?

(1) Upper oogonium and lower round antheridium

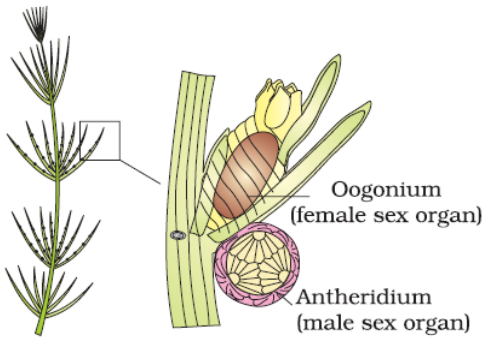
(2) Globule and nuclue present on the same plant

(3) Upper antheridium and lower oogonium

(4) Globule is male reproductive structure

Ans. **[3]**

Sol. Anthredium is present towards lower side and oogonium present towards the upper surface on same plant.



Q.96 Which of the following is responsible for peat formation ?

(1) *Marchantia* (2) *Riccia*

(3) *Funaria* (4) *Sphagnum*

Ans. **[4]**

Sol.

Peat is formed by sphagnum.

Q.97 Placenta and pericarp are both edible portions in -

(1) Apple (2) Banana

(3) Tomato (4) Potato

Ans. **[3]**

Sol.

Placenta and pericarp both are edible in tomato.

Q.98 When the margins of sepals or petals overlap one another without any particular direction, the condition is termed as -

(1) Vexillary (2) Imbricate

(3) Twisted (4) Valvate

Ans. **[2]**

Sol.

In Imbricate aestivation margins of sepal or petal overlap one another without any particular direction.

Q.99 You are given a fairly old piece of dicot stem and a dicot root. Which of the following anatomical structures will you use to distinguish between the two ?

(1) Secondary xylem

(2) Secondary phloem

(3) Protoxylem

(4) Cortical cells

Ans. **[3]**

Sol.

On the basis of position of Protoxylem, root can be differentiated from shoot. In root xylem is exarch i.e. protoxylem is towards periphery while in shoot xylem is endarch i.e. protoxylem is towards centre.

Q.100 Which one of the following statements is **correct** ?

(1) The seed in grasses is not endospermic

(2) Mango is a parthenocarpic fruit

(3) A proteinaceous aleurone layer is present in maize grain

(4) A sterile pistil is called a staminode

Ans. **[3]**

Sol.

Maize seed is endospermic seed, having outermost layer of endosperm aleuron, which is rich in protein.

Q.101 Tracheids differ from other tracheary elements in -

(1) having casparian strips

(2) being imperforate

(3) lacking nucleus

(4) being lignified

Ans. **[2]**

Sol.

Tracheids have pitted end wall while vessels are perforated end wall.

Q.102 An example of edible underground stem is -

(1) Carrot (2) Groundnut

(3) Sweet potato (4) Potato

Ans. **[4]**

Sol.

Potato tuber is edible underground stem.

Q.103 Which structures perform the function of mitochondria in bacteria ?

(1) Nucleoid (2) Ribosomes

(3) Cell wall (4) Mesosomes

Ans. **[4]**

Sol.

Mesosomes are involved in aerobic respiration in bacteria.

Q.104 The solid linear cytoskeletal elements having a diameter of 6 nm and made up of a single type of monomer are known as -

(1) Microtubules

(2) Microfilaments

(3) Intermediate filaments

(4) Lamins

Ans. **[2]**

Sol. Microfilament are made up of 2 molecules of 6 nm actin protein. Microtubule are 25 nm hollow tube like structure while intermidiate filament are 10 nm and lamins are nuclear proteins.

Q.105 The osmotic expansion of a cell kept in water is chiefly regulated by -

(1) Mitochondria (2) Vacuoles

(3) Plastids (4) Ribosomes

Ans. **[2]**

Sol.

Vacoule is involved in osmoregulation in plant cell.

Q.106 During which phase(s) of cell cycle, amount of DNA in a cell remains of 4C level if the initial amount is denoted as 2C ?

(1) G_0 and G_1 (2) G_1 and S

(3) Only G_2 (4) G_2 and M

Ans. **[4]**

Sol.

G_2 and M in 'S' phase DNA duplication occur. This leads to increase in 2C concentration to 4C concentration, which decreases to 2C at the end of M phase.

Q.107 Match the following and select the **correct** answer :

(a) Centriole	(i) Infoldings in mitochondria
(b) Chlorophyll	(ii) Thylakoids
(c) Cristae	(iii) Nucleic acids
(d) Ribozymes	(iv) Basal body cilia or flagella

	(a)	**(b)**	**(c)**	**(d)**
(1)	(iv)	(ii)	(i)	(iii)
(2)	(i)	(ii)	(iv)	(iii)
(3)	(i)	(iii)	(ii)	(iv)
(4)	(iv)	(iii)	(i)	(ii)

Ans. **[1]**

Sol. (a) Centriole (iv) Basal body cilia or flagella

(b) Chlorophyll (ii) Thylakoids

(c) Cristae (i) Infoldings in mitochondria

(d) Ribozymes (iii) Nucleic acids

Q.108 Dr. F. Went noted that if coleoptile tips were removed and placed on agar for one hour, the agar would produce a bending when placed on one side of freshly-cut coleptile stumps. of what significance is this experiment ?

(1) It made possible the isolation and exact identification of auxin

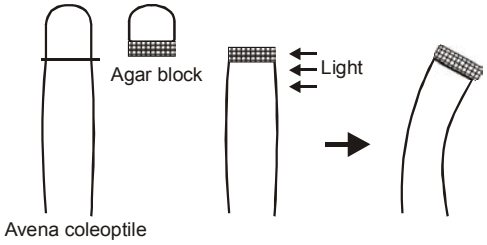
(2) It is the basis for quantitative determination of small amounts of growth-promoting substances

(3) It supports the hypothesis that IAA is auxin

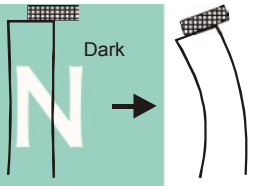
(4) It demonstrated polar movement of auxins

Ans. **[4]**

Sol.

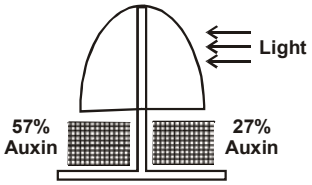


Experiment-1



Experiment-2

*This experiment of f.w. Went proves that transport of auxin is polar and basipetal.



Experiment-3

F.W. went have performed 3 main experiment given in diagrams. On the basis of these 3 experiments he gave 3 conclusions respectively –

(1) Growth is directly proportional to conc. of auxin in Agar block. On basis of Exp.-1 (in fig.)

(2) Transport of auxin is polar and basipetal. On basis of Exp.-2 (in fig.)

(3) High conc. of auxin towards dark side (57%) and less auxin conc. towards light side (27%) rest 16% is photooxidised. On basis of Exp.-3. (in fig.)

*In given question Exp.-2 is asked.

Q.109 Deficiency symptoms of nitrogen and potassium are visible first in -

(1) Senescent leaves

(2) Young leaves

(3) Roots

(4) Bunds

Ans. **[1]**

Sol.

Nitrogen and potassium are mobile elements. Deficiency symptoms of mobile elements first appears in older or mature plant parts as older parts acts as source of mobile elements.

Q.110 In which one of the following processes CO_2 is not released ?

(1) Aerobic respiration in plants

(2) Aerobic respiration in animals

(3) Alcoholic fermentation

(4) Lactate fermentation

Ans. **[4]**

Sol.

Lactic acid fermentation.

Biochemical reaction

$$2CH_3CO.COOH + 2NaDH_2 \xrightarrow{\text{Lactate dehydrogenase}}$$

(pyruvic acid) $2CH_3.CHOH.COOH$

(Lactic acid)

Q.111 Anoxygenic photosynthesis is characteristic of-

(1) *Rhodospirillum*

(2) *Spirogyra*

(3) *Chlamydomonas*

(4) *Ulva*

Ans. **[1]**

Sol.

Rhodospirillum in non-oxygenic photosynthetic bacteria.

Q.112 A few normal seedlings of tomato were kept in a dark room. After a few days they were found to have become white-coloured like albinos. Which of the following terms will you use to describe them ?

(1) Mutated (2) Embolised

(3) Etiolated (4) Defoliated

Ans. **[3]**

Sol.

Etiolation lake of chlorophyll pigments due to deficiency of sunlight. So plant get etiolated.

Q.113 Which one of the following growth regulators is known as 'stress hormone' ?

(1) Abscissic acid (2) Ethylene

(3) GA_3 (4) Indole acetic acid

Ans. **[1]**

Sol.

Abscissic acid (ABA) is considered as "Stress hormone" of plants as it protects plants from various kinds of stresses.

Q.114 Geitonogamy involves -

(1) Fertilization of a flower by the pollen from another flower of the same plant

(2) Fertilization of a flower by the pollen from the same flower

(3) Fertilization of a flower by the pollen from a flower of another plant in the same population

(4) Fertilization of a flower by the pollen from a flower of another plant belonging to a distant population

Ans. **[1]**

Sol.

Geitonogamy – pollination between two flowers of same plant.

Q.115 Male gametophyte with least number of cells is present in -

(1) *Pteris* (2) *Funaria*

(3) *Lilium* (4) *Pinus*

Ans. **[3]**

Sol.

Most reduced male gametophyte or minimum no. of cell in male gametophyte is present in angiosperm (3 celled male gametophyte). Lilium is angiosperm.

Q.116 An aggregate fruit is one which develops from-

(1) Multicarpellary syncarpous gynoecium

(2) Multicarpellary apocarpus gynoecium

(3) Complete inflorescence

(4) Multicarpellary superior ovary

Ans. **[2]**

Sol.

Aggregate fruit is developed from multicarpellary apocarpous gyanoecium.

Q.117 Pollen tablets are available in the market for -

(1) In vitro fertilization

(2) Breeding programmes

(3) Supplementing food

(4) *Ex situ* conservation

Ans. **[3]**

Sol.

Pollen tablets and syrups are used as supplementary food as rich in nutrients.

Q.118 Function of filiform apparatus is to -

(1) Recognize the suitable pollen at stigma

(2) Stimulate division of generative cell

(3) Produce nectar

(4) Guide the entry of pollen tube

Ans. **[4]**

Sol.

Filiform apparatus present in synergid cells helps in guiding pollen tube into embryo sac.

Q.119 Non-albuminous seed is produced in -

(1) Maize (2) Castor

(3) Wheat (4) Pea

Ans. **[4]**

Sol.

Pea is a non-endospermic/Non-albuminious seed, as endosperm consumed during embryo development.

Q.120 Which of the following shows coiled RNA strand and capsomeres ?

(1) Polio virus

(2) Tobacco mosaic virus

(3) Measles virus

(4) Retrovirus

Ans. **[2]**

Sol.

Tobacco mosaic virus has single stranded coiled RNA and protein capsid.

Q.121 Which one of the following is **wrongly** matched ?

(1) Transcription – Writing information from DNA to t-RNA

(2) Translation – Using information in m-RNA to make protein

(3) Repressor protein – Binds to operator to stop enzyme synthesis

(4) Operon – Structural genes, operator and promoter

Ans. **[1]**

Sol. Transcription is writing information from DNA to m-RAN not DNA from m-RNA.

Q.122 Transformation was discovered by -

(1) Meselson and Stahl

(2) Hershey and Chase

(3) Griffith

(4) Watson and Crick

Ans. **[3]**

Sol.

Transformation was discovered by Griffith in Pneumococcus pneumonie bacteria.

Q.123 Fruit colour in squash is an example of -

(1) Recessive epistasis

(2) Dominant epistasis

(3) Complementary genes

(4) Inhibitory genes

Ans. **[2]**

Sol. F_2 phenotype ratio in this gene interaction is 12 3 : 1 which represent dominant epistasis.

Q.124 Viruses have -

(1) DNA enclosed in a protein coat

(2) Prokaryotic nucleus

(3) Single chromosome

(4) Both DNA and RNA

Ans. **[1]**

Sol.

Viruses are having either RNA or DNA encapsulated by protein capsid.

Q.125 The first human hormone produced by recombinant DNA technology is -

(1) Insulin (2) Estrogen

(3) Thyroxin (4) Progesterone

Ans. **[1]**

Sol.

First human harmone produced by recombinant technology is insulin by Eli lilly an American company in 1983.

Q.126 An analysis of chromosomal DNA using the Southern hybridization technique **does not** use-

(1) Electrophoresis (2) Blotting

(3) Autoradiography (4) PCR

Ans. **[4]**

Sol. **CP Students may find this concept in CP Ex : Sheet: [Chapter : Genetics, Page No. 53]**

This is a technique of detecting DNA by using a DNA probe in this technique DNA is separated by gel electrophoresis and then transferred from the gel to membrane by blotting. The DNA was detected from membrane with a DNA probe to complementary bind to DNA the probe was labelled by radio active 32 p the labeled probes hybridise target DNA present in blot this probe is detect by auto radiography. So PCR is not included in it.

Q.127 In vitro clonal propagation in plants is characterized by -

(1) PCR and RAPD

(2) Northern blotting

(3) Electrophoresis and HPLC

(4) Microscopy

Ans. **[1]**

Sol. PCR (Polymerase chain reaction) and RAPD (Randomly Amplified Polymorphic DNA) are used to detect variations among and within the species and clones of a plant.

RAPD also used to evaluate the genetic stability of micropropagated plants.

Q.128 An alga which can be employed as food for human being is -

(1) *Ulothrix* (2) *Chlorella*

(3) *Spirogyra* (4) *Polysiphonia*

Ans. **[2]**

Sol.

Chlorella is a green algae which can be used as food supplement or food.

Q.129 Which vector can clone only a small fragment of DNA ?

(1) Bacterial artificial chromosome

(2) Yeast artificial chromosome

(3) Plasmid

(4) Cosmid

Ans. **[3]**

Sol.

Plasmid can clone only a small fragment of DNA (0.5-8 kb) other can clone large fragment of DNA like.

Cosmid (30 - 45 kb)

BAC (50 - 300 kb)

YAC (1000 - 2500 kb)

Q.130 An example of *ex situ* conservation is -

(1) National Park

(2) Seed Bank

(3) Wildlife Sanctuary

(4) Sacred Grove

Ans. **[2]**

Sol.

Seed bank is example of *ex-situ* conservation.

Q.131 A location with luxuriant growth of lichens on the trees indicates that the -

(1) trees are very healthy

(2) trees are heavily infested

(3) location is highly polluted

(4) location is not polluted

Ans. **[4]**

Sol.

Lichens not grow in polluted habitat Lichens are sensitive to oxides of sulphur, so a habitat with luxuriant growth of lichesns on trees indicates non-polluted habitat..

Q.132 Match the following and select the **correct** option :

(a) Earthworm	(i) Pioneer species
(b) Succession	(ii) Detritivore
(c) Ecosystem service	(iii) natality
(d) Population growth	(iv) Pollination

	(a)	(b)	(c)	(d)
(1)	(i)	(ii)	(iii)	(iv)
(2)	(iv)	(i)	(iii)	(ii)
(3)	(iii)	(ii)	(iv)	(i)
(4)	(ii)	(i)	(iv)	(iii)

Ans. **[4]**

Sol. This is a direct theory based question.

Q.133 A species facing extremely high risk of extinction in the immediate future is called -

(1) Vulnerable

(2) Endemic

(3) Critically Endangered

(4) Extinct

Ans. **[3]**

Sol.

Critically endangered species means species facing an extremely high risk of extinction in wild in immediate future.

Q.134 The zone of atmosphere in which the ozone layer is present is called -

(1) Ionosphere (2) Mesosphere

(3) Stratosphere (4) Troposphere

Ans. **[3]**

Sol. Ozone is present in stratosphere.

Q.135 The organization which publishes the Red List of species is -

(1) ICFRE (2) IUCN

(3) UNEP (4) WWF

Ans. **[2]**

Sol.

IUCN publishes red data book.

Q.136 Select the Taxon mentioned that represent both marine and fresh water species -

(1) Echinoderms (2) Ctenophora

(3) Cephalochordata (4) Cnidaria

Ans. **[4]**

Sol.

Phylum cnidaria includes both fresh water and marine species where as Echinoderms, Ctenophores and Cephelochordates are exclusively marine.

Q.137 Which one of the following living organisms completely *lacks* a cell wall ?

(1) Cyanobacteria

(2) Sea-fan (*Gorgonia*)

(3) *Saccharomyces*

(4) Blue-green algae

Ans. **[2]**

Sol.

Sea fan is an animal belonging to phylum coelnterata, that does not have cell wall where as cynobacteria, saccharomyces (fungus) and blue-green algae have cell wall.

Q.138 *Planaria* possesses high capacity of -

(1) Metamorphosis

(2) Regeneration

(3) Alternation of generation

(4) Bioluminescence

Ans. **[2]**

Sol.

Planaria (Dugesia) has the power of regeneration (morphallaxis) means it can regenerate the entire body with lost body part.

(Translation of option (2) in Hindi is wrong, so we have considered English option)

Q.139 A marine cartilaginous fish that can produce electric current is -

(1) *Pristis* (2) *Torpedo*

(3) *Trygon* (4) *Scoliodon*

Ans. **[2]**

Sol.

Torpedo (electric ray) produces electric current with the help of specialized muscles. Where as *Pristis* is Saw fish, *Trygon* is Sting ray, *Scoliodon* is Dog fish.

Q.140 Choose the correctly matched pair -

(1) Tendon – Specialized connective tissue

(2) Adipose tissue – Dense connective tissue

(3) Areolar tissue – Loose connective tissue

(4) Cartilage – Loose connective tissue

Ans. **[3]**

Sol.

Areolar tissue is the kind of loose connective tissue. Such type of tissues have less connective tissue cell and more intercellular space.

Q.141 Choose the correctly matched pair -

(1) Inner lining of salivary ducts – Ciliated epithelium

(2) Moist surface of buccal cavity – Glandular epithelium

(3) Tubular parts of nephrons –Cuboidal epithelium

(4) Inner surface of bronchioles – squamous epithelium

Ans. **[3]**

Sol.

Tubular part of nephron and mostly duct of glands are lined by cuboidal epithelium.

Q.142 In 'S' phase of the cell cycle -

(1) Amount of DNA-doubles in each cell

(2) Amount of DNA remains same in each cell

(3) Chromosome number is increased

(4) Amount of DNA is reduced to half in each cell

Ans. **[1]**

Sol.

DNA duplication occur in S phase.

Q.143 The motile bacteria are able to move by -

(1) Fimbriae (2) Flagella

(3) Cilia (4) Pili

Ans. **[2]**

Sol.

Motile bacteria show flagellary movement.

Q.144 Select the option which is **not correct** with respect to enzyme action -

(1) Substrate binds with enzyme at its active site

(2) Addition of lot of succinate does not reverse the inhibition of succinic dehydrogenase by malonate

(3) A non-competitive inhibitor binds the enzyme at a site distinct from that which binds the substrate

(4) Malonate is a competitive inhibitor of succinic dehydrogenase

Ans. **[2]**

Sol.

Inhibition of enzyme succinic dehydrogenase by malonate is example of competitive reversible inhibition. So if substrate succinate concentration is increased, it will remove malonate from active site and reaction becomes normal, so succinate reverse the inhibition of succinic dehydrogenase.

Q.145 Which one of the following is a non-reducing carbohydrate ?

(1) Maltose

(2) Sucrose

(3) Lactose

(4) Ribose 5-phophate

Ans. **[2]**

Sol.

Sucrose is non reducing disaccharide.

Q.146 The enzyme recombinase is required at which stage of meiosis -

(1) Pachytene (2) Zygotene

(3) Diplotene (4) Diakinesis

Ans. **[1]**

Sol.

Recombinase enzyme is involved in process of crossing over which occur in pachytene stage.

Q.147 The initial step in the digestion of milk in humans is carried out by -

(1) Lipase (2) Trypsin

(3) Rennin (4) Pepsin

Ans. **[3]**

Sol.

Initial step in the digestion of milk is carried out by rennin. Because of rennin coagulates the milk in stomach.

Q.148 Fructose is absorbed into the blood through mucosa cells of intestine by the process called -

(1) active transport

(2) facilitated transport

(3) simple diffusion

(4) co-transport mechanism

Ans. **[2]**

Sol.

Absorption of fructose by blood through mucosa cell of intestine by facilitated transport because of in this type of absorption Na^+ is used.

Q.149 Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs -

(1) as bicarbonate ions

(2) in the form of dissolved gas molecules

(3) by binding of R.B.C.

(4) as carbamino-haemoglobin

Ans. **[1]**

Sol. 70 % of CO_2 is transported in the form of bicarbonate due to presence of carbonic anhydrase enzyme inside RBC.

Q.150 Person with blood group AB is considered as universal recipient because he has -

(1) both A and B antigens on RBC but no antibodies in the plasma

(2) both A and B antibodies in the plasma.

(3) no antigen on RBC and no antibody in the plasma.

(4) both A and B antigens in the plasma but no antibodies.

Ans. **[1]**

Sol.

AB blood group individual contain both antigen A and B on its surface it does not cause antigenesis by entry of A and B antigen.

Q.151 How do parasympathetic neural signals affect the working of the heart ?

(1) Reduce both heart rate and cardiac output

(2) Heart rate is increased without affecting the cardiac output

(3) Both heart rate and cardiac output increase

(4) Heart rate decreases but cardiac output increases.

Ans. **[1]**

Sol.

Parasympathetic nerve vagus reduces the heart rate, this in turn reduces the cardiac out put also.

Q.152 Which of the following causes an increase in sodium reabsorption in the distal convoluted tubule -

(1) Increase in aldosterone levels

(2) Increase in antidiuretic hormone levels

(3) Decrease in aldosteron levels

(4) Decrease in antidiuretic hormone levels

Ans. **[1]**

Sol.

Aldosterone causes increase in Na^+ reabsorption from DCT by active process.

Q.153 Select the correct matching of the type of the point with the example in human skeletal system -

Type of joint	Example
(1) Cartilaginous joint	between frontal and parintal
(2) Pivot joint	between third and fourth cervical vertebrae
(3) Hinge joint	between humerus and pectoral girdle
(4) Gliding joint	between carpals

Ans. **[4]**

Sol.

Gliding/plain synovial joint can be found in between carpals of hand.

Q.154 Stimulation of a muscle fiber by a motor neuron occurs at -

(1) the neuromuscular junction

(2) the transverse tubules

(3) the myofibril

(4) the sacroplasmic reticulum

Ans. **[1]**

Sol.

During muscle contraction motor nerve secrete Acetylcholine neurotransmitter which goes on the muscle fibre through diffusion. Relation of motor nerve and muscle is called as neuromuscular junction.

Q.155 Injury localized to the hypothalamus would most likely disrupt -

(1) short-term memory

(2) co-ordination during locomotion

(3) executive functions, such as decision making

(4) regulation of body temperature

Ans. **[4]**

Sol.

Thermoregulation centre of body is present in hypothalamus of brain.

Q.156 Which one of the following statement is not correct ?

(1) Retinal is the light absorbing portion of visual photopigments.

(2) In retina the rods have the photo pigment rhodopsin while cones have three different photopigments

(3) Retinal is derivative of Vitamin C

(4) Rhodopsin is the purplish red protein present in rods only

Ans. **[3]**

Sol.

In this question **not correct** statement was asked. Retinal is derivative of vitamin 'A' not vitamin 'C'.

Q.157 Identify the hormone with its **correct** matching of source and function -

(1) Oxytocin-posterior pituitary, growth and maintenance of mammary glands.

(2) Melatonin-pineal gland, regulates the normal rhythm of sleep-wake cycle

(3) Progesterone-corpus-luteum, stimulation of growth and activities of female secondary sex organs.

(4) Atrial natriuretic factor-ventricular wall increases the blood pressure.

Ans. **[2]**

Sol.

Melatonin is released from pineal gland. Activity of pineal is regulated by light. Meletonin regulates diurenal rhythm.

Q.158 Fight-or-flight reaction cause activation of -

(1) the parathyroid glands, leading to increased metabolic rate

(2) the kidney, leading to suppression of reninangiotensin-aldosterone pathway

(3) the adrenal medulla, leading to increased secretion of epinephrine and norepinephrene

(4) the pancreas leading to a reduction in the blood sugar levels

Ans. **[3]**

Sol.

During fight or flight reaction sympathetic neurons activates adrenal medulla to produce adrenaline & noradrenaline.

Q.159 The shared terminal duct of the reproductive and urinary system in the human male is -

(1) Urethra (2) Ureter

(3) Vas deferens (4) Vasa efferentia

Ans. **[1]**

Sol.

Q.160 The main function of mammalian corpus luteum is to produce -

(1) estrogen only

(2) progesterone

(3) human chorionic gonadotropin

(4) relaxin only

Ans. **[2]**

Sol.

Corpus luteum secretes pregnancy hormone progesterons.

Q.161 Select the correct option describing gonadotropin activity in a normal pregnant female -

(1) High level of FSH and LH stimulates the thickening of endometrium

(2) High level of FSH and LH facilitate implantation of the embryo

(3) High level of hCG stimulates the synthesis of estrogen and progesterone

(4) High level of hCG stimulates the thicknening of endometrium

Ans. **[3]**

Sol.

HCG is released by placenta which helps in sustaining the level of sex hormones to support pregnancy.

Q.162 Tubectomy is a method of sterilization in which-

(1) small part of the fallopian tube is removed or tied up

(2) ovaries are removed surgically

(3) small part of vas deferens is removed or tied up

(4) uterus is removed surgically

Ans. **[1]**

Sol.

Tubectomy is a method of female sterilisation.

Q.163 Which of the following is a hormone releasing Intra Uterine Device (IUD) ?

(1) Multiload 375 (2) LNG-20

(3) Cervical cap (4) Vault

Ans. **[2]**

Sol.

LNG-20 is a levonorgesters releasing IUD.

Q.164 Assisted reproductive technology, IVF involves transfer of -

(1) Ovum into the fallopian tube

(2) Zygote into the fallopian tube

(3) Zygote into the uterus

(4) Embryo with 16 blastomeres into the fallopian tube

Ans. **[2]**

Sol.

Zygote intrafallopian transfer or ZIFT is the technique, which is referred in the questions.

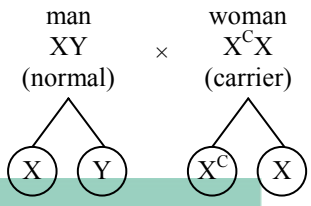
Q.165 A man whose father was colour blind marries a woman who had a colour blind mother and normal father. What percentage of male children of this couple will be colour blind ?

(1) 25 % (2) 0 %

(3) 50 % (4) 75 %

Ans. **[3]**

Sol.



Man is normal, his father is colourblind (x-linked) but x chromosome is not transmitted from his father, women is carrier b/c her mother is colourblind.

	X	Y
X^C	X^cX carrier	X^cY colourblind
X	XX Normal	XY Normal

So 50 % male child will be colourblind.

Q.166 In a population of 1000 individuals 360 belong to genotype AA, 480 to Aa and the remaining 160 to aa. Based on this data, the frequency of allele A in the population is -

(1) 0.4 (2) 0.5

(3) 0.6 (4) 0.7

Ans. **[3]**

Sol.

hardy weinbergh law

$p^2 + 2pq + q^2 = 1$

(AA) (Aa) (aa)

360 480 160

$A \rightarrow p$

$a - q$

$(p + q = 1)$

$aa = 160$

$aa = \frac{160}{1000} \times 100 = 16\ \%$

$q^2 = 0.16$

$q = 0.4\ (p + q = 1)$

so $p = 0.6$

Q.167 A human female with Turner's syndrome -

(1) has 45 chromosomes with XO

(2) has one additional X chromosome

(3) exhibits male characters

(4) is able to produce children with normal husband

Ans. **[1]**

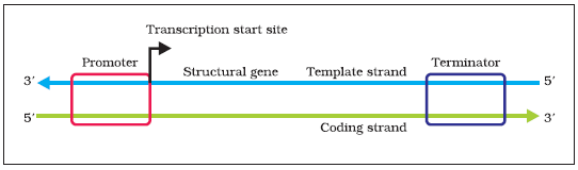
Sol.

Q.168 Select the correct option -

	Direction of RNA synthesis	Direction of reading of the template DNA strand
(1)	5' — 3'	3' —5'
(2)	3' — 5'	5' — 3'
(3)	5' — 3'	5' — 3'
(4)	3' — 5'	3' — 5'

Ans. **[1]**

Sol.



So direction of RNA synthesis in 5' → 3'

and direction of reading of template DNA strand.

Q.169 Commonly used vectors for human genome sequencing are -

(1) T-DNA

(2) BAC and YAC

(3) Expression Vectors

(4) T/A Cloning Vectors

Ans. **[2]**

Sol.

Q.170 Forelimbs of cat, lizard used in walking; forelimbs of whale used in swimming and forelimbs of bats used in flying are an example of-

(1) Analogous organs

(2) Adaptive radiation

(3) Homologous organs

(4) Convergent evolution

Ans. **[3]**

Sol.

They are the organs with common origin but perform different function.

Q.171 Which one of the following are analogous structures ?

(1) Wings of Bat and Wings of Pigeon

(2) Gills of Prawn and Lungs of Man

(3) Thorns of Bougainvillea and Tendrils of Cucurbita

(4) Flippers of Dolphin and legs of Horse

Ans. **[1]**

Sol.

Bat wings and bird wings are Analogous as flight strictures. Their structure and function have evolved by different routes from a flightless reptilian ancestor.

Q.172 Which is the particular type of drug that is obtained from the plant whose one flowering branch is shown below ?

(1) Hallucinogen (2) Depressant

(3) Stimulant (4) Pain-killer

Ans. **[1]**

Sol.

This is flowering branch of Datura having halucinogenic properties.

Q.173 At which stage of HIV infection does one usually show symptoms of AIDS ?

(1) Within 15 days of sexual contact with an infected person

(2) When the infected retro virus enters host cells

(3) When HIV damages large number of helper T-Lymphocytes

(4) When the viral DNA is produced by reverse transcriptase

Ans. **[3]**

Sol.

When HIV damage T-helper T-lymphocyte, person become immunodeficient so immunodeficient symptoms appear in the phage.

Q.174 To obtain virus-free healthy plants from a diseased one by tissue culture technique, which part/parts of the diseased plant will be taken ?

(1) Apical meristem only

(2) Palisade parenchyma

(3) Both apical and axillary meristems

(4) Epidermis only

Ans. **[3]**

Sol. In plant tissue culture virus free plants can be obtained by both apical and axillary meristems as rate of division of meristemetic tissue is faster than the rate of reproduction of virus.

Q.175 What gases are produced in anaerobic sludge digesters ?

(1) Methane and CO_2 only

(2) Methane, hydrogen sulphide and CO_2

(3) Methane, Hydrogen sulphide and O_2

(4) Hydrogen sulphide and CO_2

Ans. **[2]**

Sol.

In anaerobic sludge digestor, due to activity of anaerobic bacteria like Methanomonas & Sulphur bacteria the gases like CH_4, H_2S & CO_2 are produced.

Q.176 Just as a person moving from Delhi to Shimla to escape the heat for the duration of hot summer, thousands of migratory birds from Siberia and other extremely cold northern regions move to -

(1) Western Ghat

(2) Meghalaya

(3) Corbett National Park

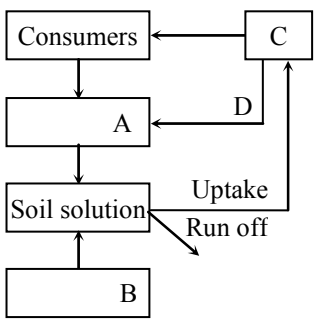
(4) Keolado National Park

Ans. **[4]**

Sol.

Migratory birds from Sibaria are Generally migrates at Keolado National park Bharatpur during winter season.

Q.177 Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (A-D). Identify the blanks.

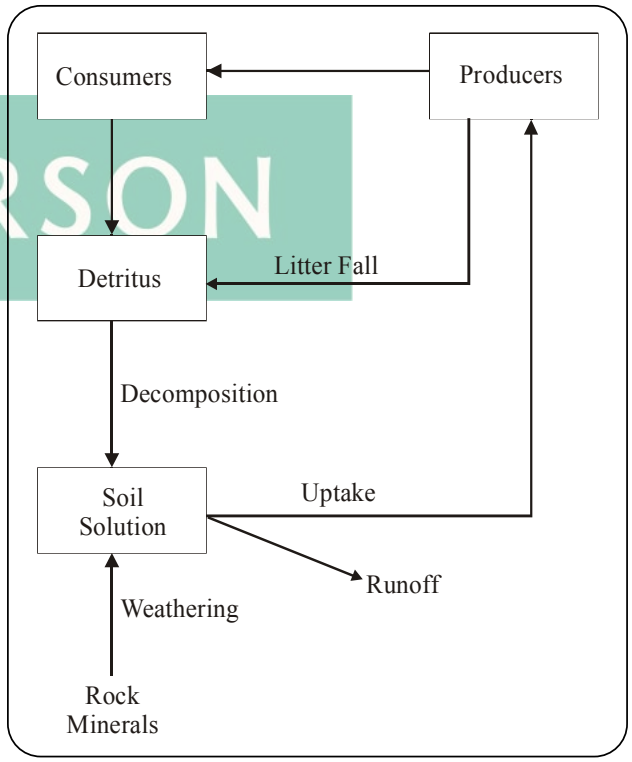


Options :

	A	B	C	D
(1)	Rock minerals	Detritus	Litter fall	Producers
(2)	Litter fall	Producers	Rock minerals	Detritus
(3)	Detritus	Rock minerals	Producers	Litter fall
(4)	Producers	Litter fall	Rock minerals	Detritus

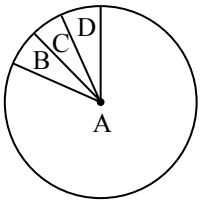
Ans. **[3]**

Sol.



A – Detritous
B – Rock minerals
C – Produces
D – Litter fall

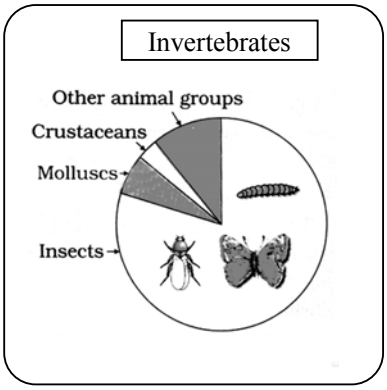
Q.178 Given below is the representation of the extent of global diversity of invertebrates. What groups the four portions (A-D) represent respectively ?



	A	B	C	D
(1)	Insects	Crustaceans	Other animal groups	Molluses
(2)	Crustaceans	Insects	Molluscs	Other animals groups
(3)	Molluscs	Other animals group	Crustaceans	Insects
(4)	Insects	Molluscs	Crustaceans	Other animal groups

Ans. **[4]**

Sol.



Q.179 A scrubber in the exhaust of a chemical industrial plant removes -

(1) gases like sulphur dioxide

(2) particulate matter of the size 5 micrometer or above

(3) gases like ozone and methane

(4) particular matter of the size 2.5 micrometer or less

Ans. **[1]**

Sol.

Scrubber in chemical industries are used to remove SPM gases like sulphur dioxides.

Q.180 If 20 J of energy is trapped at producer level, then how much energy will be available to peacock as food in the following chain ?

plant → mice → snake → peacock

(1) 0.02 J (2) 0.002 J

(3) 0.2 J (4) 0.0002 J

Ans. **[1]**

Sol. **CP Students may find similar question in CP Exercise Sheet: [Chapter : Ecology (Ecosystem), Level # 2, Page No. 124, Q. 52]**

This is based on Lindemann's 10 percent Law so if plant trapped 20 Joule energy then

Plant → mice → snake → peacock

20 J 2 J 0.2 J 0.02 J

So energy available for Peacock is 0.02 J.

1. Leaves become modified into spines in :
(1) Silk Cotton (2) *Opuntia* (3) Pea (4) Onion

1. (2)

2. Vertical distribution of different species occupying different levels in a biotic community is known as :
(1) Pyramid (2) Divergence (3) Stratification (4) Zonation

2. (3)

3. Transpiration and root pressure cause water to rise in plants by :
(1) pushing and pulling it, respectively (2) pulling it upward
(3) pulling and pushing it, respectively (4) pushing it upward

3. (3)

4. Gene regulation governing lactose operon of *E.coli* that involves the lac I gene product is :
(1) Feedback inhibition because excess of β−galactosidase can switch off transcription
(2) Positive and inducible because it can be induced by lactose
(3) negative and inducible because repressor protein prevents transcription
(4) negative and repressible because repressor protein prevents transcription

4. (2)

5. High value of BOD (Biochemical Oxygen Demand) indicates that :
(1) consumption of organic matter in the water is higher by the microbes
(2) water is pure
(3) water is highly polluted
(4) water is less polluted

5. (3)

6. Which one of the following matches is **correct**?

(1)	Agaricus	Parasitic fungus	Basidiomycetes
(2)	Phytophthora	Aseptate mycelium	Basidiomycetes
(3)	Alternaria	Sexual reproduction absent	Deuteromycetes
(4)	Mucor	Reproduction by Conjugation	Ascomycetes

6. (3)

7. Which of these is **not** an important component of initiation of parturition in humans?
(1) Release of prolactin (2) Increase in estrogen and progesterone ratio
(3) Synthesis of prostaglandins (4) Release of oxytocin

7. (1)

8. A chemical signal that has both endocrine and neural roles is :
(1) Cortisol (2) Melatonin (3) Calcitonin (4) Epinephrine

8. (4)

9. Match each disease with its **correct** type of vaccine :
(a) tuberculosis (i) harmless virus
(b) Whooping cough (ii) inactivated toxin
(c) diphtheria (iii) killed bacteria
(d) polio (iv) harmless bacteria

	(a)	(b)	(c)	(d)
(1)	(i)	(ii)	(iv)	(iii)
(2)	(ii)	(i)	(iii)	(iv)
(3)	(iii)	(ii)	(iv)	(i)
(4)	(iv)	(iii)	(ii)	(i)

9. (4)

10. Nuclear envelope is a derivative of :
(1) Rough endoplasmic reticulum
(2) Smooth endoplasmic reticulum
(3) Membrane of Golgi complex
(4) Microtubules

10. (2)

11. The crops engineered for glyphosate are resistant/tolerant to:
(1) Herbicides (2) Fungi (3) Bacteria (4) Insects

11. (1)

12. Vascular bundles in monocotyledons are considered closed because :
(1) Xylem is surrounded all around by phloem
(2) A bundle sheath surrounds each bundle
(3) Cambium is absent
(4) There are no vessels with perforations

12. (3)

13. Read the following five statements (A to E) and select the option with **all correct** statements :
(A) Mosses and Lichens are the first organisms to colonise a bare rock.
(B) *Selaginella* is a homosporous pteridophyte.
(C) Coralloid roots in *Cycas* have VAM.
(D) Main plant body in bryophytes is gametophytic, whereas in pteridophytes it is sporophytic.
(E) In gymnosperms, male and female gametophytes are present within sporangia located on sporophyte
(1) (B), (C) and (E) (2) (A), (C) and (D) (3) (B), (C) and (D) (4) (A), (D) and (E)

13. (4)

14. True nucleus is absent in :
(1) *Volvox* (2) *Anabaena* (3) *Mucor* (4) *Vaucheria*

14. (2)

15. Which one of the following statements in **not** true?
(1) Honey is made by bees by digesting pollen collected from flowers
(2) Pollen grains are rich in nutrients, and they are used in the form of tablets and syrups
(3) Pollen grains of some plants cause severe allergies and bronchial afflictions in some people
(4) The flowers pollinated by flies and bats secrete foul odour to attract them

15. (1)

16. Removal of proximal convoluted tubule from the nephron will result in :
(1) No urine formation
(2) More diluted urine
(3) More concentrated urine
(4) No change in quality and quantity of urine

16. (3)

17. A gymnast is able to balance his body upside down even in the total darkness because of :
(1) Organ of corti
(2) Cochlea
(3) Vestibular apparatus
(4) Tectorial membrane

17. (3)

18. The hilum is a scar on the :
(1) Seed, where micropyle was present
(2) Seed, where funicle was attached
(3) Fruit, where it was attached to pedicel
(4) Fruit, where style was present

18. (2)

19. Which one of the following is **correct**?
(1) Blood = Plasma + RBC + WBC + Platelets
(2) Plasma = Blood – Lymphocytes
(3) Serum = Blood + Fibrinogen
(4) Lymph = Plasma + RBC + WBC

19. (1)

20. The guts of cow and buffalo possess :
(1) Cyanobacteria
(2) *Fucus* spp.
(3) *Chlorella* spp.
(4) Methanogens

20. (4)

21. Which one of the following may require pollinators, but is genetically similar to autogamy?
(1) Cleistogamy (2) Geitonogamy (3) Xenogamy (4) Apogamy

21. (2)

22. In sea urchin DNA, which is double stranded, 17 % of the bases were shown to be cytosine. The percentages of the other three bases expected to be present in this DNA are :
(1) G 8.5%, A 50%, T 24.5%
(2) G 34%, A 24.5%, T 24.5%
(3) G 17%, A 16.5%, T 32.5%
(4) G 17%, A 33%, T 33%

22. (4)

23. Capacitation refers to changes in the :
(1) sperm after fertilization
(2) sperm before fertilization
(3) ovum before fertilization
(4) ovum after fertilization

23. (2)

24. Which of the following had the smallest brain capacity?
(1) *Homo habilis*
(2) *Homo erectus*
(3) *Homo sapiens*
(4) *Homo neanderthalensis*

24. (1)

25. Which of the following viruses is **not** transferred through semen of an infected male?
(1) Ebola virus
(2) Hepatitis B virus
(3) Human immunodeficiency virus
(4) Chikungunya virus

25. (4)

26. A major characteristic of the monocot root is the presence of :
(1) Cambium sandwiched between phloem and xylem along the radius
(2) Open vascular bundles
(3) Scattered vascular bundles
(4) Vasculature without cambium

26. (4)

27. Blood pressure in the mammalian aorta is maximum during:
(1) Diastole of the right atrium
(2) Systole of the left atrium
(3) Diastole of the right ventricle
(4) Systole of the left ventricle

27. (4)

28. In Bt cotton, the Bt toxin present in plant tissue as pro–toxin is converted into active toxin due to :
(1) presence of conversion factors in insect gut (2) alkaline pH of the insect gut
(3) acidic pH of the insect gut (4) action of gut micro–organisms

28. (2)

29. In an ecosystem the rate of production of organic matter during photosynthesis is termed as :
(1) Net productivity (2) Net primary productivity
(3) Gross primary productivity (4) Secondary productivity

29. (3)

30. In a ring girdled plant :
(1) Neither root nor shoot will die (2) The shoot dies first
(3) The root dies first (4) The shoot and root die together

30. (3)

31. Erythropoiesis starts in :
(1) Red bone marrow (2) Kidney (3) Liver (4) Spleen

31. (1)

32. Keel is the characteristics feature of flower of :
(1) Tomato (2) Tulip (3) *Indigofera* (4) *Aloe*

32. (3)

33. In which of the following gametophyte is **not** independent free living?
(1) *Pinus* (2) *Funaria* (3) *Marchantia* (4) *Pteris*

33. (1)

34. The structures that are formed by stacking of organized flattened membranous sacs in the chloroplasts are:
(1) Stroma (2) Cristae (3) Grana (4) Stroma lamellae

34. (3)

35. Which of the following does **not** favour the formation of large quantities of dilute urine ?
(1) Atrial-natriuretic factor (2) Alcohol
(3) Caffeine (4) Renin

35. (4)

36. DNA is **not** present in:
(1) Mitochondria (2) Chloroplast (3) Ribosomes (4) Nucleus

36. (3)

37. Which of the following are the important flora rewards to the animal pollinators?
(1) Protein pellicle and stigmatic exudates
(2) Colour and large size of flower
(3) Nectar and pollen grains
(4) Floral fragrance and calcium crystals

37. (3)

38. Which of the following represents the **correct** combination without any exception?

	Characteristics	Class
(1)	Body covered with feathers; skin moist and glandular; fore-limbs form wings; lungs with air sacs	Aves
(2)	Mammary gland; hair on body; pinnae; two pairs of limbs	Mammalia
(3)	Mouth ventral; gills without operculum; skin with placoid scales; persistent notochord	Chondrichthyes
(4)	Sucking and circular mouth; jaws absent, integument without scales; paired appendages	Cyclostomata

38. (2)

39. Alleles are:
(1) heterozygotes
(2) different phenotype
(3) true breeding homozygotes
(4) different molecular forms of a gene

39. (4)

40. Hysterectomy is surgical removal of:
(1) Mammary glands (2) Uterus (3) Prostate gland (4) Vas-deference

40. (2)

41. The UN Conference of Parties on climate change in the year 2011 was held in :
(1) Qatar (2) Poland (3) South Africa (4) Peru

41. (3)

42. HIV that causes AIDS, first starts destroying:
(1) Thrombocytes
(2) B – Lymphocytes
(3) Leucocytes
(4) Helper T – Lymphocytes

42. (4)

43. Which one of the following statements is **wrong**?
(1) Mannitol is stored food in Rhodophyceae
(2) Algin and carragen are products of algae
(3) Agar–agar is obtained from *Gelidium* and *Gracilaria*
(4) *Chlorella* and *Spirulina* are used as space food

43. (1)

44. Cryopreservation of gametes of threatened species in viable and fertile condition can be referred to as:
(1) In situ cryo–conservation of biodiversity
(2) In situ conservation of biodiversity
(3) Advanced ex–situ conservation of biodiversity
(4) In situ conservation by sacred groves

44. (3)

45. Select the **correct** matching in the following pairs:
(1) Rough ER — Oxidation of fatty acids
(2) Smooth ER — Oxidation of phospholipids
(3) Smooth ER — Synthesis of lipids
(4) Rough ER — Synthesis of glycogen

45. (3)

46. Secondary Succession takes place on/in :
(1) Newly cooled lava
(2) Bare rock
(3) Degraded forest
(4) Newly created pond

46. (3)

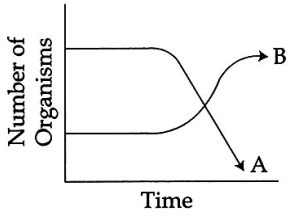
47. Which of the following is not a sexually transmitted disease ?
(1) Encephalitis
(2) Syphilis
(3) Acquired Immuno Deficiency Syndrome (AIDS)
(4) Trichomoniasis

47. (1)

48. The movement of a gene from one linkage group to another is called:
(1) Crossing over (2) Inversion (3) Duplication (4) Translocation

48. (1)

49. The following graph depicts changes in two populations (A and B) of herbivores in a grassy field. A possible reason for these changes is that:



(1) Population A consumed the members of population B
(2) Both plant populations in this habitat decreased
(3) Population B competed more successfully for food than population A
(4) Population A produced more offspring than population B

49. (3)

50. Typical growth curve in plants is :
(1) Parabolic (2) Sigmoid (3) Linear (4) Stair-steps shaped

50. (2)

51. Which one gives the most valid and recent explanation for stomatal movements ?
(1) Guard cell photosynthesis (2) Transpiration
(3) Potassium influx and efflux (4) Starch hydrolysis

51. (3)

52. Cytochromes are found in:
(1) Lysosomes (2) Matrix of mitochondria
(3) Outer wall of mitochondria (4) Cristae of mitochondria

52. (4)

53. Rachel Carson's famous book "Silent Spring" is related to:
(1) Ecosystem management (2) Pesticide pollution
(3) Noise pollution (4) Population explosion

53. (2)

54. Which of the following regions of the brain is **incorrectly** paired with its function ?
(1) Cerebrum - calculation and contemplation
(2) Medulla oblongata - homeostatic control
(3) Cerebellum - language comprehension
(4) Corpus callosum - communication between the left and right cerebral cortices

54. (3)

55. Which of the following characteristics is mainly responsible for diversification of insects on land?
(1) Eyes (2) Segmentation
(3) Bilateral symmetry (4) Exoskeleton

55. (4)

56. Sliding filament theory can be best explained as :
(1) When myofilaments slide pass each other, Myosin filaments shorten while Actin filaments do not shorten
(2) When myofilaments slide pass each other Actin filaments shorten while Myosin filament do not shorten
(3) Actin and Myosin filaments shorten and slide pass each other
(4) Actin and Myosin filaments do not shorten but rather slide pass each other

56. (4)

57. Which one of the following is **not** an inclusion body found in prokaryotes?
(1) Polysome (2) Phosphate granule
(3) Cyanophycean granule (4) Glycogen granule

57. (1)

58. The mass of living material at a trophic level at a particular time is called :

(1) Standing crop
(2) Gross primary productivity
(3) Standing state
(4) Net primary productivity

58. (1)

59. Select the correct option:

	I		II
(a)	Synapsis aligns homologous chromosomes	(i)	Anaphase-II
(b)	Synthesis of RNA and protein	(ii)	Zygotene
(c)	Action of enzyme recombinase	(iii)	G_2-phase
(d)	Centromeres do not separate but chromatids move towards opposite poles	(iv)	Anaphase-I
		(v)	Pachytene

	(a)	**(b)**	**(c)**	**(d)**
(1)	(ii)	(iii)	(iv)	(v)
(2)	(ii)	(i)	(iii)	(iv)
(3)	(ii)	(iii)	(v)	(iv)
(4)	(i)	(ii)	(v)	(iv)

59. (3)

60. Multiple alleles are present:

(1) On non-sister chromatids
(2) On different chromosomes
(3) At different loci on the same chromosome
(4) At the same locus of the chromosome

60. (4)

61. Which of the following is **not** one of the prime health risks associated with greater UV radiation through the atmosphere due to depletion of stratospheric ozone ?

(l) Increased liver cancer
(2) Increased skin cancer
(3) Reduced Immune System
(4) Damage to eyes

61. (1)

62. Which is the most common mechanism of genetic variation in the population of a sexually-reproducing organism?

(1) Recombination
(2) Transduction
(3) Chromosomal aberrations
(4) Genetic drift

62. (1)

63. Minerals known to be required in large amounts for plant growth include:

(1) magnesium, sulphur, iron, zinc
(2) phosphorus, potassium, sulphur, calcium
(3) calcium, magnesium, manganese, copper
(4) potassium, phosphorus, selenium, boron

63. (2)

64. Transmission tissue is characteristic feature of

(1) Wet stigma
(2) Hollow style
(3) Solid style
(4) Dry stigma

64. (3)

65. A man with blood group 'A' marries a woman with blood group 'B'. What are all the possible blood groups of their offsprings?

(1) O only
(2) A and B only
(3) A, B and AB only
(4) A, B, AB and O

65. (4)

66. Which of the following statements is **not** correct ?

(1) Acini are present in the pancreas and secrete carboxypeptidase
(2) Brunner's glands are present in the submucosa of stomach and secrete pepsinogen
(3) Goblet cells are present in the mucosa of intestine and secrete mucus
(4) Oxyntic cells are present in the mucosa of stomach and secrete HCl.

66. (2)

67. Perigynous flowers are found in :

(1) Rose
(2) Guava
(3) Cucumber
(4) China rose

67. (1)

68. An abnormal human baby with 'XXX' sex chromosomes was born due to:

(1) fusion of two sperms and one ovum
(2) formation of abnormal sperms in the father
(3) formation of abnormal ova in the mother
(4) fusion of two ova and one sperm

68. (3)

69. What causes a green plant exposed to the light on only one side, to bend toward the source of light as it grows ?

(1) Auxin accumulates on the shaded side, stimulating greater cell elongation there.
(2) Green plants need light to perform photosynthesis.
(3) Green plants seek light because they are phototropic.
(4) Light stimulates plant cells on the lighted side to grow faster.

69. (1)

70. The chromosomes in which centromere is situated close to one end are :

(1) Sub-metacentric
(2) Metacentric
(3) Acrocentric
(4) Telocentric

70. (3)

71. A technique of micropropagation is:

(1) Embryo rescue
(2) Somatic hybridization
(3) Somatic embryogenesis
(4) Protoplast fusion

71. (3)

72. A somatic cell that has just completed the S phase of its cell cycle, as compared to gamete of the same species, has:

(1) four times the number of chromosomes and twice the amount of DNA
(2) twice the number of chromosomes and twice the amount of DNA
(3) same number of chromosomes but twice the amount of DNA
(4) twice the number of chromosomes and four times the amount of DNA

72. (4)

73. Gastric juice of infants contains :

(1) amylase, rennin, pepsinogen
(2) maltase, pepsinogen, rennin
(3) nuclease, pepsinogen, lipase
(4) pepsinogen, lipase, rennin

73. (4)

74. Which of the following animals is **not** viviparous ?
(1) Whale (2) Flying fox (Bat) (3) Elephant (4) Platypus

74. (4)

75. $\oplus$ ♀ $K_{(5)}$ $C_{(5)}$ A_5 $\underline{G_{(2)}}$ is the floral formula of
(1) *Brassica* (2) *Allium* (3) *Sesbania* (4) *Petunia*

75. (4)

76. In which of the following both pairs have **correct** combination?
(1) *In situ* conservation: Tissue culture
Ex situ conservation: Sacred groves
(2) *In situ* conservation: National Park
Ex situ conservation: Botanical Garden
(3) *In situ* conservation: Cryopreservation
Ex situ conservation: Wildlife Sanctuary
(4) *In situ* conservation: Seed Bank
Ex situ conservation: National Park

76. (2)

77. Which body of the Government of India regulates GM research and safety of introducing GM organisms for public services ?
(1) Research Committee on Genetic Manipulation
(2) Bio - safety committee
(3) Indian Council of Agricultural Research
(4) Genetic Engineering Approval Committee

77. (4)

78. Which of the following endoparasites of humans does show viviparity ?
(1) *Ascaris lumbricoides* (2) *Ancylostoma duodenale*
(3) *Enterobius vermicularis* (4) *Trichinella spiralis*

78. (4)

79. The terga, sterna and pleura of cockroach body are joined by:
(1) Cartilage (2) Cementing glue
(3) Muscular tissue (4) Arthrodial membrane

79. (4)

80. Most animals are tree dwellers in a:
(1) tropical rain forest (2) coniferous forest
(3) thorn woodland (4) temperate deciduous forest

80. (1)

81. Which of the following enhances or induces fusion of protoplasts ?
(1) IAA and gibberellins (2) Sodium chloride and potassium chloride
(3) Polyethylene glycol and sodium nitrate (4) IAA and kinetin

81. (3)

82. Glenoid cavity articulates :
(1) humerus with scapula (2) clavicle with acromion
(3) scapula with acromion (4) clavicle with scapula

82. (1)

83. A population will **not** exist in Hardy–Weinberg equilibrium if :

(1) the population is large
(2) individuals mate selectively
(3) there are no mutations
(4) there is no migration

83. (2)

84. Male gametes are flagellated in :

(1) *Spirogyra* (2) *Polysiphonia* (3) *Anabaena* (4) *Ectocarpus*

84. (4)

85. When you hold your breath, which of the following gas changes in blood would first lead to the urge to breathe?

(1) rising CO_2 and falling O_2 concentration
(2) falling O_2 concentration
(3) rising CO_2 concentration
(4) falling CO_2 concentration

85. (3)

86. Which of the following cells during gametogenesis is normally diploid?

(1) Secondary polar body
(2) Primary polar body
(3) Spermatid
(4) Spermatogonia

86. (4)

87. In ginger vegetative propagation occurs through :

(1) Runners (2) Rhizome (3) Offsets (4) Bulbils

87. (2)

88. Which one of the following statements is **incorrect**?

(1) The presence of the competitive inhibitor decreases the Km of the enzyme for the substrate.
(2) A competitive inhibitor reacts reversibly with the enzyme to form an enzyme–inhibitor complex.
(3) In competitive inhibition, the inhibitor molecule is not chemically changed by the enzyme.
(4) The competitive inhibitor does not affect the rate of breakdown of the enzyme–substrate complex.

88. (1)

89. The active form of *Entamoeba histolytica* feeds upon:

(1) blood only
(2) erythrocytes; mucosa and submucosa of colon
(3) mucosa and submucosa of colon only
(4) food in intestine

89. (2)

90. How many pairs of contrasting characters in pea plants were studied by Mendel in his experiments?

(1) Seven (2) Five (3) Six (4) Eight

90. (1)

91. A radiation of energy 'E' falls normally on a perfectly reflecting surface. The momentum transferred to the surface is (C = Velocity of light) :

(1) $\frac{E}{C^2}$ (2) $\frac{E}{C}$ (3) $\frac{2E}{C}$ (4) $\frac{2E}{C^2}$

91. (3)

$p = \frac{E}{c}$

For reflecting surface

$\Delta p = p - (-p) = 2p = \frac{2E}{c}$.

92. A ship A is moving Westwards with a speed of 10 km h^{-1} and a ship B 100 km South of A, is moving Northwards with a speed of 10 km h^{-1}. The time after which the distance between them becomes shortest, is :

(1) $10\sqrt{2}$ h (2) 0 h (3) 5h (4) $5\sqrt{2}$ h

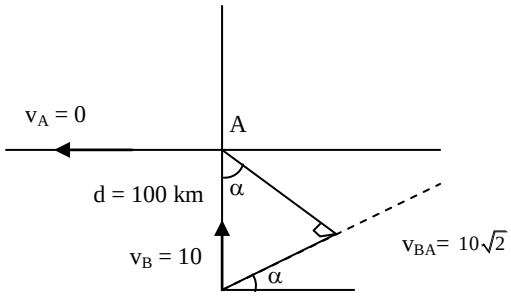
92. (3)

$v_{BA} = 10\sqrt{2}$ km $\quad \alpha = 45°$

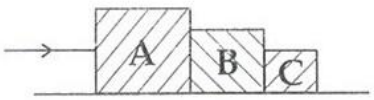
A N = minimum distance between the two

$= d \cos\alpha$

time taken to reach at N = $\frac{d\cos\alpha}{v_{BA}} = \frac{100 \times \frac{1}{v^2}}{10\sqrt{2}} = 5h$



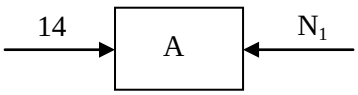
93. Three blocks A, B and C, of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is :



(1) 18 N (2) 2 N (3) 6 N (4) 8 N

93. (3)

$a = \frac{14}{7} = 2 m/s^2$



$\therefore 14 - N_1 = 4 \times 2$

$N_1 = 6N$

94. The electric field in a certain region is acting radially outward and is given by E = Ar . A charge contained in a sphere of radius 'a' centred at the origin of the field, will be given by :

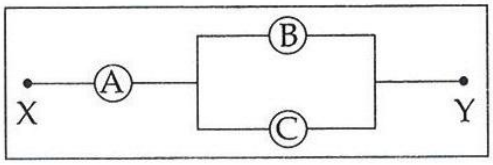
(1) $\in_0 Aa^3$ (2) $4\pi\in_0 Aa^2$ (3) $A\in_0 a^2$ (4) $4\pi\in_0 Aa^3$

94. (4)

$\oint \vec{E}\cdot\vec{ds} = E\,4\pi a^2 = A.a\,4\pi a^2 = 4\pi Aa^3$

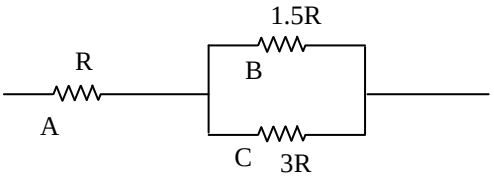
$\oint \vec{E}\cdot\vec{ds} = \frac{Q_{ex}}{\varepsilon_0} \qquad \therefore Q_{ex} = 4\pi\varepsilon_0 A a^3$

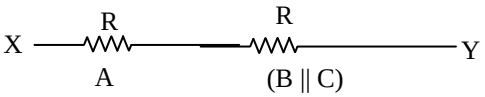
95. A, B and C are voltmeters of resistance R, 1.5 R and 3R respectively as shown in the figure. When some potential difference is applied between X and Y, the voltmeter readings are V_A, V_B and V_C respectively.
Then :



(1) $V_A \neq V_B \neq V_C$ (2) $V_A = V_B = V_C$
(3) $V_A \neq V_B = V_C$ (4) $V_A = V_B \neq V_C$

95. (2)
Ckt is equivalent to





$\therefore V_A = V_B = V_C$

96. In a double slit experiment, the two slits are 1 mm apart and the screen is placed 1 m away. A monochromatic light of wavelength 500 nm is used. What will be the width of each slit for obtaining ten maxima of double slit within the central maxima of single slit pattern ?
(1) 0.02 mm (2) 0.2 mm (3) 0.1 mm (4) 0.5 mm

96. (2)

In a double slit experiment, the two slits are 1 mm apart.

$d = 1 \text{ mm} = 10^{-3}$ m.

The screen is placed at a distance D = 1 m away. Monochromatic light of wave length

$\lambda = 500 \text{ nm} = 5 \times 10^{-7}$ m is used.

The distance between two successive maxima or two successive minima is

$$\frac{\lambda D}{d} = \frac{5\times10^{-7}}{10^{-3}} = 5\times10^{-4}\,\text{m} = 0.5\,\text{mm}$$

Ten maxima are contained within a distance

$10 \times 0.5 \text{ mm} = 5 \text{ mm}$

For a single slit pattern we have

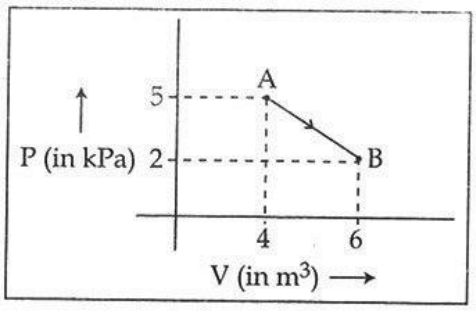
$$\sin\theta = \frac{\lambda}{a}$$

The width of the central maxima is

$$2D\sin\theta = \frac{2D\lambda}{a} = 5 \text{ mm}$$

$$\therefore \quad a = \frac{2D\lambda}{5\times10^{-3}} = \frac{2\times5\times10^{-7}}{5\times10^{-3}} = 2\times10^{-4}\,\text{m} = 0.2\,\text{mm}$$

97. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in the figure,



The change in internal energy of the gas during the transition is :

(1) −12 kJ (2) 20 kJ (3) −20 kJ (4) 20 J

97. (3)

$\Delta U = nC_V \Delta T$

$= n\frac{5R}{2}\Delta T = \frac{5}{2}nR\Delta T$

$= \frac{5}{2}(P_f V_f - P_i V_i) = \frac{5}{2}(2 \times 6 - 5 \times 4) = \frac{5}{2}(-8) = -20$ kJ

98. A rod of weight W is supported by two parallel knife edges A and B and is in equilibrium in a horizontal position. The knives are at a distance d from each other. The centre of mass of the rod is at distance x from A. The normal reaction on A is :

(1) $\frac{W(d-x)}{d}$ (2) $\frac{Wx}{d}$ (3) $\frac{Wd}{x}$ (4) $\frac{W(d-x)}{x}$

98. (1)

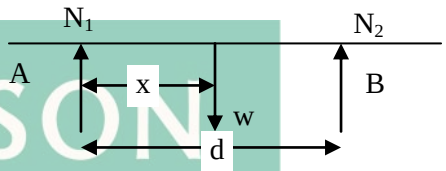
For equilibrium

$N_1 x = N_2 (d - x)$ and $N_1 + N_2 = w$

$\therefore N_1 x = (w - N_1)(d - x)$

$N_1 x + N_1 (d - x) = w(d - x)$

$\therefore N_1 = \frac{w(d-x)}{d}$



99. Kepler's third law states that square of period of revolution (T) of a planet around the sun, is proportional to third power of average distance r between sun and planet

i.e. $T^2 = Kr^3$

here K is constant.

If the masses of sun and planet are M and m respectively then as per Newton's law of gravitation force of attraction between them is

$F = \frac{GMm}{r^2}$, here G is gravitational constant

The relation between G and K is described as :

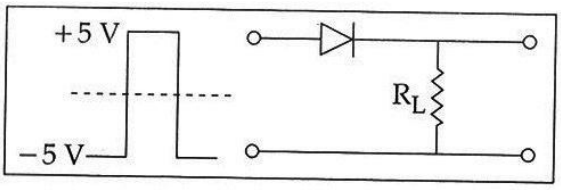
(1) $K = \frac{1}{G}$ (2) $GK = 4\pi^2$ (3) $GMK = 4\pi^2$ (4) $K = G$

99. (3)

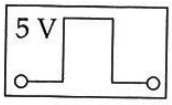
$T = \frac{2\pi r}{v} = 2\pi \frac{r}{\sqrt{\frac{GM}{r}}} = 2\pi \frac{r^{3/2}}{\sqrt{GM}}$

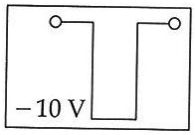
$T^2 = \frac{4\pi^2}{GM} r^3 = Kr^3$ $\therefore k = \frac{4\pi^2}{GM}$ $\therefore GMK = 4\pi^2$

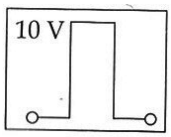
100. If in a p-n junction, a square input signal of 10 V is applied, as shown,

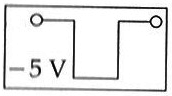


then the output across R_L will be :

(1) 

(2) 

(3) 

(4) 

100. (1)

101. Two particles of masses m_1, m_2 move with initial velocities u_1 and u_2. On collision, one of the particles get excited to higher level, after absorbing energy ε. If final velocities of particles be v_1 and v_2 then we must have :

(1) $\frac{1}{2}m_1^2u_1^2+\frac{1}{2}m_2^2u_2^2+\varepsilon=\frac{1}{2}m_1^2v_1^2+\frac{1}{2}m_2^2v_2^2$

(2) $m_1^2u_1+m_2^2u_2-\varepsilon=m_1^2v_1+m_2^2v_2$

(3) $\frac{1}{2}m_1u_1^2+\frac{1}{2}m_2u_2^2=\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2-\varepsilon$

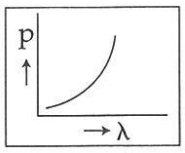
(4) $\frac{1}{2}m_1u_1^2+\frac{1}{2}m_2u_2^2-\varepsilon=\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2$

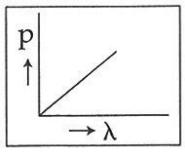
101. (4)

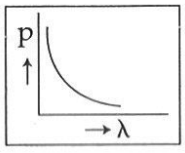
Systems energy will be used for excitation

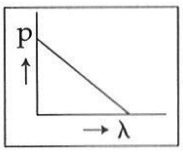
$\therefore \frac{1}{2}m_1n_1^2+\frac{1}{2}m_2n_2^2=\frac{1}{2}m_1v_1^2+\frac{1}{2}m_2v_2^2+\varepsilon$

102. Which of the following figures represent the variation of particle momentum and the associated de-Broglie wavelength?

(1) 

(2) 

(3) 

(4) 

102. (3)

$p=\frac{h}{\lambda} \quad \therefore \; p\propto\frac{1}{\lambda}$

$\therefore$ (3) is the correct graph.

103. The approximate depth of an ocean is 2700 m. The compressibility of water is 45.4×10^{-11} Pa^{-1} and density of water is 10^3 kg/m^3. What fractional compression of water will be obtained at the bottom of the ocean?

(1) 1.4×10^{-2} (2) 0.8×10^{-2} (3) 1.0×10^{-2} (4) 1.2×10^{-2}

103. (4)

$$\text{Compressibility} = \frac{1}{\text{bulk modulus}} = \frac{\Delta V}{V}\frac{1}{p}$$

$$\therefore \quad \frac{\Delta V}{V} = p \times \text{compressibility}$$

$$= h\rho g \cdot \text{compressibility}$$

$$= 2700 \times 10^3 \times 10 \times 45.4 \times 10^{-11}$$

$$= 1.2 \times 10^{-2}$$

104. The two ends of a metal rod are maintained at temperatures 100°C and 110°C. the rate of heat flow in the rod is found to be 4.0 J/s. If the ends are maintained at temperatures 200°C and 210°C, the rate of heat flow will be :

(1) 4.0 J/s (2) 44.0 J/s (3) 16.8 J/s (4) 8.0 J/s

104. (1)

$$\text{Rate of heat flow} = \frac{k \cdot A \cdot \Delta T}{x}$$

Since ΔT is same i.e. 10°C, the rate of flow will be same i.e. 4.0 J/s.

105. A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to $v(x) = \beta x^{-2n}$,

where β and n are constants and x is the position of the particle. The acceleration of the particle as a function of x, is given by :

(1) $-2n\beta^2 e^{-4n+1}$ (2) $-2n\beta^2 x^{-2n-1}$ (3) $-2n\beta^2 x^{-4n-1}$ (4) $-2\beta^2 x^{-2n+1}$

105. (3)

$$\upsilon(x) = \beta x^{-2n}$$

$$a = \frac{d\upsilon}{dt} = \frac{d\upsilon}{dx}\cdot\frac{dx}{dt} = \frac{d\upsilon}{dx}\cdot\upsilon$$

$$\frac{d\upsilon}{dx} = -2n\beta x^{-2n-1}$$

$$\therefore \quad a = -2n\,\beta\, x^{-2n-1}.\,\beta x^{-2n} = -2n\,\beta^2\, x^{-4n-1}$$

106. The refracting angle of a prism is A, and refractive index of the material of the prism is cot (A/2). The angle of minimum deviation is :

(1) 180° + 2A (2) 180° − 3A (3) 180° − 2A (4) 90° − A

106. (3)

$$\mu = \cot\frac{A}{2} = \frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\frac{A}{2}} \qquad \therefore \quad \frac{\cos\left(\frac{A}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

$$\therefore \quad \cos\frac{A}{2} = \sin\left(\frac{A+\delta m}{2}\right) \qquad \therefore \quad \sin\left(90-\frac{A}{2}\right) = \sin\left(\frac{A+\delta m}{2}\right)$$

$$\therefore \quad 90° - \frac{A}{2} = \frac{A+\delta m}{2}$$

$$\therefore \quad 180° - A = A + \delta m$$

$$\therefore \quad \delta m = 180° - 2A$$

107. A particle is executing SHM along a straight line. Its velocities at distances x_1 and x_2 from the mean position are V_1 and V_2, respectively. Its time period is :

(1) $2\pi\sqrt{\frac{V_1^2 - V_2^2}{x_1^2 - x_2^2}}$ (2) $2\pi\sqrt{\frac{x_1^2 + x_2^2}{V_1^2 + V_2^2}}$ (3) $2\pi\sqrt{\frac{x_2^2 - x_1^2}{V_1^2 - V_2^2}}$ (4) $2\pi\sqrt{\frac{V_1^2 + V_2^2}{x_1^2 + x_2^2}}$

107. (3)

$$\upsilon_1 = \omega\sqrt{A^2 - x_1^2} \qquad \therefore \quad \upsilon_1^2 = \omega^2\left(A^2 - x_1^2\right)$$

$$\upsilon_2 = \omega\sqrt{A^2 - x_2^2} \qquad \therefore \quad \upsilon_2^2 = \omega^2\left(A^2 - x_2^2\right)$$

$$\therefore \quad \upsilon_1^2 - \upsilon_2^2 = = \omega^2\left(x_2^2 - x_1^2\right) \therefore \quad \omega^2 = \frac{\upsilon_1^2 - \upsilon_2^2}{x_2^2 - x_1^2}$$

$$\therefore \quad \omega = \sqrt{\frac{\upsilon_1^2 - \upsilon_2^2}{x_2^2 - x_1^2}} \qquad \therefore \quad T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{x_2^2 - x_1^2}{\upsilon_1^2 - \upsilon_2^2}}$$

108. Two similar springs P and Q have spring constants K_P and K_Q, such that $K_P > K_Q$. They are stretched, first by the same amount (case a), then by the same force (case b). The work done by the springs W_P and W_Q are related as, in case (a) and case (b), respectively :

(1) $W_P < W_Q$; $W_Q < W_P$ (2) $W_P = W_Q$; $W_P > W_Q$

(3) $W_P = W_Q$; $W_P = W_Q$ (4) $W_P > W_Q$; $W_Q > W_P$

108. (4)

Case (a) : $w = \frac{1}{2}kx^2$

$w_P = \frac{1}{2}k_P x^2$

$W_Q = \frac{1}{2}k_Q x^2$

$\because \; k_P > k_Q, w_P > w_Q$

Case (b) : $w = \frac{1}{2}Fx$

$F = k_P x_P = k_Q x_Q$

$\therefore \; \frac{x_P}{x_Q} = \frac{k_Q}{k_P}$

$\therefore \; \frac{w_P}{w_Q} = \frac{x_P}{x_Q} = \frac{k_Q}{k_P}$

$\because \; k_Q < k_P \, , w_P < w_Q$

109. Consider 3rd orbit of He^+ (Helium), using non-relativistic approach, the speed of electron in this orbit will be [given K = 9×10^9 constant, Z = 2 and h(Planck's Constant) = 6.6×10^{-34} J s]

(1) 3.0×10^8 m/s (2) 2.92×10^6 m/s

(3) 1.46×10^6 m/s (4) 0.73×10^6 m/s

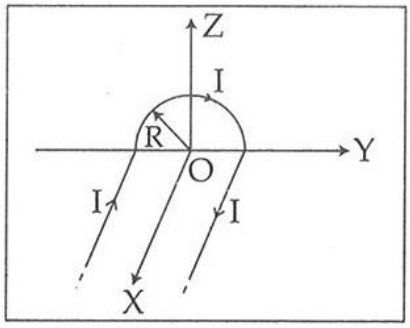
109. (3)

$$v = \frac{1}{4\pi\varepsilon_0}\frac{2\pi z\varepsilon^2}{nh}$$

substituting the values, we get

$v = 1.46 \times 10^6$ m/s.

110. A wire carrying current I has the shape as shown in adjoining figure. Linear parts of the wire are very long and parallel to X-axis while semicircular portion of radius R is lying in Y-Z plane. Magnetic field at point O is :



(1) $\vec{B} = \frac{\mu_0}{4\pi}\frac{1}{R}\left(\pi\hat{i} - 2\hat{k}\right)$ (2) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$

(3) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} - 2\hat{k}\right)$ (4) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$

110. (4)

Due to Semicircular wire

$$\vec{B}_1 = \frac{\mu_0 I}{4R}\left(-\hat{i}\right) = \frac{\mu_0 \pi I}{4\pi R}\left(-\hat{i}\right)$$

due to two straight wires

$$\vec{B}_2 = 2\frac{\mu_0 I}{4\pi R}\left(-\hat{k}\right)$$

Net field, $\vec{B} = \vec{B}_1 + \vec{B}_2 = -\frac{\mu_0 I}{4\pi R}\left(\pi\hat{i} + 2\hat{k}\right)$

111. A particle of mass m is driven by a machine that delivers a constant power k watts. If the particle starts from rest the force on the particle at time t is :

(1) $\frac{1}{2}\sqrt{mk}\, t^{-1/2}$ (2) $\sqrt{\frac{mk}{2}}\, t^{-1/2}$ (3) $\sqrt{mk}\, t^{-1/2}$ (4) $\sqrt{2mk}\, t^{-1/2}$

111. (3)

$K = F\upsilon$

$= F\,at = F\frac{F}{m}t$

$K = \frac{F^2}{m}t$

$F = \sqrt{\frac{mK}{t}} = \sqrt{mK}\, t^{-\frac{1}{2}}$

112. The fundamental frequency of a closed organ pipe of length 20 cm is equal to the second overtone of an organ pipe open at both the ends. The length of organ pipe open at both the ends is :

(1) 140 cm (2) 80 cm (3) 100 cm (4) 120 cm

112. (4)

For closed organ pipe fundamental frequency

$n_1 = \frac{v}{4\ell_1}$

For open organ pipe fundamental frequency

$n_2 = \frac{v}{2\ell_2}$

The second overtone is

$$n_2^1 = 3 \cdot n_2 = \frac{3v}{2\ell_2}$$

$$n_2^1 = n_1$$

$$\frac{3v}{2\ell_2} = \frac{v}{4\ell_1} \qquad \therefore\ \ell_2 = 6\ell_1 = 6 \times 20 = 120 \text{ cm.}$$

113. An electron moving in a circular orbit of radius r makes n rotations per second. The magnetic field produced at the centre has magnitude :

(1) $\frac{\mu_0 ne}{2r}$ (2) $\frac{\mu_0 ne}{2\pi r}$ (3) Zero (4) $\frac{\mu_0 n^2 e}{r}$

113. (1)

At the centre of a circular current

$$B = \frac{\mu_0 i}{2r}$$

have $i = n e$

$$\therefore \qquad B = \frac{\mu_0 n e}{2r}$$

114. Two identical thin plano-convex glass lenses (refractive index 1.5) each having radius of curvature of 20 cm are placed with their convex surfaces in contact at the centre. The intervening space is filled with oil of refractive index 1.7. The focal length of the combination is :

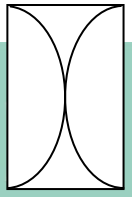
(1) 50 cm (2) −20 cm (3) −25 cm (4) −50 cm

114. (4)

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$$

$$\frac{1}{f_1} = (1.5-1)\left(\frac{1}{\infty} - \frac{1}{-20}\right) = \frac{1}{40}$$

$$\frac{1}{f_3} = (1.5-1)\left(\frac{1}{20} - \frac{1}{\infty}\right) = \frac{1}{40}$$



$$\frac{1}{f_2} = (1.7-1)\left(\frac{1}{-20} - \frac{1}{20}\right); \qquad \frac{1}{f_2} = (1.7-1)\left(\frac{1}{-20} - \frac{1}{20}\right) = -\frac{0.7 \times 2}{20} = -\frac{2.8}{40}$$

$$\frac{1}{f} = \frac{1}{40} - \frac{2.8}{40} + \frac{1}{40} = \frac{1-2.8+1}{40} = -\frac{0.8}{40}$$

$$f = -\frac{40}{0.8} = -50 \text{ cm}$$

115. On observing light from three different stars P, Q and R, it was found that intensity of violet colour is maximum in the spectrum of P, the intensity of green colour is maximum in the spectrum of R and the intensity of red colour is maximum in the spectrum of Q. If T_P, T_Q and T_R are the respective absolute temperatures of P, Q and R, then it can be concluded from the above observations that :

(1) $T_P < T_Q < T_R$ (2) $T_P > T_Q > T_R$

(3) $T_P > T_R > T_Q$ (4) $T_P < T_R < T_Q$

115. (2)

Accordingly to Wien's law

$$\lambda \propto \frac{1}{T} \qquad \text{and} \qquad \lambda_V < \lambda_G < \lambda_R$$

$$\therefore \qquad T_P > T_Q > T_R$$

116. If energy (E), velocity (V) and time (T) are chosen as the fundamental quantities, the dimensional formula of surface tension will be :

(1) $[E^{-2} V^{-1} T^{-3}]$ (2) $[E V^{-2} T^{-1}]$ (3) $[E V^{-1} T^{-2}]$ (4) $[E V^{-2} T^{-2}]$

116. (4)

[Surface Tension] = MT^{-2}

$\therefore$ $MT^{-2} = k E^a V^b T^c$

$= k (ML^2 T^{-2})^a (LT^{-1})^b T^c$

$MT^{-2} = KM^a L^{2a+b} T^{-2a-b+c}$

$\therefore$ $a = 1$

$2a + b = 0$

$-2a - b + c = -2$

On solving $a = 1, b = -2, c = -2$

$\therefore$ Required answer is $EV^{-2} T^{-2}$

117. A Carnot engine, having an efficiency of $\eta = \frac{1}{10}$ as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is :

(1) 1 J (2) 100 J (3) 99 J (4) 90 J

117. (4)

$\eta = \frac{Q_H - Q_L}{Q_H}$

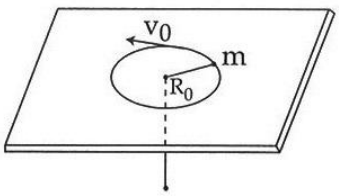
$\frac{1}{10} = \frac{10}{Q_H}$

$Q_H = 100$ J and $Q_H - Q_L = 10$

$\therefore$ $100 - Q_L = 10$

$Q_L = 100 - 10 = 90$ J

118. A mass m moves in a circle on a smooth horizontal plane with velocity v_0 at a radius R_0. The mass is attached to a string which passes through a smooth hole in the plane as shown.



The tension in the string is increased gradually and finally m moves in a circle of radius $\frac{R_0}{2}$. The final value of the kinetic energy is :

(1) $\frac{1}{2}mv_0^2$ (2) mv_0^2 (3) $\frac{1}{4}mv_0^2$ (4) $2mv_0^2$

118. (4)

When a mass moves in a circle of radius R_0 with velocity v_0, its kinetic energy is given by

$KE_1 = \frac{1}{2}mv_0^2$ …… (1)

The centripetal force required for circular motion is

$F_C = \frac{mv_0^2}{R_0}$ …… (2)

The tension in the string is gradually increased and the radius of the circle decreased to $\frac{R_0}{2}$.

When the radius of the circle is R $\left(R_0 > R > \frac{R_0}{2} \right)$ the tension in the string is the same as the centripetal force.

$T = F_C = \frac{mv^2}{R} = \frac{L^2}{mR^3}$ …….. (3)

where L = mRv is the angular momentum which is conserved.

Work done in reducing the radius of the circle from R_0 to $\frac{R_0}{2}$ is

$$W = -\int_{R_0}^{R_0/2} F_C dR = -\int_{R_0}^{R_0/2} \frac{L^2 dR}{mR^3} = -\frac{L^2}{m}\int_{R_0}^{R_0/2} \frac{dR}{R^3} = -\frac{L^2}{m}\left[-\frac{1}{2R^2}\right]_{R_0}^{R_0/2}$$

$$= -\frac{L^2}{2m}\left[\frac{1}{R^2}\right]_{R_0/2}^{R_0} = \frac{L^2}{2m}\left[\frac{1}{R^2}\right]_{R_0}^{R_0/2}$$

$$= \frac{L^2}{2m}\left[\frac{4}{R_0^2} - \frac{1}{R_0^2}\right] = \frac{L^2}{2m}\frac{3}{R_0^2} = \frac{m^2 v_0^2 R_0^2}{2m}\frac{3}{R_0^2} = \frac{3}{2}mv_0^2$$

Total kinetic energy = Initial kinetic energy + Work done

$$= \frac{1}{2}mv_0^2 + \frac{3}{2}mv_0^2 = 2mv_0^2$$

119. For a parallel beam of monochromatic light of wavelength 'λ', diffraction is produced by a single slit whose width 'a' is of the order of the wavelength of the light. If 'D' is the distance of the screen from the slit, the width of the central maxima will be :

(1) $\frac{2Da}{\lambda}$ (2) $\frac{2D\lambda}{a}$ (3) $\frac{D\lambda}{a}$ (4) $\frac{Da}{\lambda}$

119. (2)

For a parallel beam of monochromatic light of wavelength λ, diffraction is produced by a single slit whose width 'a' is of the order of the wavelength we have

$\sin\theta = \frac{\lambda}{a}$ …… (1)

where θ is the angle subtended by the first minima and the central maxima at the slit.

$\therefore$ $2\sin\theta = \frac{2\lambda}{a}$ …… (2)

If x is the width of the central maxima, we have

$\frac{x}{D} = \frac{2\lambda}{a}$

$\therefore$ $x = \frac{2D\lambda}{a}$ …… (3)

where D is the distance of the screen from the slit.

120. A wind with speed 40 m/s blows parallel to the roof of a house. The area of the roof is 250 m^2. Assuming that the pressure inside the house is atmospheric pressure, the force exerted by the wind on the roof and the direction of the force will be :

(P_{air} = 1.2 kg/m^3)

(1) 2.4×10^5 N, downwards (2) 4.8×10^5 N, downwards

(3) 4.8×10^5 N, upwards (4) 2.4×10^5 N, upwards

120. (4)

From Bernoulli's equation

$P = P_0 + \frac{1}{2}\rho v^2$

Force will act due to pressure difference

$\therefore \quad P - P_0 = \frac{1}{2}\rho v^2$

$= \frac{1}{2} \times 1.2 \times (40)^2$

$= 0.0096 \times 10^5$

$\therefore$ Force acting upwards

$F = 0.0096 \times 10^5 \times 250 = 2.4 \times 10^5$ N upwards

121. The ratio of the specific heats $\frac{C_p}{C_v} = \gamma$ in terms of degrees of freedom (n) is given by :

(1) $\left(1+\frac{n}{2}\right)$ (2) $\left(1+\frac{1}{n}\right)$ (3) $\left(1+\frac{n}{3}\right)$ (4) $\left(1+\frac{2}{n}\right)$

121. (4)

For a monoatomic gas

$$C_V = \frac{3}{2}R \quad C_P = \frac{5}{2}R \quad \gamma = \frac{C_P}{C_V} = \frac{5}{3}$$

For a diatomic gas

$$C_V = \frac{5}{2}R \quad C_P = \frac{7}{2}R \quad \gamma = \frac{C_P}{C_V} = \frac{7}{5}$$

For a triatomic gas

$$C_V = 3R \quad C_P = 4R \quad \gamma = \frac{C_P}{C_V} = \frac{4}{3}$$

This fits into the pattern $\left(1+\frac{2}{n}\right)$, where n is the number of the degrees of freedom.

122. If radius of the $^{27}_{13}Al$ nucleus is taken to be R_{Al}, then the radius of $^{125}_{53}Te$ nucleus is nearly :

(1) $\left(\frac{13}{53}\right)^{1/3} R_{Al}$ (2) $\left(\frac{53}{13}\right)^{1/3} R_{Al}$ (3) $\frac{5}{3}R_{Al}$ (4) $\frac{3}{5}R_{Al}$

122. (3)

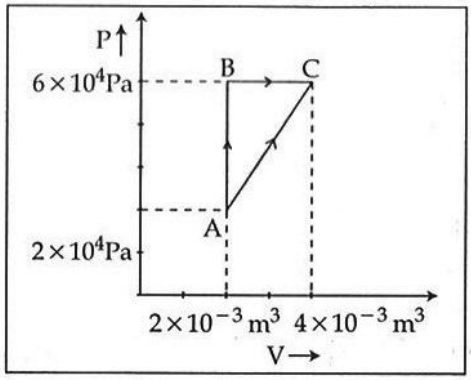
Radius of the nucleus goes as

$R \propto A^{1/3}$, where A is the atomic mass.

If R_{Te} is the radius of the nucleus of telurium atom and R_{Al} is the radius of the nucleus of aluminium atom we have

$$\frac{R_{Te}}{R_{Al}} = \frac{(125)^{1/3}}{(27)^{1/3}} = \frac{5}{3} \qquad \therefore \quad R_{Te} = \frac{5}{3}R_{Al}$$

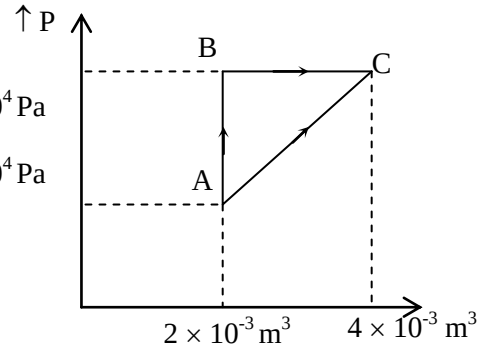
123. Figure below shows two paths that may be taken by a gas to go from a state A to a state C.



In process AB, 400 J of heat is added to the system and in process BC, 100 J of heat is added to the system. The heat absorbed by the system in the process AC will be :

(1) 300 J (2) 380 J (3) 500 J (4) 460 J

123. (4)



See figure alongside

Process AB is isochoric so no work is done.

Heat added to be system is Q = 400 J.

$$Q = \Delta U + \Delta W$$

where ΔU is the change in internal energy

ΔW is the work done.

Since $\Delta W = 0$

$\Delta U = Q = 400$ J

Change in internal energy is 400 J.

Process BC is isobaric and the work done is given by

$$\Delta W = P(V_2 - V_1) = 6 \times 10^4(4 \times 10^{-3} - 2 \times 10^{-3})$$
$$= 6 \times 10^4 \times 2 \times 10^{-3} = 120 \text{ J}$$

Heat added to be system is Q = 100 J.

Since $Q = \Delta U + \Delta W$

$\therefore$ $\Delta U = Q - \Delta W = (100 - 120)$ J $= -20$ J

Change in internal energy is $-$ 20 J.

Total increase in internal energy is going from state A to state C is 400 – 20 = 380 J

Work done in process AC is the area under the curve.

Area of the trapezium = $\frac{1}{2}(P_2 + P_1) \times (V_2 - V_1)$

$$= \frac{1}{2}\left(6 \times 10^4 + 2 \times 10^4\right) \times \left(4 \times 10^{-3} - 2 \times 10^{-3}\right)$$

$$= \frac{1}{2} \times 8 \times 10^4 \times 2 \times 0^{-3} = 80 \text{ J}.$$

Since $Q = \Delta U + \Delta W$

and ΔU the change in internal energy in process AC, we have

$\Delta U = 380$ J and $\Delta W = 80$ J

$\therefore$ $Q = \Delta U + \Delta U = 380 + 80 = 460$ J

124. A block of mass 10 kg, moving in x direction with a constant speed of 10 ms^{-1}, is subjected to a retarding force F = 0.1 x J/m during its travel from x = 20 m to 30 m. Its final KE will be :

(1) 250 J (2) 475 J (3) 450 J (4) 275 J

124. (2)

The block of mass M = 10 kg is moving in the x – direction with a speed v = 10 m/s.

Its initial kinetic energy is

$KE_i = \frac{1}{2}mv^2 = \frac{1}{2} \times 10 \times (10)^2 = 500$ J.

It is subjected to a retarding force F = 0.1 x J/m during its travel from x = 20 m to 30 m.

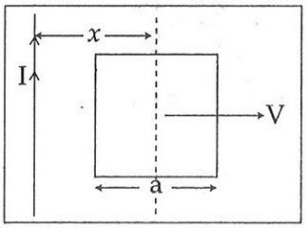
Work done is given by

$$W = -\int_{x=20}^{x=30} \vec{F}.\vec{dx} = -\int_{x=20}^{x=30} (0.1\,x)dx = -0.1\left[\frac{x^2}{2}\right]_{x=20}^{x=30} = -0.1\left[\frac{900}{2} - \frac{400}{2}\right]$$

$$= -0.1 \times \frac{500}{2} = -0.1 \times 250 = -25 \text{ J}$$

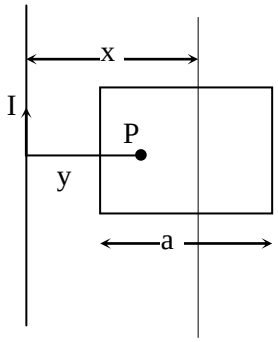
Final kinetic energy is, $KE_f = KE_i + W = 500 - 25 = 475$ J

125. A conducting square frame of side 'a' and a long straight wire carrying current I are located in the same plane as shown in the figure. The frame moves to the right with a constant velocity 'V'. The emf induced in the frame will be proportional to :



(1) $\frac{1}{(2x-a)(2x+a)}$ (2) $\frac{1}{x^2}$ (3) $\frac{1}{(2x-a)^2}$ (4) $\frac{1}{(2x+a)^2}$

125. (1)



See figure alongside.

Let x be the distance of the centre of the frame from the long straight wire carrying current I.

Consider the point P at a distance y from the long straight wire carrying current I.

Strength of magnetic induction at point P is given by

$$B=\frac{\mu_0}{4\pi}\frac{2I}{y}$$

Integrating over y from y = (x – a/2) to y = (x + a/2)

We get

$$\int_{x-\frac{a}{2}}^{x+\frac{a}{2}} B\,dy=\int_{x-\frac{a}{2}}^{x+\frac{a}{2}}\frac{\mu_0}{4\pi}\frac{2I}{y}dy=\frac{\mu_0}{2\pi}I\int_{x-\frac{a}{2}}^{x+\frac{a}{2}}y\,dy=\frac{\mu_0 I}{2\pi}\left[\ln y\right]_{(x-a/2)}^{(x+a/2)}$$

$$=\frac{\mu_0 I}{2\pi}\ln\left[\frac{x+a/2}{x-a/2}\right]$$

Total flux contained in the square frame is

$$\phi=\frac{\mu_0 Ia}{2\pi}\ln\left[\frac{x+a/2}{x-a/2}\right]$$

Rate of change of flux is

$$\frac{d\phi}{dt}=\frac{\mu_0 Ia}{2\pi}\frac{d}{dt}\left[\ln\left[\frac{x+a/2}{x-a/2}\right]\right]=\frac{\mu_0 Ia}{2\pi}\left[\frac{x-a/2}{x+a/2}\right]\frac{d}{dt}\left[\frac{x+a/2}{x-a/2}\right]$$

$$=\frac{\mu_0 Ia}{2\pi}\left[\frac{2x-a}{2x+a}\right]\frac{(x-a/2)\frac{d}{dt}(x+a/2)-(x+a/2)\frac{d}{dt}(x-a/2)}{(x-a/2)^2}$$

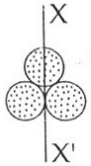
$$=\frac{\mu_0 Ia}{2\pi}\frac{(2x-a)}{(2x+a)}\times\frac{4}{(2x-a)^2}\left[(x-a/2)v-(x+a/2)v\right]$$

$$=\frac{2\mu_0 Ia}{\pi}\frac{1}{(2x-a)(2x+a)}v\left[-a\right]=-\frac{2\mu_0 Ia^2 v}{\pi}\frac{1}{(2x-a)(2x+a)}$$

$$\varepsilon=-\frac{d\phi}{dt}=\frac{2\mu_0 Ia^2 v}{\pi}\frac{1}{(2x-a)(2x+a)}$$

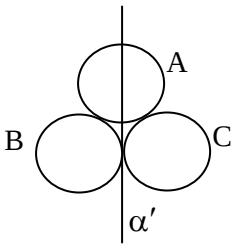
$$\varepsilon\propto\frac{1}{(2x-a)(2x+a)}$$

126. Three identical spherical shells, each of mass m and radius r are placed as shown in figure. Consider an axis XX′ which is touching to two shells and passing through diameter of third shell.
Moment of inertia of the system consisting of these three spherical shells about XX′ axis is :



(1) $4\ mr^2$ (2) $\frac{11}{5}mr^2$ (3) $3\ mr^2$ (4) $\frac{16}{5}mr^2$

126. (1)
See figure alongside
A is a spherical shell whose mass is m and radius is r.



Its moment of inertia about the XX' axis is $I_A = \frac{2}{3}mr^2$
B is a spherical shell whose mass is m and radius is r.
Its moment of inertia about its own axis is $I_B = \frac{2}{3}mr^2$
Its moment of inertia about XX' axis is

$$I_{B'} = I_B + mr^2 = \frac{5}{3}mr^2$$

Similarly the moment of inertia of the spherical shell C about the XX' axis is

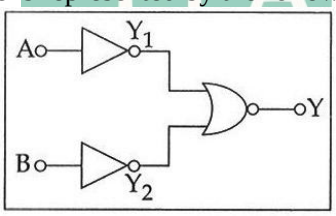
$$I_{C'} = \frac{5}{3}mr^2$$

Total moment of inertia is

$$I = I_A + I_{B'} + I_{C'}$$

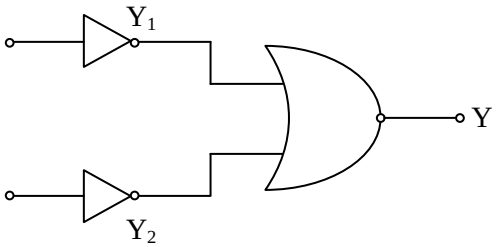
$$= \frac{2}{3}mr^2 + \frac{5}{3}mr^2 + \frac{5}{3}mr^2 = 4mr^2$$

127. Which logic gate is represented by the following combination of logic gates ?



(1) NOR (2) OR (3) NAND (4) AND

127. (4)
We have $\overline{(\overline{A} + \overline{B})}$



Truth table

A	B	Y_1	Y_2	Y
0	0	1	1	0
1	0	0	1	0
1	0	0	1	0
0	1	1	0	0
1	1	0	0	1

This correspond to AND gate

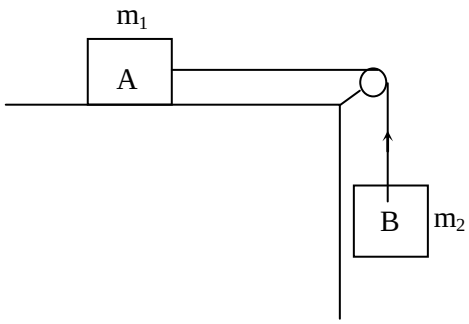
128. A block A of mass m_1 rests on a horizontal table. A lights string connected to it passes over a frictionless pulley at the edge of table and from its other end another block B of mass m_2 is suspended. The coefficient of kinetic friction between the block and the table is μ_k. When the block A is sliding on the table, the tension in the string is :

(1) $\frac{m_1 m_2 (1-\mu_k) g}{(m_1+m_2)}$ (2) $\frac{(m_2+\mu_k m_1) g}{(m_1+m_2)}$

(3) $\frac{(m_2-\mu_k m_1) g}{(m_1+m_2)}$ (4) $\frac{m_1 m_2 (1+\mu_k) g}{(m_1+m_2)}$

128. (4)

See figure alongside



Let T be the tension in the string.

Let a be the acceleration of the combination.

We have,

$m_2 g - T = m_2 a$ ....(1)

for block B.

And

$T - \mu_k m_1 g = m_1 a$ ...(2)

for block A.

Adding equation (1) and (2) we get,

$(m_2 - \mu_k m_1) g = (m_1 + m_2) a$

$\therefore \quad a = \frac{(m_2-\mu_k m_1) g}{(m_1+m_2)}$ ....(3)

From equation (2) and (3) we get,

$T = \mu_k m_1 g + m_1 a$

$= \mu_k m_1 g + m_1 g \frac{(m_2-\mu_k m_1)}{(m_1+m_2)} = m_1 g \left[\mu_k + \frac{(m_2-\mu_k m_1)}{(m_1+m_2)}\right]$

$= m_1 g \left[\frac{\mu_k m_1 + \mu_k m_2 + m_2 - \mu_k m_1}{(m_1+m_2)}\right]$

$= \frac{m_1 m_2 (1+\mu_k) g}{(m_1+m_2)}$

129. A certain metallic surface is illuminated with monochromatic light of wavelength, λ. The stopping potential for photo-electric current for this light is $3V_0$. If the same surface is illuminated with light of wavelength 2λ, the stopping potential is V_0. The threshold wavelength for this surface for photo-electric effect is :

(1) $\frac{\lambda}{6}$ (2) 6λ (3) 4λ (4) $\frac{\lambda}{4}$

129. (3)

We have,

$\frac{hc}{\lambda} = W + e(3V_0)$ ....(1)

where W is the work function and $(3V_0)$ is the stopping potential when monochromatic light of wavelength λ is used.

Also,

$\frac{hc}{2\lambda} = W + eV_0$ ....(2)

where V_0 is the stopping potential when monochromatic light of wavelength 2λ is used.

Subtracting equation (2) from equation (1)

We get,

$$\frac{hc}{2\lambda} = 2e\,V_0$$

$$\therefore \quad V_0 = \frac{hc}{4e\lambda} \qquad \ldots.(3)$$

Substituting in equation (2) we get,

$$\frac{hc}{2\lambda} = W + e\,V_0 = W + \frac{hc}{4\lambda}$$

$$\therefore \quad W = \frac{hc}{4\lambda}$$

The threshold wavelength is therefore 4λ.

130. When two displacements represented by $y_1 = a\sin(\omega t)$ and $y_2 = b\cos(\omega t)$ are superimposed the motion is :

(1) simple harmonic with amplitude $\frac{(a+b)}{2}$

(2) not a simple harmonic

(3) simple harmonic with amplitude $\frac{a}{b}$

(4) simple harmonic with amplitude $\sqrt{a^2+b^2}$

130. (4)

$y_1 = a\sin(\omega t)$ $\qquad$ $y_2 = b\cos(\omega t)$

Let $a = c\cos(\phi)$ and $b = c\sin(\phi)$

We have,

$$y_1 + y_2 = a\sin(\omega) + b\cos(\omega t)$$
$$= c\cos\phi\sin(\omega t) + c\sin\phi\cos(\omega t)$$
$$= c[\sin(\omega t + \phi)]$$

where $c^2 = a^2 + b^2$ [since $a^2 + b^2 = c^2\cos^2(\phi) + c^2\sin^2(\phi) = c^2$]

$$\therefore \quad c = \sqrt{a^2+b^2}$$

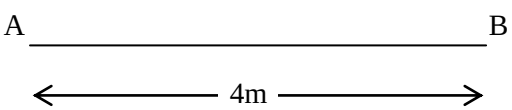
The superimposed motion is simple harmonic with amplitude $\sqrt{a^2+b^2}$.

131. A potentiometer wire has length 4 m and resistance 8 Ω. The resistance that must be connected in series with the wire and an accumulator of e.m.f. 2V, so as to get a potential gradient 1 mV per cm on the wire is :

(1) 48 Ω (2) 32 Ω (3) 40 Ω (4) 44 Ω

131. (2)

Figure alongside shows a potentiometer wire of length L = 4m and resistance $R_{AB} = 8\Omega$.



Resistance connected in series is R.

When an accumulator of emf $\varepsilon = 2V$ is used, we have current I given by,

$$I = \frac{\varepsilon}{R + R_{AB}} = \frac{2}{8+R}$$

The resistance per unit length of the potentiometer wire is given by,

$$\frac{R_{AB}}{L} = \frac{8}{4} = 2\,\Omega/m$$

The potential gradient is given by

$$\frac{IR_{AB}}{L} = \frac{2}{8+R} \times \frac{R_{AB}}{L} = \frac{2\times 2}{8+R}$$

For a potential gradient $1\,\text{mV}$ per $\text{cm} = \dfrac{1\times10^{-3}}{10^{-2}} = 0.1\,\text{V/m}$

We have $\dfrac{4}{8+R} = 0.1$

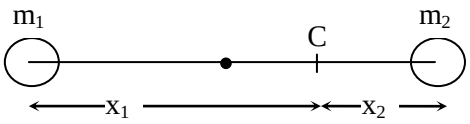
$\therefore$ 8 + R = 40 $\quad\therefore$ R = 32 Ω

132. Two spherical bodies of mass M and 5 M and radii R and 2 R are released in free space with initial separation between their centres equal to 12 R. If they attract each other due to gravitational force only, then the distance covered by the smaller body before collision is :

(1) 1.5 R (2) 2.5 R (3) 4.5 R (4) 7.5 R

132. (4)

Let $m_1 = M$ and $m_2 = 5M$



Let centre of mass C at a distance x_1 from m_1 and x_2 from m_2.

$$m_1x_1 = m_2x_2$$

$$Mx_1 = 5Mx_2$$

$\therefore$ $x_1 = 5x_2$ and $x_1 + x_2 = 12R$

$\therefore$ $5x_2 + x_2 = 12R$

$\therefore$ $6x_2 = 12R$

$$x_2 = 2R$$

$\therefore$ $x_1 = 10R$

Since the masses are moving under mutual attraction the position of centre of mass remains constant.

When the masses are in contact, let x_1' and x_2' be the distance of their centres from the centre of mass.

$\therefore$ $m_1x_1' = m_2x_2'$

$\therefore$ $Mx_1' = 5Mx_2'$

$\therefore$ $x_1' = 5x_2'$

Also $x_1' + x_2' = 3R$

$$5x_2' + x_2' = 3R$$

$$6x_2' = 3R$$

$\therefore$ $x_2' = 0.5R$ and $x_1' = 2.5R$

Hence the distance travelled by the smaller mass is

$$x_1 - x_1' = 10R - 2.5R = 7.5R$$

133. A resistance 'R' draws power 'P' when connected to an AC source. If an inductance is now placed in series with the resistance, such that the impedance of the circuit becomes 'Z', the power drawn will be :

(1) P (2) $P\left(\dfrac{R}{Z}\right)^2$ (3) $P\sqrt{\dfrac{R}{Z}}$ (4) $P\left(\dfrac{R}{Z}\right)$

133. (2)

A resistance R draws power P when connected to an AC source.

The magnitude of voltage of the AC source is

$V^2 = RP$

$\therefore$ $V = \sqrt{PR}$

An inductor of inductance L and reactance ωL is now placed in series with the resistance.

The impedance Z is given by

$$Z = \sqrt{R^2+\omega^2L^2}$$

$$\tan\phi = \frac{\omega L}{R} \qquad \tan^2\phi = \frac{\omega^2L^2}{R^2}$$

$$1+\tan^2\phi = \frac{1+\omega^2L^2}{R^2} = \frac{R^2+\omega^2L^2}{R^2} = \sec^2\phi$$

$$\cos^2\phi = \frac{R^2}{R^2+\omega^2L^2} \qquad \cos\phi = \frac{R}{(R^2+\omega^2L^2)^{1/2}} = \frac{R}{Z}$$

Power drawn is $VI'\cos\phi = V\left(\frac{V}{Z}\right)\left(\frac{R}{Z}\right)$

$$= \frac{V^2R}{Z^2} = \frac{V^2}{R}\left(\frac{R^2}{Z^2}\right) = P\left(\frac{R}{Z}\right)^2$$

134. Across a metallic conductor of non-uniform cross section a constant potential difference is applied. The quantity which remains constant along the conductor is :

(1) electric filed (2) current density

(3) current (4) drift velocity

134. (3)

135. A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is **incorrect** ?

(1) The charge on the capacitor is not conserved.

(2) The potential difference between the plates decreases K times.

(3) The energy stored in the capacitor decreases K times.

(4) the change in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{K}-1\right)$.

135. (1)

A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it.

The charge on the capacitor is given by

$$Q = CV$$

The energy stored in the capacitor is

$$E = \frac{1}{2}CV^2$$

When a dielectric slab of dielectric constant K is inserted in it, the charge Q is conserved. The capacitance becomes K times the original capacitance. ($C' = KC$)

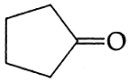
The voltage becomes $\frac{1}{K}$ time the original voltage.

$$V' = \frac{V}{K}$$

The change in energy stored is

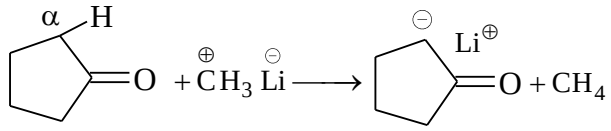
$$\frac{Q^2}{2C'}-\frac{Q^2}{2C} = \frac{Q^2}{2KC}-\frac{Q^2}{2C} = \frac{Q^2}{2C}\left[\frac{1}{K}-1\right]$$

$$= \frac{1}{2}CV^2\left[\frac{1}{K}-1\right]$$

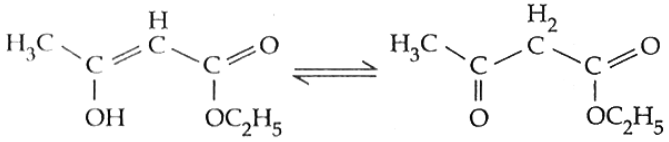
136. Treatment of cyclopentanone  with methyl lithium gives which of the following species ?

(1) Cyclopentanonyl biradical
(2) Cyclopentanonyl anion
(3) Cyclopentanonyl cation
(4) Cyclopentanonyl radical

136. (2)

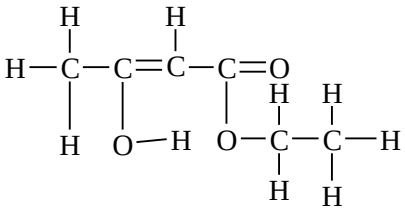


137. The enolic form of ethyl acetoacetate as below has :



(1) 9 sigma bonds and 1 pi - bond
(2) 18 sigma bonds and 2 pi - bonds
(3) 16 sigma bonds and 1 pi-bond
(4) 9 sigma bonds and 2 pi - bonds

137. (2)



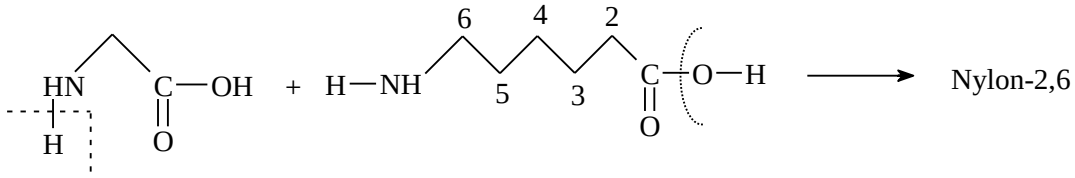
18 sigma bonds and 2 pi-bonds

138. Biodegradable polymer which can be produced from glycine and aminocaproic acid is :

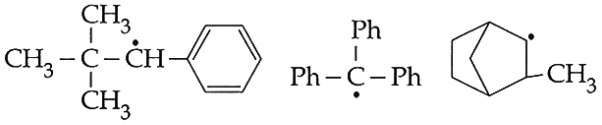
(1) Nylon 6, 6
(2) Nylon 2 – nylon 6
(3) PHBV
(4) Buna – N

138. (2)

Nylon-2-nylon-6 or Nylon-2,6 is an alternating polyamide co-polymer of glycine and amino caproic acid.



139. Consider the following compounds



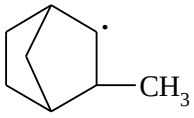
(I) (II) (III)

Hyperconjugation occurs in :

(1) I and III
(2) I only
(3) II only
(4) III only

139. (4)

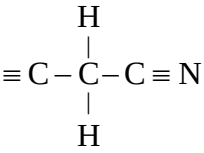
Hyperconjugation occurs if sp^2 hybrid carbon atom attached to sp^3 hybrid carbon atom having α–H i.e.,

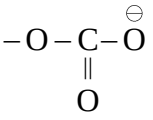


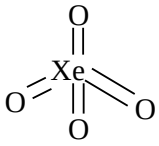
140. Which of the following species contain equal number of σ - and π - bonds ?

(1) $CH_2(CN)_2$ (2) HCO_3^- (3) XeO_4 (4) $(CN)_2$

140. (3)

1.  $6\sigma + 4\pi$

2.  $4\sigma + 1\pi$

3.  $4\sigma + 4\pi$

4. $N \equiv C - C \equiv N$ $3\sigma + 4\pi$

141. The **correct** bond order in the following species is :

(1) $O_2^- < O_2^+ < O_2^{2+}$ (2) $O_2^{2+} < O_2^+ < O_2^-$

(3) $O_2^{2+} < O_2^- < O_2^+$ (4) $O_2^+ < O_2^- < O_2^{2+}$

141. (1)

Bond order of $O_2^- = 1.5$

Bond order of $O_2^+ = 2.5$

Bond order of $O_2^{+2} = 3$

$\therefore \quad O_2^- < O_2^+ < O_2^{2+}$

142. The function of "Sodium pump" is a biological process operating in each and every cell of all animals. Which of the following biologically important ions is also a constituent of this pump ?

(1) Fe^{2+} (2) Ca^{2+} (3) Mg^{2+} (4) K^+

142. (4)

Since K^+ ions are the most abundant cations within the cell fluids, they activate many enzymes which are responsible for oxidation of glucose to produce ATP (adenosine triphosphate).

There is a very large variation in the concentration of Na^+ and K^+ ions found on the opposite sides of cell membrane. These ionic gradients called the sodium-potassium pump operate across the cell membranes which consume more than one-third of the ATP used by a resting animal and about 15 kg per hour in a resting human being.

143. Which of these statements about $[Co(CN)_6]^{3-}$ is **true** ?

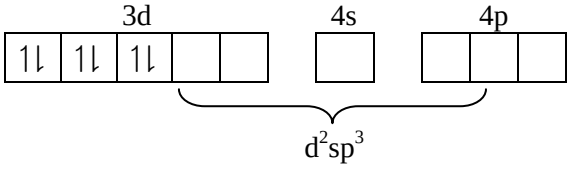
(1) $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a high-spin configuration.

(2) $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a low-spin configuration

(3) $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a low-spin configuration.

(4) $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a high-spin configuration.

143. (2)



$[Co(CN)_6]^{3-}$ has no unpaired electrons and will have low spin configuration.

144. The activation energy of a reaction can be determined from the slope of which of the following graphs ?

(1) $\frac{T}{\ln K}$ vs. $\frac{1}{T}$ (2) ln K vs. T (3) $\frac{\ln K}{T}$ vs. T (4) ln K vs. $\frac{1}{T}$

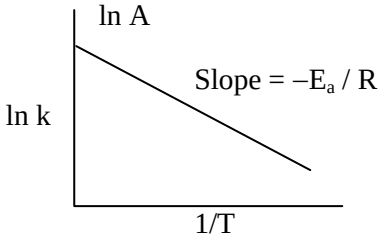
144. (4)

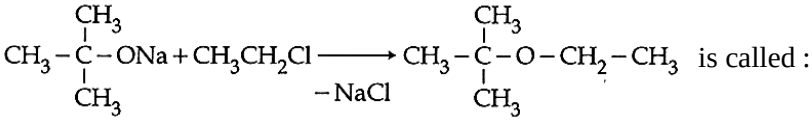
By Arrhenius equation

$k = A \cdot e^{-Ea/RT}$

$\ln k = \ln A - \frac{E_a}{RT}$

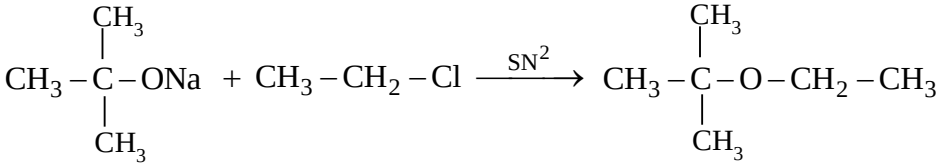
Slope $= -\frac{E_a}{R}$



145. The reaction  is called :

(1) Gatterman – Koch reaction (2) Williamson Synthesis
(3) Williamson continuous etherification process (4) Etard reaction

145. (2)



The reaction is called Williamson synthesis.

146. Which one is **not** equal to zero for an ideal solution ?

(1) $\Delta P = P_{observed} - P_{Raoult}$ (2) ΔH_{mix}
(3) ΔS_{mix} (4) ΔV_{mix}

146. (3)

For ideal solution, $\Delta S_{mix} = 0$.

147. "Metals are usually not found as nitrates in their ores".

Out of the following two (a and b) reasons which is / are **true** for the above observation ?

(a) Metal nitrates are highly unstable
(b) Metal nitrates are highly soluble in water.

(1) a is true but b is false (2) a and b are true
(3) a and b are false (4) a is false but b is true

147. (4)

Metal nitrates are usually not found as nitrates in their ores because they are highly soluble in water.

148. An organic compound 'X' having molecular formula $C_5H_{10}O$ yields phenyl hydrazone and gives negative response to the Iodoform test and Tollen's test. It produces n-pentane on reduction. 'X' could be :

(1) n-amyl alcohol (2) pentanal (3) 2-pentanone (4) 3-pentanone

148. (4)

Pentanal gives negative response to the Iodoform test and Tollen's test.

149. Cobalt(III) chloride forms several octahedral complexes with ammonia. Which of the following will not give test for chloride ions with silver nitrate at 25°C ?

(1) $CoCl_3.6NH_3$ (2) $CoCl_3.3NH_3$ (3) $CoCl_3.4NH_3$ (4) $CoCl_3.5NH_3$

149. (2)

$[CoCl_3(NH_3)_3]$ doesn't ionize so doesn't give test for chloride ions.

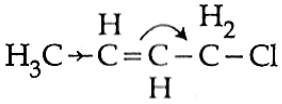
150. A mixture of gases contains H_2 and O_2 gases in the ratio of 1 : 4 (w/w). What is the molar ratio of the two gases in the mixture ?

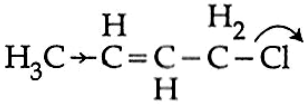
(1) 2 : 1 (2) 1 : 4 (3) 4 : 1 (4) 16 : 1

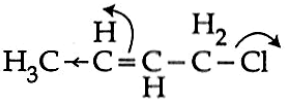
150. (3)

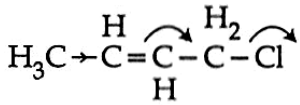
$$\frac{w_{H_2}}{w_{O_2}} = \frac{1}{4} \; ; \qquad \frac{n_{H_2}}{n_{O_2}} = \frac{w_{H_2}}{M_{H_2}} \times \frac{M_{O_2}}{w_{O_2}} = \frac{1}{4} \times \frac{32}{2} = 4$$

151. Which of the following is the most **correct** electron displacement for a nucleophilic reaction to take place ?

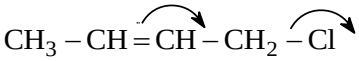
(1) 

(2) 

(3) 

(4) 

151. (4)

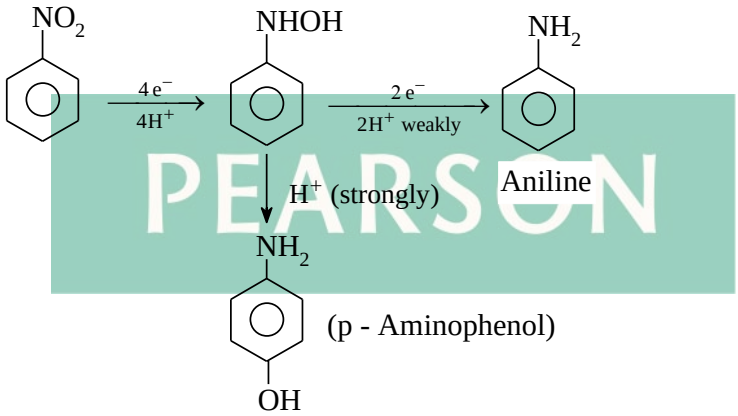


152. The electrolytic reduction of nitrobenzene in strongly acidic medium produces :

(1) Aniline (2) p–Aminophenol (3) Azoxybenzene (4) Azobenzene

152. (2)

Electrolytic reduction of nitrobenzene in weakly acidic medium gives aniline but in strongly acidic medium, it gives para-amino phenol obviously through the acid catalysed rearrangement of initially formed phenyl hydroxyl amine.



153. Nitrogen dioxide and sulphur dioxide have some properties in common. Which property is shown by one of these compounds, but **not** by the other ?

(1) is used as a food–preservative (2) forms 'acid–rain'

(3) is a reducing agent (4) is soluble in water

153. (1)

$NaHSO_3$ is used as food preservative as it produces SO_2 on decomposition which checks the oxidation of food.

154. Which of the following statements is **correct** for a reversible process in a state of equilibrium ?

(1) $\Delta G^\circ = 2.30\ RT \log K$ (2) $\Delta G = -2.30\ RT \log K$

(3) $\Delta G = 2.30\ RT \log K$ (4) $\Delta G^\circ = -2.30\ RT \log K$

154. (4)

$\Delta G = \Delta G^\circ + 2.303\ RT \log K$

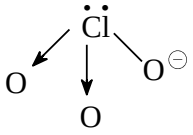
$0 = \Delta G^\circ + 2.303\ RT \log K$

$\Delta G^\circ = -2.303\ RT \log K$

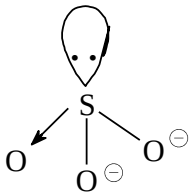
155. Which of the following pairs of ions are isoelectronic and isostructural ?

(1) ClO_3^-, SO_3^{2-} (2) CO_3^{2-}, SO_3^{2-} (3) ClO_3^-, CO_3^{2-} (4) SO_3^{2-}, NO_3^-

155. (1)



$3bp + 1\ell p$



$3bp + 1\ell p$

$\therefore$ ClO_3^- and SO_3^{2-} are isoelectronic and are pyramidal.

156. The angular momentum of electron in 'd' orbital is equal to :

(1) $0\,\hbar$ (2) $\sqrt{6}\,\hbar$ (3) $\sqrt{2}\,\hbar$ (4) $2\sqrt{3}\,\hbar$

156. (2)

Angular momentum of electron in 'd' orbital = $\sqrt{\ell(\ell+1)}\,\hbar$

= $\sqrt{2(2+1)}\,\hbar = \sqrt{6}\,\hbar$

157. Which of the following options represents the **correct** bond order ?

(1) $O_2^- < O_2 > O_2^+$ (2) $O_2^- > O_2 > O_2^+$ (3) $O_2^- < O_2 < O_2^+$ (4) $O_2^- > O_2 < O_2^+$

157. (3)

Bond order of $O_2^- = 1.5$, Bond order of $O_2 = 2.0$, Bond order of $O_2^+ = 2.5$

Bond order : $O_2^+ > O_2 > O_2^-$

158. Magnetic moment 2.84 B.M. is given by : (At. Nos., Ni = 28, Ti = 22, Cr = 24, Co = 27)

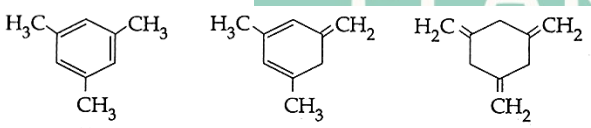
(1) Co^{2+} (2) Ni^{2+} (3) Ti^{3+} (4) Cr^{2+}

158. (2)

Magnetic moment = $\sqrt{n(n+2)}$ B.M. = 2.84 i.e., n = 2

Ni^{+2} i.e., $3d^8$ contains two unpaired electrons.

159. Given



(I) (II) (III)

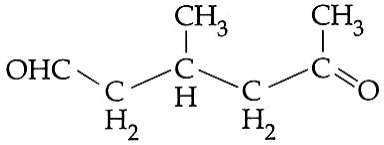
The enthalpy of hydrogenation of these compounds will be in the order as :

(1) II > I > III (2) I > II > III (3) III > II > I (4) II > III > I

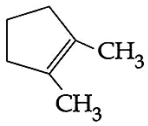
159. (3)

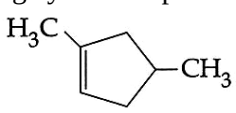
Enthalpy of hydrogenation $\propto \dfrac{1}{\text{Stability of Compound}}$

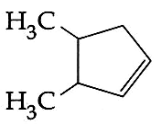
160. A single compound of the structure

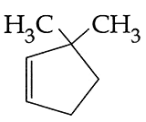


is obtainable from ozonolysis of which of the following cyclic compounds ?

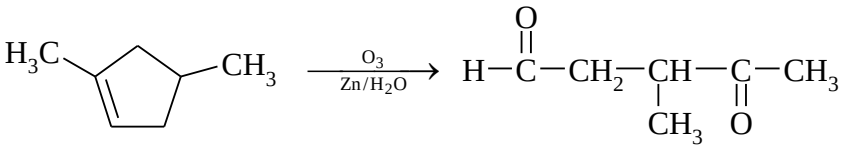
(1) 

(2) 

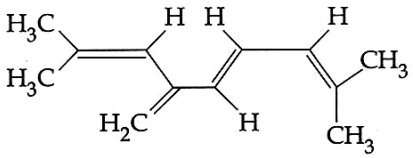
(3) 

(4) 

160. (2)



161. The total number of π–bond electrons in the following structure is :



(1) 16 (2) 4 (3) 8 (4) 12

161. (3)

4π bonds ≡ 8π electrons

162. The K_{sp} of Ag_2CrO_4, AgCl, AgBr and AgI are respectively, 1.1×10^{-12}, 1.8×10^{-10}, 5.0×10^{-13}, 8.3×10^{-17}. Which one of the following salts will precipitate last if $AgNO_3$ solution is added to the solution containing equal moles of NaCl, NaBr, NaI and Na_2CrO_4 ?

(1) Ag_2CrO_4 (2) AgI (3) AgCl (4) AgBr

162. (1)

Let conc. of NaCl, NaBr, NaI and Na_2CrO_4 is 1M.

$K_{sp}\,(Ag_2CrO_4) = [Ag^+]^2\,[CrO_4^{2-}]$

$$[Ag^+]_{Ag_2CrO_4} = \sqrt{\frac{K_{sp}\,(Ag_2CrO_4)}{[CrO_4^{2-}]}} = \sqrt{1.1\times10^{-12}} = \sqrt{1.1}\times10^{-6}$$

$$[Ag^+]_{AgI} = \frac{K_{sp}\,(AgI)}{[I^-]} = \frac{8.3\times10^{-13}}{1}$$

$$[Ag^+]_{AgCl} = \frac{K_{sp}\,(AgCl)}{[Cl^-]} = \frac{1.8\times10^{-10}}{1}$$

$$[Ag^+]_{AgBr} = \frac{K_{sp}\,(AgBr)}{[Br^-]} = 5.0\times10^{-13}$$

$\because$ Solubility of Ag_2CrO_4 is highest it will precipitate last.

163. When initial concentration of a reactant is doubled in a reaction, its half–life period is not affected. The order of the reaction is :

(1) More than zero but less than first (2) Zero
(3) First (4) Second

163. (3)

$t_{1/2} \propto [A]_0^{1-n}$

For first order reaction, half-life period is not depends upon initial concentration.

164. Which of the following processes does not involve oxidation of iron ?

(1) Liberation of H_2 from steam by iron at high temperature
(2) Rusting of iron sheets
(3) Decolourization of blue $CuSO_4$ solution by iron.
(4) Formation of $Fe(CO)_5$ from Fe.

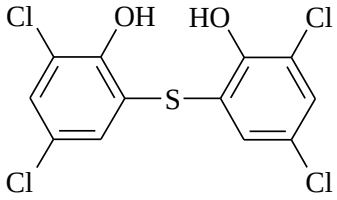
164. (4)

(1) $3Fe + 4H_2O \xrightarrow{\Delta} Fe_3O_4 + 4H_2$ Oxidation of Fe

(4) $Fe + 5CO \longrightarrow Fe(CO)_5$ No change in O.N. of Fe

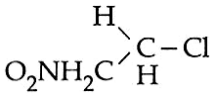
165. Bithional is generally added to the soaps as an additive to function as a/an :
(1) Antiseptic (2) Softener (3) Dryer (4) Buffering agent

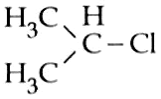
165. (1)
Bithional functions as antiseptic.

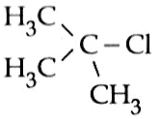


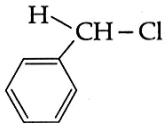
Bithional

166. In which of the following compounds, the C – Cl bond ionisation shall give most stable carbonium ion ?

(1) 

(2) 

(3) 

(4) 

166. (3)
3° carbocation are more stable than benzylic carbocation.

167. A given metal crystallizes out with a cubic structure having edge length of 361 pm. If there are four metal atoms in one unit cell, what is the radius of one atom ?
(1) 108 pm (2) 40 pm (3) 127 pm (4) 80 pm

167. (3)
It is a fcc structure.

$4r = \sqrt{2}\,a$

$r = \frac{\sqrt{2}\,a}{4} = \frac{\sqrt{2}\times 361}{4} = 127 \text{ pm}$

168. The boiling point of 0.2 mol kg^{-1} solution of X in water is greater than equimolal solution of Y in water. Which one of the following statements is **true** in this case ?
(1) Y is undergoing dissociation in water while X undergoes no change.
(2) X is undergoing dissociation in water.
(3) Molecular mass of X is greater than the molecular mass of Y.
(4) Molecular mass of X is less than the molecular mass of Y.

168. (2)
Molality of solution of x = molality of solution of y = 0.2 mol/kg
By elevation in boiling point relation
$\Delta T_b = i K_b m$ or $\Delta T_b \propto i$
$\because$ ΔT_b of solution of 'x' > ΔT_b of solution of 'y'.
$\therefore$ 'i' of solution of x > i of solution of 'y' $\therefore$ Solute of 'x' undergoing dissociation.

169. In Duma's method for estimation of nitrogen, 0.25 g of an organic compound gave 40 mL of nitrogen collected at 300 K temperature and 725 mm pressure. If the aqueous tension at 300K is 25mm, the percentage of nitrogen in the compound is :
(1) 15.76 (2) 17.36 (3) 18.20 (4) 16.76

169. (4)
0.25 g 40 mL N_2 at 300K, 725 mm pressure
Aq. tension at 300 K is 25 mm
725 – 25 = 700 mm
Temp. 300 K , Mass of the sub 0.25 g , Vol. of moist nitrogen = 40 mL

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\therefore \quad V_2 = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2} = \frac{700 \times 40 \times 273}{300 \times 760} = \frac{7644000}{228000} = 33.52\,\text{mL}$$

% of nitrogen

22400 mL of nitrogen at S.T.P weighs = 28 g

33.52 mL of nitrogen at S.T.P. weighs

$$= \frac{28 \times 33.52}{22400} = \frac{938.56}{22400} = 0.0419\,\text{g}$$

Percentage of nitrogen in org. compound $= \frac{0.0419}{0.25} \times 100 = 16.76\ \%$

170. The species Ar, K^+ and Ca^{2+} contain the same number of electrons. In which order do their radii increase ?

(1) $K^+ < Ar < Ca^{2+}$ (2) $Ar < K^+ < Ca^{2+}$ (3) $Ca^{2+} < Ar < K^+$ (4) $Ca^{2+} < K^+ < Ar$

170. (4)

For Isoelectronic species : $Ca^{+2} < K^+ < Ar$

171. Because of lanthanoid contraction, which of the following pairs of elements have nearly same atomic radii ? (Numbers in the parenthesis are atomic numbers).

(1) Zr (40) and Ta (73) (2) Ti (22) and Zr (40)

(3) Zr (40) and Nb (41) (4) Zr (40) and Hf (72)

171. (4)

Zr – Hf (group 4)

↑ ↑——— 3rd transition series (144 pm)

Second transition series (145 pm)

172. The number of d–electrons in Fe^{2+} (Z = 26) is **not** equal to the number of electrons in which one of the following ?

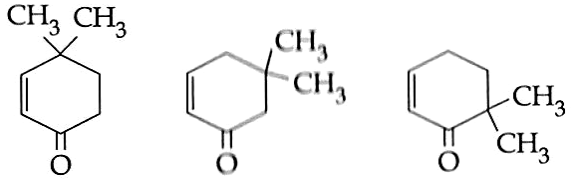
(1) p – electrons in Ne (Z = 10) (2) s – electrons in Mg (Z = 12)

(3) p – electrons in Cl (Z = 17) (4) d – electrons in Fe (Z = 26)

172. (3)

$_{17}Cl = 1s^2 2s^2 2p^6 3s^2 3p^5$ $\quad Fe^{2+} = 3d^6$

173. Given :

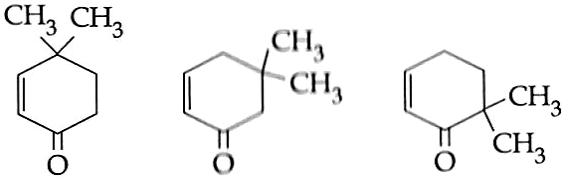


(I) (II) (III)

Which of the given compounds can exhibit tautormerism ?

(1) I, II and III (2) I and II (3) I and III (4) II and III

173. (1)



(I) (II) (III)

Compound (I) , (II) and (III) can exhibit tautormerism.

174. Which one of the following electrolytes has the same value of van't Hoff's factor (i) as that of $Al_2(SO_4)_3$ (if all are 100% ionised)

(1) $K_4[Fe(CN)_6]$ (2) K_2SO_4 (3) $K_3[Fe(CN)_6]$ (4) $Al(NO_3)_3$

174. (1)

$K_4[Fe(CN)_6 \rightleftharpoons 4K^+ + [Fe(CN)_6]^{4-}$ …(i = 5)

No. of ions are five. In $Al_2(SO_4)_3 \rightleftharpoons 2Al^{3+} + 3SO_4^{2-}$ …(i = 5)

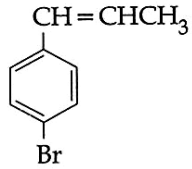
175. Maximum bond angle at nitrogen is present in which of the following ?

(1) NO_3^- (2) NO_2 (3) NO_2^- (4) NO_2^+

175. (4)

NO_3^-	NO_2	NO_2^-	NO_2^+
120°	> 120°	< 120°	180°

176. The reaction of $C_6H_5CH = CHCH_3$ with HBr produces :

(1) 

(2) $C_6H_5\underset{\underset{Br}{|}}{C}HCH_2CH_3$

(3) $C_6H_5CH_2\underset{\underset{Br}{|}}{C}HCH_3$

(4) $C_6H_5CH_2CH_2CH_2Br$

176. (2)

$$C_6H_5 - CH = CH - CH_3 + H - Br \longrightarrow C_6H_5 - \underset{\underset{Br}{|}}{CH} - CH_2 - CH_3$$

177. Which property of colloidal solution is independent of charge on the colloidal particles ?

(1) Tyndall effect (2) Coagulation (3) Electrophoresis (4) Electro–osmosis

177. (1)

Tyndall effect is the scattering of light by sol particles, it depends on size and not on charge.

178. Solubility of the alkaline earth's metal sulphates in water decreases in the sequence :

(1) Ba > Mg > Sr > Ca (2) Mg > Ca > Sr > Ba

(3) Ca > Sr > Ba > Mg (4) Sr > Ca > Mg > Ba

178. (2)

Mg > Ca > Sr > Ba.

The solubility of sulphate decreases on moving down the group. The values of solubility products which decrease gradually also explain the decrease in solubility on moving down the group.

Metal sulphate	$MgSO_4$	$CaSO_4$	$SrSO_4$	$BaSO_4$
Solubility product	10	2.4×10^{-5}	7.6×10^{-7}	1.5×10^{-9}

179. A device that converts energy of combustion of fuels like hydrogen and methane, directly into electrical energy is known as :

(1) Ni–Cd cell (2) Fuel Cell (3) Electrolytic Cell (4) Dynamo

179. (2)

In fuel cell energy of combustion is converted into electrical energy.

180. If the value of an equilibrium constant for a particular reaction is 1.6×10^{12}, then at equilibrium the system will contain :

(1) similar amounts of reactants and products (2) all reactants

(3) mostly reactants (4) mostly products

180. (4)

$R \rightarrow P$; $K = [P]_{eq} / [R]_{eq}$

AIPMT 2016

1. In a testcross involving F_1 dihybrid flies, more parental-type offspring were produced than the recombinat-type offspring. This indicates:
   (1) Both of the characters are controlled by more than one gene.
   (2) The two genes are located on two different chromosomes
   (3) Chromosomes failed to separate during meiosis.
   (4) The two genes are linked and present on the same chromosome.

1. (4)

Sol.: Linkage increase incidence of parentals.
Hint: Chapter Principles of Inheritance and Variation
NCERT page no.83

2. Water soluble pigments found in plant cell vacuoles are:
   (1) Anthocyanins (2) Xanthophylls (3) Chlorophylls (4) Carotenoids

2. (1)

Anthocyanins are water soluble vacuolar pigments
Hint: Chapter Photosynthesis in higher plants
Not given in NCERT

3. Which of the following pairs of hormones are not antagonistic (having opposite effects) to each other?
   (1) Relaxin - Inhibin (2) Parathormone - Calcitonin
   (3) Insulin - Glucagon (4) Aldosterone - Atrial Natriuretic factor

3. (1)

Sol.: Relaxin hormone causes relaxation of pelvic ligaments during parturition were as inhibin has negative feedback effect with FSH
Chapter: Chemical co-ordination and integration
OUT of NCERT

4. Mitochondria and chloroplast are:
   (a) semi-autonomous organelles.
   (b) formed by division of pre - existing organelles and they contain DNA but lack protein synthesizing machinery.
   Which one of the following options is correct?
   (1) Both (a) and (b) are false. (2) Both (a) and (b) are correct.
   (3) (b) is true but (a) is false. (4) (a) is true but (b) is false.

4. (4)

Sol.: Both are semi autonomous and have protein synthesizing machinery including ribosomes.
Hint: Chapter cell the unit of life
NCERT page no.134

5. Which of the following is not a feature of the plasmids?
   (1) Single - stranded (2) Independent replication
   (3) Circular structure (4) Transferable

5. (1)

Sol.: Plasmids are ds-DNA molecules that are separate from a cells nucleoid in prokaryotes.
Chapter: Biotechnology Principles and Processes
Plasmid is double stranded DNA, Autonomously replicating unit, found in prokaryotes.

6. A plant in your garden avoids photorespiratory losses, has improved water use efficiency, shows high rates of photosynthesis at high temperatures and has improved efficiency of nitrogen utilization. In which of the following physiological groups
would you assign this plant?
(1) Nitrogen fixer (2) C_3 (3) C_4 (4) CAM

6. (3)

Sol.: Reduction of photorespiration in C_4 plants enhances both yield and nitrogen efficiency.
Hint: Chapter Photosynthesis in higher plants
NCERT page no.90

7. Emerson's enhancement effect and Red drop have been instrumental in the discovery of:
(1) Oxidative phosphorylation
(2) Photophosphorylation and non-cyclic electron transport
(3) Two photosystems opera ting simultaneously
(4) Photophosphorylation and cyclic electron transport

7. (3)
Hint: Chapter Photosynthesis in higher plants
Not given in NCERT

8. Which type of tissue correctly matches with its location?

Tissue	**Location**
(1) Cuboidal epithelium	Lining of stomach
(2) Smooth muscle	Wall of intestine
(3) Areolar tissue	Tendons
(4) Transitional epithelium	Tip of nose

8. (2)

Sol.: Smooth muscles are involuntary muscles present in wall of intestine.
Chapter: Structural organization in Animals
NCERT Page 101- last para, 103- 1st and 2nd para, 104- 2nd para

9. When does the growth rate of a population following the logistic model equal zero? The logistic model is given as dN/dt = rN(l-N/K):
(1) when death rate is greater than birth rate. (2) when N/ K is exactly one.
(3) When N nears the carrying capacity of the habitat (4) when N/K equals zero.

9. (2)
Hint: Chapter Organisms and Population
NCERT page no.231

10. Which one of the following statements is not true?
(1) Stored pollen in liquid nitrogen can be used in the crop breeding programmes
(2) Tapetum helps in the dehiscence of anther
(3) Exine of pollen grains is made up of sporopollenin
(4) Pollen grains of many species cause severe allergies

10. (2)

Sol.: Tapetum is nutritive layer of anther.
Hint: Chapter Sexual Reproduction in flowering plants
NCERT page no.22 to 24

11. Which one of the following statements is wrong?

(1) Phycomycetes are also called algal fungi. (2) Cyanobacteria are also called blue-green algae.

(3) Golden algae are also called desmids. (4) Eubacteria are also called false bacteria.

11. (4)

Sol.; Eubacteria literally means true bacteria.

Hint: Chapter Biological classification

NCERT page no.19

12. The A vena curvature is used for bioassay of:

(1) Ethylene (2) ABA (3) GA_3 (4) IAA

12. (4)

Sol.: Avena curvature test is a bioassay for auxins.

Hint: Chapter plant growth and development, NCERT page no.247

13. Which of the following structures is homologus to the wing of a bird?

(1) Flipper of Whale (2) Dorsal fin of a Shark

(3) Wing of a Moth (4) Hind limb of Rabbit

13. (1)

Chapter: Evolution

Actually the wing of bat is homologous to flipper of whale. They have asked wings of birds. The most suitable answer is option 3 but it is a debatable question.

14. Blood pressure in the pulmonary artery is:

(1) less than that in the venae cavae. (2) same as that in the aorta.

(3) more than that in the carotid. (4) more than that in the pulmonary vein.

14. (4)

Chapter: Body fluids and Circulation

Blood flows under higher pressure in arteries than veins. So, blood pressure in Pulmonary artery will be higher than vena cava, but lower than aorta and carotid artery.

OUT of NCERT

15. Fertilization in humans is practically feasible only if:

(1) the sperms are transported into cervix within 48 hrs of release of ovum in uterus.

(2) the sperms are transported into vagina just after the release of ovum in fallopian tube,

(3) the ovum and sperms are transported simultaneously to ampullary - isthmic junction of the fallopian tube.

(4) the ovum and sperms are transported simultaneously to ampullary - isthmic junction of the cervix.

15. (3)

Chapter: Human Reproduction

NCERT Page 51- 2nd para, 8^{th} line

16. In meiosis crossing over is initiated at:

(1) Diplotene (2) Pachytene (3) Leptotene (4) Zygotene

16. (2)

Sol.: Pachytene follows zygotene and is characterized by crossing over.

Hint: Chapter cell cycle cell division

NCERT page no.168

17. Chrysophytes, Euglenoids, Dinoflagellates and Slime moulds are included in the kingdom:

(1) Animalia (2) Monera (3) Protista (4) Fungi

17. (3)

Hint: Chapter Biological classification

NCERT page no.20 and 21

18. Lack of relaxation between successive stimuli in sustained muscle contraction is known as:

(1) Tonus (2) Spasm (3) Fatigue (4) Tetanus

18. (4)

Chapter: Movement and Locomotion

OUT of NCERT

19. Identify the correct statement on 'inhibin':

(1) Is produced by nurse cells in testes and inhibits the secretion of LH.

(2) Inhibits the secretion of LH, FSH and Prolactin.

(3) Is produced by granulose cells in ovary and inhibits the secretion of FSH.

(4) Is produced by granulose cells in ovary and inhibits the secretion of LH.

19. (3)

Sol.: Inhibin hormone is produced by granulosa cells of follicles in ovary and inhibit the secretion of FSH

Chapter: Human Reproduction

Inhibin is secreted by corpus luteum to inhibit FSH but not LH

20. Name the chronic respiratory disorder caused mainly by cigarette smoking:

(1) Respiratory alkalosis (2) Emphysema (3) Asthma (4) Respirator)' acidosis

20. (2)

Sol.: In Emphysema wall separating alveoli breaks and there is decrease in overall surface area available for gas exchange.

Chapter: Breathing and Exchange of Gases

NCERT Page 275, last para

21. Which of the following most appropriately describes haemophilia?

(1) Dominant gene disorder (2) Recessive gene d isorder

(3) X-linked recessive gene disorder (4) Chromosomal disorder

21. (3)

Sol.: It follows X-linked / criss – cross inheritance.

Hint: Chapter Principles of Inheritance and Variation

NCERT page no.89

22. Select the correct statement:

(1) The leaves of gymnosperms are not well adapted to extremes of climate

(2) Gymnosperms are both homosporous and heterosporous

(3) Salvinia, Ginkgo and Pinuf all are gymnosperms

(4) Sequoia is one of the tallest trees

22. (4)

Sol.: *Sequoia* or redwood trees are among the tallest trees.

Hint: Chapter Plant kingdom

NCERT page no.38 and 39

23. Which of the following is required as inducer(s) for the expression of Lac operon?

(1) lactose and galactose (2) glucose (3) galactose (4) lactose

23. (4)

Hint: Chapter Molecular Basis of Inheritance

NCERT page no.117

24. A tall true breeding garden pea plant is crossed with a dwarf true breeding garden pea plant. When the F_1plants were selfed the resulting genotypes were in the ratio of :

(1) 3:1:: Dwarf: Tall

(2) 1:2:1:: Tall homozygous: Tall heterozygous : Dwarf

(3) 1:2:1:: Tall heterozygous: Tall homozygous : Dwarf

(4) 3:1:: Tall: Dwarf

24. (2)

Sol.: Monohybrid mendelian cross

Hint: Chapter Principles of Inheritance

NCERT page no.73

25. Which part of the tobacco plant is infected by *Meloidogyite incognita* ?

(1) Root (2) Flower (3) Leaf (4) Stem

25. (1)

Sol.: It is the root-knot nematode

Chapter: Biotechnology and Its applications

NCERT Page 210, 3rd para, 3rd Line

26. Which of the following is not a characteristic feature during mitosis in somatic cells?

(1) Synapsis (2) Spindle fibres

(3) Disappearance of nucleolus (4) Chromosome movement

26. (1)

Sol.: Synapsis occurs during meiosis I between homologous chromosomes

Hint: Chapter Cell the unit of life

NCERT page no.137 and 138

27. Which of the following statements is not true for cancer cells in relation to mutations?

(1) Mutations inhibit production of telomerase. (2) Mutations in proto-oncogenes accelerate the cell cycle.

(3) Mutations destroy telomerase inhibitor. (4) Mutations inactivate the cell control.

27. (1)

Chapter: Human health and diseases

Cancer lines have large amount of telomerase. If mutation inhibits production of telomerase, the quantity of telomerase will be reduced.

OUT of NCERT

28. One of the major components of cell wall of most fungi is:

(1) Hemicellulose (2) Chitin (3) Peptidoglycan (4) Cellulose

28. (2)

Sol.: Chitin is a polymer of N-acetylglucosamine.

Hint: Chapter Biological classification

Not given in NCERT

29. Cotyledon of maize grain is called:

(1) scutellum (2) plumule (3) coleorhiza (4) coleoptile

29. (1)

Sol.: It is the rudimentary cotyledon.

Hint: Chapter Morphology of Flowering plants

NCERT page no.177

30. Which of the following would appear as the pioneer organisms on bare rocks?

(1) Green algae (2) Lichens (3) Liverworts (4) Mosses

30. (2)

Sol.: Lichens are pioneer vegetation during xerarch.

Hint: Chapter Ecosystem

NCERT page no.250

31. Changes in GnRH pulse frequency in females is controlled by circulating levels of:

(1) progesterone and inhibin (2) estrogen and progesterone

(3) estrogen and inhibin (4) progesterone only

31. (2)

Sol.: GnRH is secreted by hypothalamus & it acts on anterior pituitary to regulate production of FSH & LH

Chapter: Human Reproduction

Inhibin inhibits FSH from pituitary but doesn't inhibit GnRH from hypothalamus.

OUT of NCERT

32. Antivenom injection contains preformed antibodies while polio drops that are administered into the body contain:

(1) Attenuated pathogens (2) Activated pathogens

(3) Harvested antibodies (4) Gamma globulin

32. (1)

Sol.: Polio drops that are administered into the body contain attenuated pathogens.

Chapter: Human health and diseases

OUT of NCERT

33. Photosensitive compound in human eye is made up of:

(1) Transducin and Retinene (2) Guanosine and Retinol

(3) Opsin and Retinal (4) Opsin and Retinol

33. (3)

Sol.: Photosensitive compound in human retina consist of protein opsin & retinal

Chapter: Neural control and Co-ordination

NCERT Page 324- 4th Para, 4th Line

34. Specialised epidermal cells surrounding the guard cells are called:

(1) Lenticels (2) Complementary cells

(3) Subsidiary cells (4) Bulliform cells

34. (3)

Hint: Chapter Anatomy of flowering plants

NCERT page no.89

35. Which of the following features is not present in the Phylum - Arthropoda?

(1) Jointed appendages (2) Chitinous exoskeleton

(3) Metameric segmentation (4) Parapodia

35. (4)

Sol.: Parapodia are extensions of body wall in case of annelids

Chapter: Kingdom Animalia

Parapodia is a feature of Annelids

NCERT Page 53

36. Reduction in pH of blood will:

(1) release bicarbonate ions by the liver. (2) reduce the rate of heart beat.

(3) reduce the blood supply to the brain (4) decrease the affinity of hemoglobin with oxygen.

36. (4)

Sol.: affinity of hemoglobin with oxygen decreases when pH decreases.

Chapter: Breathing and Exchange of Gases

High concentration of Hydrogen ions causes dissociation curve to shift towards right favouring breakdown of oxyhaemoglobin

NCERT Page 274

37. Which of the following characteristic features always holds true for the corresponding group of animals ?

(1)	3 - chambered heart with one incompletely divided ventricle	Reptilia
(2)	Cartilaginous endoskeleton	Chondrichthyes
(3)	Viviparous	Mammalia
(4)	Possess a mouth with an upper and a lower jaw	Chordata

37. (2)

Chapter: Kingdom Animalia

Exception to option 1 is Prototherians (egg laying Mammals)

Exception to option 2 is Cyclostomes (jawless vertebrate)

Exception to option 3 is Crocodile (Reptile with 4 chambered heart)

38. Match the terms in Column I with their description in Column II and choose the correct option:

Column I	**Column II**
(a) Dominance	(i) Many genes govern a single character
(b) Codominance	(ii) In a heterozygous organism only one allele expresses itself
(c) Pleiotropy	(iii) In a heterozygous organism both alleles express themselves fully
(d) Polygenic inheritance	(iv) A single gene influences many characters C

Code:

	(a)	(b)	(c)	(d)
(1)	(iv)	(iii)	(i)	(ii)
(2)	(ii)	(i)	(iv)	(iii)
(3)	(ii)	(iii)	(iv)	(i)
(4)	(iv)	(i)	(ii)	(iii)

38. (3)

Hint: Chapter Principles of Inheritance and Variation

NCERT page no.75, 76, 77

39. A typical fat molecule is made up of:

(1) Three glycerol and three fatty add molecules

(2) Three glycerol molecules and one fatty acid molecule.

(3) One glycerol and three fatty acid molecules

(4) One glycerol and one fatty acid molecule

39. (3)

Sol.: Triglycerides consist of one glycerol and three fatty acid molecules.

Chapter: Biomolecules

A typical fat molecule or neutral fat or true fats or triglycerides consists of one glycerol and 3 fatty acid molecules.

NCERT Page 144- 2nd para

40. Proximal end of the filament of stamens attached to the:

(1) Thalamus or petal (2) Anther (3) Connective (4) Placenta

40. (1)

Hint: Chapter Sexual Reproduction flowering plants

NCERT page no.21

41. Which one of the following statements is wrong?

(1) Glycine is a sulphur containing amino acid.

(2) Sucrose is a disaccharide.

(3) Cellulose is a polysaccharide.

(4) Uracil is a pyrimidine.

41. (1)

Sol.: Glycine is simplest amino acid. Sulphur containing amino acids are cysteine & methionine.

Chapter: Biomolecules

NCERT Page 145, 148

42. Water vapour comes out from the plant leaf through the stomatal opening. Through the same stomatal opening carbon dioxide diffuses into the plant during photosynthesis. Reason out the above statements using one of following options:

(1) One process occurs during day time, and the other at night.

(2) Both processes cannot happen simultaneously.

(3) Both processes can happen together because the diffusion coefficient of water and CO_2 is different

(4) The above processes happen only during nighttime.

42. (3)

Hint: Chapter Photosynthesis in higher plants

Not given in NCERT

43. A complex of ribosomes attached to a single strand of RNA is known as:

(1) Okazaki fragment (2) Polysome (3) Polymer (4) Polypeptide

43. (2)

Hint: Chapter cell the unit of life, NCERT page no.129

44. Which one of the following is a characteristic feature of cropland ecosystem?

(1) Ecological succession (2) Absence of soil organisms

(3) Least genetic diversity (4) Absence of weeds

44. (3)

Hint: Chapter Ecosystem

Not given in NCERT

45. Which of the following is the most important cause of animals and plants being driven to extinction?

(1) Co - extinctions (2) Over-exploitation

(3) Alien species invasion (4) Habitat loss and fragmentation

45. (4)

Hint: Chapter Biodiversity and conservation, NCERT page no.264

46. In a chloroplast the highest number of protons is found in:

(1) Antennae complex (2) Stroma

(3) Lumen of thyiakoids (4) Inter membrane space

46. (3)

Sol.: Due to development of proton gradient.

Hint: Chapter Photosynthesis in higher plants

NCERT page no.214

47. Which of the following is not required for any of the techniques of DNA fingerprinting available at present?

(1) DNA - DNA hybridization (2) Polymerase chain reaction

(3) Zinc finger analysis (4) Restriction enzymes

47. (3)

Hint: Chapter Molecular Basis of Inheritance

Not given in NCERT

48. The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals, include the:

(1) Eubacteria (2) Halophiles (3) Thermoaddophiles (4) Methanogens

48. (4)

Hint: Chapter Biological classification

NCERT page no.19

49. Which of the following features is not present in *Penplaneta americana*?

(1) Metamerically segmented body

(2) Schizocoelom as body cavity^

(3) Indeterminate and radial cleavage during embryonic development

(4) Exoskeleton composed of N-acetylglucosamine

49. (3)

Sol.: *Periplaneta americana* as spiral cleavage during embryonic development.

Chapter: Structural organization in Animals

N- acetyl glucosamine is chitin which forms exoskeleton in cockroach. Arthropods are metamerically segmented. Schizocoel is found in Annelids, Arthropods, and Molluscs. Cockroach shows indeterminate and spiral cleavage (also seen in Annelids and Molluscs)

OUT of NCERT

50. A system of rotating crops with legume or grass pasture to improve soil structure and fertility is called:

(1) Shifting agriculture (2) Ley farming (3) Contour farming (4) Strip farming

50. (2)

Sol.: It is a system of rotating crops with legumes / grass pastures to improve soil structure and fertility.

Hint: Chapter Strategies for Enhancement in Food Production

Not given in NCERT

51. Which of the following is wrongly matched in the given table?

	Microbe	Product	Application
(1)	Clostridium butylicum	Lipase	removal of oil stains
(2)	Trichoderma polysporum	Cyclosporin A	Immunosuppressive drug
(3)	Monascus purpureus	Statins	lowering of blood cholesterol
(4)	Streptococcus	Streptokinase	removal of clot from blood vessel

51. (1)

Hint: Chapter Microbes in human welfare, Not given in NCERT

52. In mammals, which blood vessel would normally carry largest amount of urea?

(1) Hepatic Portal Vein (2) Renal Vein (3) Dorsal Aorta (4) Hepatic Vein

52. (4)

Sol.: Urea is synthezied in liver from ammonia and carbon dioxide.

Chapter: Elimination of Nitrogenous waste

OUT of NCERT

53. Pick out the corrcct statements:

(a) Haemophilia is a sex-linked recessive disease

(b) Down's syndrome is due to aneuploidy.

(c) Phenylketonuria is an autosomal recessive gene disorder.

(d) Sickle cell anaemia is an X - linked recessive gene disorder.

(1) (a), (b) and (c) are correct. (2) (a) and (d) are correct.

(3) (b) and (d) are correct (4) (a), (c) and (d) are correct

53. (1)

Sol.: It is an autosomal recessive disorder.

Hint: Chapter Principles of Inheritance and variation

NCERT page no.89 and 90

54. Which of the following guards the opening of hepatopancreatic duct into the duodenum?

(1) Sphincter of Oddi (2) Semilunar valve (3) Deocaecal valve (4) Pyloric sphincter

54. (1)

Sol.: Sphincter of Oddi guards the opening of hepatopancretic duct into the duodenum.

Chapter: Digestion and Absorption

NCERT Page 261, 2nd para, 3rd line

55. Microtubules are the constituents of:

(1) Centrosome, Nucleosome and Centrioles (2) Cilia, Flagella and Peroxisomes

(3) Spindle fibres, Centrioles and Cilia (4) Centrioles, Spindle fibres and Chromatin

55. (3)

Hint: Chapter Cell the unit of life

NCERT page no.137 and 138

56. The coconut water from tender coconut represents:

(1) Free nuclear endosperm (2) Endocarp

(3) Fleshy mesocarp (4) Free nuclear pro embryo

56. (1)

Hint: Sexual reproduction in flowering plant

NCERT page no.35

57. Tricarpellary, syncarpous gynoecium is found in flowers of:

(1) Poaceae (2) Liliaceae (3) Solanaceae (4) Fabaceae

57. (2)

Hint: Chapter Morphology of Flowering Plants

NCERT page no. 81

58. Which of the following is not a stem modification?

(1) Flattened structures of Opuntia (2) Pitcher of Nepenthes

(3) Thorns of citrus (4) Tendrils of cucumber

58. (2)

Hint: Chapter Morphology of flowering plants

Not given in NCERT

59. The taq polymerase enzyme is obtained from:

(1) *Pseudomonas putida* (2) *Thermtis aqttaticus*

(3) *Thiobacillus ferroxidans* (4) *Bacillus subtilis*

59. (2)

Sol.: It is a thermostable enzyme.

Chapter: Biotechnology Principles and Processes

NCERT Page 203, 1st para, 8th Line

60. Stems modified into flat green organs performing the functions of leaves are known as:

(1) Scales (2) Cladodes (3) Phyllodes (4) Phylloclades

60. (4)

Sol.: Seen in Cactus, Opuntia etc.

Hint: Chapter Morphology of Flowering plants

Not given in NCERT

61. In higher vertebrates, the immune system can distinguish self-cells and non-self. If this property is lost due to genetic abnormality and it attacks self-cells, then it leads to:

(1) Active immunity (2) Allergic response

(3) Graft rejection (4) Auto-immune disease

61. (4)

Chapter: Human health and diseases

NCERT Page 153, 3rd para- 5th Line

62. Nomenclature is governed by certain universal rules.

Which one of the following is contrary to the rules of nomenclature?

(1) When written by hand, the names are to be underlined

(2) Biological names can be written in any language

(3) The first word in a biological name represents the genus name, and the second is a specific epithet

(4) The names are written in Latin and are italicised

62. (2)

Sol.: It is written in Latin.

Hint: Chapter living world

NCERT page no.7

63. In bryophytes and pteridophytes, transport of male gametes requires:

(1) Water (2) Wind (3) Insects (4) Birds

63. (1)

Sol.: The male gametes are motile / flagellated.

Hint: Chapter Plant Kingdom

NCERT page no.35 and 36

64. In context of Amniocentesis/ which of the following statement is incorrect?

(1) It can be used for detection of Cleft palate.

(2) It is usually done when a woman is between 14-16 weeks pregnant

(3) It is used for prenatal sex determination.

(4) It can be used for detection of Down syndrome.

64. (1)

Sol.: Amniocentesis is not used for detection of cleft palate.

Chapter: Reproductive health

Cleft palate is a structural deformity which can be detected only on ultrasound.

OUT of NCERT

65. In the stomach, gastric ad£ is secreted by the:

(1) acidic cells (2) gastrin secreting cells (3) parietal cells (4) peptic cells

65. (3)

Sol.: Parietal or oxyntic cells present in gastric glands of stomach secrete HCl.

Chapter: Digestion and Absorption

NCERT Page 262, 2nd para, 3rd line

66. Spindle fibres attach on to:

(1) Kinetosome of the chromosome (2) Telomere of the chromosome

(3) Kinetochore of the chromosome (4) Centromere of the chromosome

66. (3)

Hint: Chapter Cell cycle cell division

NCERT page no.165

67. Which is the National Aquatic Animal of India?

(1) Sea - horse (2) Gangetic shark (3) River dolphin (4) Blue whale

67. (3)

Hint: Not given in NCERT

68. Which one of the following cell organelles is enclosed by a single membrane?

(1) Nuclei (2) Mitochondria (3) Chloroplasts (4) Lysosomes

68. (4)

Hint: Chapter Cell the unit of life

NCERT page no. 134

69. The two polypeptides of human insulin are linked together by:

(1) Disulphide bridges (2) Hydrogen bonds (3) Phosphodiester bond (4) Covalent bond

69. (1)

Hint: Chapter Biotechnology and its application

NCERT page no.211 Para 1, diagram 12.3

Insulin is a simple protein showing 3 chains A B and C connected by Disulphide bridges

70. In which of the following, all three are macronutrients?

(1) Nitrogen, nickel, phosphorus (2) Boron, zinc, manganese

(3) Iron, copper, molybdenum (4) Molybdenum, magnesium, manganese

70. Incorrect Question (Bonus)

71. Which of the following statements is wrong for viroids?

(1) Their RNA is of high molecular weight (2) They lack a protein coat

(3) They are smaller titan viruses (4) They cause infections

71. (1)

Sol.: RNA is of low molecular weight.

Hint: Chapter Biological classification

NCERT page no.27

72. Analogous structures are a result of:

(1) Stabilizing selection (2) Divergent evolution (3) Convergent evolution (4) Shared ancestry

72. (3)

Chapter: Evolution

NCERT Page 131, 1st para, 3rd line

73. Select the incorrect statement:

(1) LH triggers secretion of androgens from the Leydig cells.

(2) FSH stimulates the Sertoli cells which help in sperrniogenesis.

(3) LH triggers ovulation in ovary

(4) LH and FSH decrease gradually during the follicular phase.

73. (4)

Sol.: Level of LH and FSH increases gradually during the follicular phase.

Chapter: Human Reproduction

LH and FSH gradually increases during follicular phase.

NCERT Page 50, figure 3.9

74. Which one of the following characteristics is not shared by birds and mammals?

(1) Warm blooded nature (2) Ossified endoskeleton

(3) Breathing using lungs (4) Viviparity

74. (4)

Chapter: Kingdom Animalia

Birds are strictly oviparous

75. Which of the following statements is not correct?

(1) Some reptiles have also been reported as pollinators in some plant species

(2) Pollen grains of many species can germinate on the stigma of a flower, but only one pollen tube of the same species grows into the style.

(3) Insects that consume pollen or nectar without bringing about pollination are called pollen/nectar robbers

(4) Pollen germination and pollen tube growth are regulated by chemical components of pollen interacting with those of the pistil.

75. (2)

Hint: Chapter Sexual Reproduction in Flowering Plants

NCERT page no.31

76. Seed formation without fertilization in flowering plants involves the process of:

(1) Apomixis (2) Sporulation (3) Budding (4) Somatic hybridization

76. (1)

Hint: Chapter Sexual Reproduction in flowering plants

NCERT page no.38

77. Which of the following approaches does not give the defined action of contraceptive?

(1)	Vasectomy	prevents spermatogenesis
(2)	Barrier methods	prevent fertilization
(3)	Intra uterine devices	increase phagocytosis of sperms, suppress sperm motility and fertilizing capacity of sperms
(4)	Hormonal contraceptives	Prevent/retard entry of sperms, prevent ovulation and fertilization

77. (1)

Sol.: Sperm production continues after vasectomy

Chapter: Reproductive health

Vasectomy doesn't prevent spermatogenesis as it occurs in Testis.

NCERT Page 60, 5th Last line, 2nd para 1st line, Page 61- 2nd Para, 9th- 11th Line

78. The amino acid Tryptophan is the precursor for the synthesis of:

(1) Cortisol and Cortisone (2) Melatonin and Serotonin

(3) Thyroxine and Triiodothyronine (4) Estrogen and Progesterone

78. (2)

Chapter: Chemical Control and Co-ordination

T3, T4 are derivatives of tyrosine. Estrogen, Progesterone, Cortisol and Cortisone are steroids.

OUT of NCERT

79. A river with an inflow of domestic sewage rich in organic waste may result in:

(1) Death of fish due to lack of oxygen.

(2) Drying of the river very soon due to algal bloom.

(3) Increased population of aquatic food web organisms.

(4) An increased production of fish due to biodegradable nutrients.

79. (1)

Hint: Chapter Environmental Issues

NCERT page no.275

80. Gause's principle of competitive exclusion states that:

(1) Larger organisms exclude smaller ones through competition.

(2) More abundant species will exclude the less abundant species through competition.

(3) Competition for the same resources excludes species having different food preferences.

(4) No two species can occupy the same niche, indefinitely for the same limiting resources.

80. (4)

Hint: Chapter Organisms and Population; NCERT page no.235

81. Asthma may be attributed to:

(1) accumulation of fluid in the lungs (2) bacterial infection of the lungs

(3) allergic reaction of the mast cells in the lungs (4) inflammation of the trachea

81. (3)

Chapter: Human Health and diseases

Mast cells are histaminic causing inflammation during asthma

NCERT Page 123, 2nd para

82. The standard petal of a papilionaceous corolla is also called:

(1) Corona (2) Carina (3) Pappus (4) Vexfllum

82. (4)

Hint: Chapter Morphology of Flowering plants

NCERT page no.74

83. Which of the following is a restriction endonuclease?

(1) RNase (2) Hind II (3) Protease (4) DNase

83. (2)

Chapter: Biotechnology Principles and Process

NCERT Page 195, 5th para, 6th Line

84. It is much easier for a small animal to run uphill than for a large animal, because:

(1) The efficiency of muscles in large animals is less than in the small animals.

(2) It is easier to carry a small body weight.

(3) Smaller animals have a higher metabolic rate

(4) Small animals have a lower O_2 requirement

84. (3)

Chapter: Organisms and Population; OUT of NCERT

85. Following are the two statements regarding the origin of life:

(a) The earliest organisms that appeared on the earth were non-green and presumably anaerobes.

(b) The first autotrophic organisms were the chemoautotrophs that never released oxygen.

Of the above statements which one of the following options is correct?

(1) Both (a) and (b) are false. (2) (a) is correct but (b) is false.

(3) (b) is correct but (a) is false. (4) Both (a) and (b) are correct

85. (4)

Chapter: Evolution ; OUT of NCERT

86. A cell at telophase stage is observed by a student in a plant brought from the field. He tells his teacher that this cell is not like other cells at telophase stage. There is no formation of cell plate and thus the cell is containing more number of chromosomes as
compared to other dividing cells. This would result in:

(1) Polyteny (2) Aneuploidy (3) Polyploidy (4) Somaclonal variation

86. (3)

Hint: Chapter Principles of Inheritance and Variation

NCERT page no.90

87. Depletion of which gas in the atmosphere can lead to an increased incidence of skin cancers:

(1) Methane (2) Nitrous oxide (3) Ozone (4) Ammonia

87. (3)

Hint: Chapter Environmental Issues

NCERT page no.282

88. Joint Forest Management Concept was introduced in India during:

(1) 1990s (2) 1960s (3) 1970s (4) 1980s

88. (4)

Hint: Chapter Environmental Issues

NCERT page no.285

89. Which one of the following is the starter codon?

(1) UAG (2) AUG (3) UGA. (4) UAA

89. (2)

Hint: Chapter Molecular Basis of Inheritance

NCERT page no.115

90. The term ecosystem was coined by:

(1) E. Wanning (2) E.P.Odum (3) A.G. Tansley (4) E. Haeckel

90. (3)

Hint: Chapter Ecosystem

Not given in NCERT

91. What is the minimum velocity with which a body of mass m must enter a vertical loop of radius R so that it can complete the loop ?

(1) $\sqrt{5gR}$ (2) $\sqrt{gR}$ (3) $\sqrt{2gR}$ (4) $\sqrt{3gR}$

91. (1)

To complete the vertical loop, the minimum speed required at the lowest point = 5gR So ans is (1)

92. If the magnitude of sum of two vectors is equal to the magnitude difference of the two vectors, the angle between these vectors is :

(1) 180° (2) 0° (3) 90° (4) 45°

92. (3)

$$\left|\vec{A}+\vec{B}\right| = \left|\vec{A}-\vec{B}\right|$$

$$(A)^2 + (B)^2 + 2(A)(B)\cos\theta = (A)^2 + (B)^2 - 2(A)(B)\cos\theta$$

$$2\cos\theta = 0 \qquad \Rightarrow \theta = 90^\circ$$

93. At what height from the surface of earth the gravitation potential and the value of g are -5.4×10^7 J kg^{-2} and $6.0 ms^{-2}$ respectively? Take the radius of earth as 6400 km :

(1) 2000 km (2) 2600 km (3) 1600 km (4) 1400 km

93. (2)

$$-\frac{GM}{r} = 5.4 \times 10^7$$

$$-\frac{GM}{r^2} = 6$$

dividing both the equations, r = 9000 km.

so height from the surface = 9000 – 6400 = 2600 km

94. A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn of the solenoid is 4×10^{-3} Wb . The self-inductance of the solenoid is :

(1) 1 H (2) 4 H (3) 3 H (4) 2 H

94. (1)

$$\phi_{self} = Li$$

$$(4 \times 10^{-3})(1000) = (L)(4)$$

$$L = 1 \text{ Henry}$$

95. An inductor 20 mH, a capacitor $50\ \mu F$ and a resistor $40\ \Omega$ are connected in series across a source of emf V = 10 sin 340 t. The power loss in A.C. circuit is:

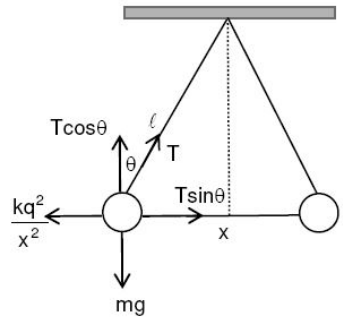
(1) 0.89 W (2) 0.51 W (3) 0.67 W (4) 0.76 W

95. (2)

96. Two identical charged spheres suspended from a common point by two massless strings of lengths l, are initially at a distance $d(d << l)$ apart because of their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity v. The v varies as a function of the distance x between the spheres, as :

(1) $v \propto x^{-1}$ (2) $v \propto x^{\frac{1}{2}}$ (3) $v \propto x$ (4) $v \propto x^{-\frac{1}{2}}$

96. (4)



$T\sin\theta = \frac{kq^2}{x^2}$

$T\cos\theta = mg$

Dividing the equations

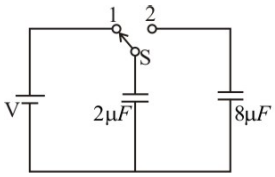
$\tan\theta = \frac{kq^2}{mgx^2}$ here $\tan\theta \approx \sin\theta = \frac{x}{2\ell}$

$\Rightarrow \quad \frac{x}{2\ell} = \frac{kq^2}{x^2}$

$\Rightarrow \quad q \propto x^{3/2}$

$\Rightarrow \quad \frac{dq}{dt} \propto \frac{3}{2}x^{1/2}\left(\frac{dx}{dt}\right) \quad \Rightarrow \quad \frac{dx}{dt} \propto x^{-1/2}$

97.



A capacitor of $2\mu F$ is charged as shown in the diagram. When the switch S is turned to position 2, the percentage of its stored energy dissipated is :

(1) 80% (2) 0% (3) 20% (4) 75%

97. (1)

Initial energy stored in the $2\mu F$ capacitor is $= \frac{1}{2}(2\mu)V^2 = V^2\mu J$

Energy less $= \frac{C_1C_2}{2(C_1+C_2)}(V_1 - V_2)^2 = \frac{(2\mu)(8\mu)}{2(2\mu+8\mu)}(V-0)^2$

$E_{loss} = \frac{5}{4}V^2\mu J$

$\%\ \text{loss} = \frac{5/4\,V^2}{V^2} \times 100 = 80\%$

98. A particle moves so that its position vector is given by $r = \cos\omega t\ x + \sin\omega t\ y$. Where ω is a constant.

Which of the following is true?

(1) Velocity is perpendicular to $\vec{r}$ and acceleration is directed away from the origin.

(2) Velocity and acceleration both are perpendicular to $\vec{r}$.

(3) Velocity and acceleration both are parallel to $\vec{r}$.

(4) Velocity is perpendicular to $\vec{r}$ and acceleration is directed towards the origin.

98. (4)

$$\vec{V} = \cos\omega t\hat{i} + \sin\omega t\hat{j}$$

$$\vec{V} = \frac{d\vec{r}}{dt} = -\omega\sin\omega t\,\hat{i} + \omega\cos\omega t\,\hat{j}$$

$$\vec{a} = \frac{d\vec{V}}{dt} = -\omega^2\cos\omega t\,\hat{i} - \omega^2\sin\omega t\,\hat{j}$$

since $\vec{r}.\vec{V} = 0$ so $\vec{r} \perp_r \vec{V}$

and $\vec{a} = -\omega^2\vec{r}$

so $\vec{a}$ will be always aiming towards the origin.

99. From a disc of radius R and mass M, a circular hole of diameter R, whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis, passing through the centre ?

(1) $9\ MR^2/32$ (2) $15\ MR^2/32$ (3) $13\ MR^2/32$ (4) $11\ MR^2/32$

99. (3)

$$I_1 = \frac{MR^2}{2}$$

$$I_2 = \frac{\left(\frac{M}{4}\right)\left(\frac{R}{2}\right)^2}{2} + \left(\frac{M}{4}\right)\left(\frac{R}{2}\right)^2 = \frac{3MR^2}{32}$$

$$I_{net} = I_1 - I_2 = \frac{MR^2}{2} - \frac{3MR^2}{32} = \frac{13MR^2}{32}$$ so answer is 3.

100. The ratio of escape velocity at earth (v_e) to the escape velocity at a planet (v_p) whose radius and mean density are twice as that of earth is :

(1) $1:\sqrt{2}$ (2) 1 : 2 (3) $1:2\sqrt{2}$ (4) 1 : 4

100. (3)

$$V_e = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{2G \times \rho \times \frac{4}{3}\pi R^3}{R}}$$

$$\Rightarrow \quad V_e \propto R\sqrt{\rho}$$

$$\frac{V_1}{V_2} = \frac{R_1\sqrt{\rho_1}}{R_2\sqrt{\rho_2}} \quad \Rightarrow \quad \frac{V_1}{V_2} = \frac{1}{2\sqrt{2}}$$

so answer is 3.

101. A potentiometer wire is 100 cm long and a constant potential difference is maintained across it. Two cells are connected in series first to support one another and then in opposite direction. The balance points are obtained at 50 cm and 10 cm from the positive end of the wire in the two cases. The ratio of emf's is :

(1) 3 : 2 (2) 5 : 1 (3) 5 : 4 (4) 3 : 4

101. (1)

$$\frac{\varepsilon_1+\varepsilon_2}{\varepsilon_1-\varepsilon_2}=\frac{5}{1} \quad \varepsilon_1+\varepsilon_2=5\varepsilon_1-5\varepsilon_2$$

$$6\varepsilon_2=4\varepsilon_1$$

$$\frac{\varepsilon_1}{\varepsilon_2}=\frac{3}{2}$$

102. A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of 15 ms^{-1}. Then, the frequency of sound that the observer hears in the echo reflected from the cliff is :

(Take velocity of sound in air = 330 ms^{-1})

(1) 885 Hz (2) 765 Hz (3) 800 Hz (4) 838 Hz

102. (4)

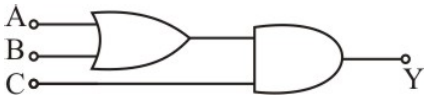
$$f=f_0\left(\frac{V+V_0}{V-V_s}\right)$$

$$800\left(\frac{330+0}{330-15}\right)$$

$$\frac{330}{315}\times 800$$

$$\frac{330}{315}\times 800\left(\frac{330}{330}\right)=838\text{Hz}$$

103. To get output 1 for the following circuit, the correct choice for the input is :



(1) A = 1, B = 0, C = 1 (2) A = 0, B = 1, C = 0

(3) A = 1, B = 0, C = 0 (4) A = 1, B = 1, C = 0

103. (1)

Using properties of OR and AND Gate

104. In a diffraction pattern due to a single slit of width 'a', the first minimum is observed at an angle 30° when light of wavelength 5000 Å is incident on the slit. The first secondary maximum is observed at an angle of :

(1) $\sin^{-1}\left(\frac{3}{4}\right)$ (2) $\sin^{-1}\left(\frac{1}{4}\right)$ (3) $\sin^{-1}\left(\frac{2}{3}\right)$ (4) $\sin^{-1}\left(\frac{1}{2}\right)$

104. (1)

$\sin\theta=\frac{\lambda}{a}$ Position of first minima

$\sin 30°=\frac{5000}{a}$ a = 10,000 A°

$\sin\theta=\frac{3\lambda}{2a}=\frac{\times 5000}{2\times 10,000}$

$\theta=\sin^{-1}3/4$ position of first secondary maxima.

105. When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ, the stopping potential is $\frac{V}{4}$. The threshold wavelength for the metallic surface is :

(1) 3λ (2) 4λ (3) 5λ (4) $\frac{5}{2}\lambda$

105. (1)

$$\frac{hc}{\lambda}=\frac{hc}{\lambda_0}+ev \qquad .....(1)$$

$$\frac{hc}{2\lambda}=\frac{hc}{\lambda_0}+e\frac{v}{4} \qquad .....(2)$$

$$\frac{hc}{2\lambda}=\frac{3ev}{4}$$

$$ev=\frac{2hc}{3\lambda}$$

$$\frac{hc}{\lambda}=\frac{hc}{\lambda_0}+\frac{2hc}{3\lambda}$$

$$\frac{hc}{\lambda_0}=\frac{hc}{3\lambda}$$

$$\lambda_0=3\lambda$$

106. When an α-particle of mass 'm' moving with velocity ' v ' bombards on a heavy nucleus of charge 'Ze', its distance of closest approach from the nucleus depends on m as :

(1) m (2) $\frac{1}{m}$ (3) $\frac{1}{\sqrt{m}}$ (4) $\frac{1}{m^2}$

106. (2)

$$\frac{1}{2}mv^2=\frac{kze^2}{r} \qquad r\propto\frac{1}{m}$$

107. Match the corresponding entries of column 1 with column 2. 'Where m is the magnification produced by the mirror]

Column 1	Column 2
(A) $m=-2$	(a) Convex mirror
(B) $m=-\frac{1}{2}$	(b) Concave mirror
(C) $m=+2$	(c) Real image
(D) $m=+\frac{1}{2}$	(d) Virtual image

(1) A → c and d; B → b and d; C → b and c; D → a and d

(2) A → b and c; B → b and c; C → b and d; D → a and d

(3) A → a and c; B → a and d; C → a and b; D → c and d

(4) A → c and d; B → b and c; C → b and d; D → b and c

107. (2)

(A) → b, c; (B) → b, c (C)→ b, d (D) → a, d

108. A particle of mass 10 g moves along a circular of radius 64 cm with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to 8×10^{-4}J by the end of the second revolution after the beginning of the motion ?

(1) 0.2 m/s^2 (2) 0.1 m/s^2 (3) 0.15 m/s^2 (4) 0.18 m/s^2

108. (2)

$$\frac{1}{2}\times10\times10^{-3}\times v^2=8\times10^{-4}$$

$$V^2=16\times10^{-2}$$

$$V=4\times10^{-1}=0.4\,m/s$$

$0.4 \times 0.4 = 0 + 2 \times a \times 4\pi \times \frac{6.4}{100}$

$a = 0.1\ m/s^2$

109. A small signal voltage $V(t) = V_0 \sin \omega t$ is applied across and ideal capacitor C :

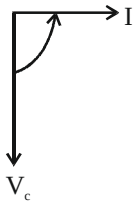
(1) Current I(t) leads voltage V(t) by 180°

(2) Current I(t), lags voltage V(t) by 90°

(3) Over a full cycle the capacitor C does not consume any energy from the voltage source. Current I(t) is in phase with voltage V(t).

(4) Current I(t) is in phase with voltage V(t)

109. (3)



$\text{Cos}\phi = 0$ so it will not consume energy

110. A disk and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first ?

(1) Depends on their masses (2) Disk

(3) Sphere (4) Both reach at the same time

110. (3)

$$a_c = \frac{F}{M}\left[\frac{1+{}^{r}/_{R}}{1+{}^{I_c}/_{MR^2}}\right] = g\sin\theta\left[\frac{1}{1+\frac{I_c}{MR^2}}\right]$$

Since sphere has less moment of inertia

So it reaches bottom first

111. Coefficient of linear expansion of brass and steel road are α_1 and α_2. Lengths of brass and steel rods are l_1 and l_2 respectively. If $(l_2 - l_1)$ is maintained same at all temperatures, which one of the following relations holds good ?

(1) $\alpha_1 l_1 = \alpha_2 l_2$ (2) $\alpha_1 l_2 = \alpha_2 l_1$ (3) $\alpha_1 l_2^2 = \alpha_2 l_1^2$ (4) $\alpha_1^2 l_2 = \alpha_2^2 l_1$

111. (1)

$l_1' = l_1(1 + \alpha_1 \Delta T)$

$l_2' = l_2(1 + \alpha_2 \Delta T)$

$l_1' = l_1 + l_1 \alpha_1 \Delta T$

$l_2' = l_2 + l_2 \alpha_2 \Delta T$

$l_1' - l_2' = l_1 - l_2 + (l_1\alpha_1 - l_2\alpha_2)\Delta T$

$l_1\alpha_1 = l_2\alpha_2$

112. A astronomical telescope has objective and eyepiece of focal lengths 40 cm and 4 cm respectively. To view an object 200 cm away from the objective, the lenses must be separated by a distance :

(1) 54.0 cm (2) 37.3 cm (3) 46.0 cm (4) 50.0 cm

112. (1)

$$\frac{1}{V} - \frac{1}{-200} = \frac{1}{40}$$

$$\frac{1}{V}=\frac{1}{40}=\frac{1}{200}=\frac{5-1}{200}=\frac{4}{200}=\frac{1}{50}$$

$V = 50$ cm

$50 + 4 = 54$ cm

113. A uniform circular disc of radius 50 cm at rest is free to turn about an axis which is perpendicular to its plane and passes through its centre. It is subjected to a torque which produces a constant angular acceleration of 2.0 rad s^{-2}. Its net acceleration in ms^{-2} at the end of 2.0 s is a approximately.

(1) 3.0 (2) 8.0 (3) 7.0 (4) 6.0

113. (2)

$\omega_f = \omega_i + \alpha t$

$= 0 + 2 \times 2 = 4$

$a_c = \omega^2 r = 4^2 \times ½ = 8$

114. A refrigerator works between 4°C and 30°C. It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power required is : (Take 1 cal = 4.2 Joules)

(1) 2365 W (2) 2.365 W (3) 23.65 W (4) 236.5 W

114. (4)

$$COP = \frac{T_2}{T_1 - T_2} = \frac{\text{Heat extracted}}{\text{input work}}$$

115. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process until its volume is again reduced to half. Then :

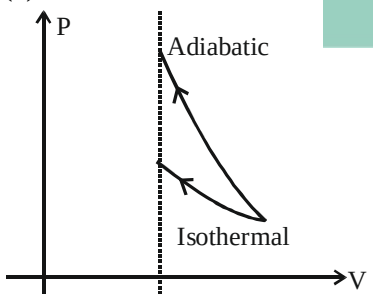
(1) Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas.

(2) Compressing the gas isothermally will require more work to be done.

(3) Compressing the gas through adiabatic process will require more work to be done.

(4) Compressing the gas isothermally or adiabatically will require the same amount of work.

115. (3)



116. The intensity at the maximum in a Young's double slit experiment is I_0. Distance between two slits is $d = \lambda$, where λ is the wavelength of light used in the experiment. What will be the intensity in front of one of the slits on the screen place at a distance D = 10d ?

(1) $\frac{I_0}{2}$ (2) I_0 (3) $\frac{I_0}{4}$ (4) –

116. (1)

$$I = I_{max}\cos^2\left(\frac{\pi y}{\beta}\right) \quad \Rightarrow \quad \beta = \frac{D\lambda}{d} = 10\lambda$$

y for a position in front of a slit

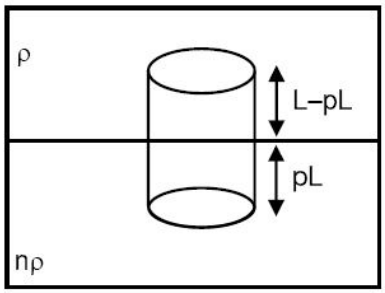
$$\frac{\beta}{2} = \left(\frac{5\lambda}{2}\right) = 2.5\lambda \quad \Rightarrow \quad I = I_0\cos^2\left(\frac{\pi(2.5\lambda)}{10\lambda}\right)$$

$$= I_0\cos^2\left(\frac{\pi}{4}\right) \quad = \frac{I_0}{2}$$

117. Two non-mixing liquids of densities ρ and $n\rho(n>1)$ are put in a container. The height of each liquid is h. A solid cylinder of length L and density d is put in this container. The cylinder floats with its axis vertical and length $pL(p<1)$ in the denser liquid. The density d is equal to :

(1) $\{1+(n-1)\}p/\rho$ (2) $\{1+(n+1)\}p/\rho$ (3) $\{2+(n+1)\}p/\rho$ (4) $\{2+(n-1)\}p/\rho$

117. (1)



wt of body = upthrust by the two liquids

If A = Area of section then

$(d\ A.L)\ g = [\rho A\ (L - pL) + n\rho\ ApL]\ g$

On solving

$\Rightarrow \quad d = (1+(n-1)p)\rho$

118. Consider the junction diode as ideal. The value of current flowing through AB is :

(1) 10^{-3} A (2) 0 A (3) 10^{-2} A (4) 10^{-1} A

118. (3)

For diode as ideal

$$i = \frac{\Delta V}{R} = \frac{4-(-6)}{10^3} = 10^{-2}\ A$$

119. A car is negotiating a curved road of radius R. The road is banked at an angle θ. The coefficient of friction between the tyres of the car and the road is μ_s. The maximum safe velocity on this road is :

(1) $\sqrt{\frac{g}{R^2}\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$ (2) $\sqrt{gR^2\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$ (3) $\sqrt{gR\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$ (4) $\sqrt{\frac{g}{R}\frac{\mu_s+\tan\theta}{1-\mu_s\tan\theta}}$

119. (3)

For maximum speed the tendency of body is to slip up the incline

$$\text{hence } \frac{V_{max}^2}{Rg} = \frac{\tan\theta+\mu}{1-\mu\tan\theta}$$

$$\text{or } V_{max} = \sqrt{Rg\left(\frac{\tan\theta+\mu}{1-\mu\tan\theta}\right)}$$

120. A long straight wire of radius a carries a steady current I. The current uniformly distributed over its cross – section. The ratio of the magnetic fields B and B' , at radial distances $\frac{a}{2}$ and 2a respectively, form the axis of the wire is :

(1) 4 (2) $\frac{1}{4}$ (3) $\frac{1}{2}$ (4) 1

120. (4)

121. Given the value of Rydberg constant is 10^7 m^{-1}, the wave number of the last line of the Balmer series in hydrogen spectrum will be:

(1) 2.5×10^7 m^{-1} (2) 0.025×10^4 m^{-1} (3) 0.5×10^7 m^{-1} (4) 0.25×10^7 m^{-1}

121. (4)

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{\infty^2}\right) \quad \Rightarrow \quad \text{wave number} = \frac{10^7\ m^{-1}}{4}$$

122. Ii the velocity of a particle is $v = At + Bt^2$, where A and B are constants, then the distance travelled by it between Is and 2s is :

(1) $\frac{A}{B} + \frac{B}{3}$ (2) $\frac{3}{2}A + 4B$ (3) $3A + 7B$ (4) $\frac{3}{2}A + \frac{7}{3}B$

122. (4)

Distance

$$s = \int_1^2 v\,dt = \int_1^2 At + Bt^2$$

$$= \frac{3A}{2} + \frac{7B}{3}$$

123. The angle of incidence for a rayof lightata refracting surface of a prism is 45°. The angle of prism is 60°. If the ray suffers minimum deviation through the prism, the angle of minimum deviation and refractive index of the material of the prism respectively, are

(1) $30°; \frac{1}{\sqrt{2}}$ (2) $45°; \frac{1}{\sqrt{2}}$ (3) $30°; \sqrt{2}$ (4) $45°; \sqrt{2}$

123. (3)

Give A = 60 and i = e = 60

$\delta_{min} = i + e - A = 45 + 45 - 60 = 30$

$$\mu = \frac{\sin\left(\frac{\delta_m + A}{2}\right)}{\sin\left(\frac{A}{2}\right)} = \sqrt{2}$$

124. 124. The molecules of a given mass of a gas have r.m.s. velocity of 200 ms^{-1} at 27°C and 1.0×10^5 Nm^{-2} pressure. When the temperature and pressure of the gas are respectively, 127°C and 0.05×10^5 Nm^{-2}. the r.m.s. velocity of its molecules in ms^{-1} is:

(1) $\frac{100}{3}$ (2) $100\sqrt{2}$ (3) $\frac{400}{\sqrt{3}}$ (4) $\frac{100\sqrt{2}}{3}$

124. (3)

$$V_{RMS} = \sqrt{\frac{3RT}{Mo}}$$

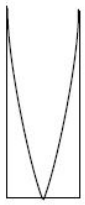
$$\frac{V_1}{V_2} = \sqrt{\frac{T_1}{T_2}}$$

$$\frac{200}{V_2} = \sqrt{\frac{300}{400}} \Rightarrow V_2 = \frac{400}{\sqrt{3}}$$

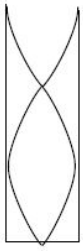
125. An air column, closed at one end and open at the other, resonates with a tuning fork when the smallest length of the column is 50 cm. The next larger length of the column resonating with the same tuning fork is:

(1) 200 cm (2) 66.7 cm (3) 100 cm (4) 150 cm

125. (4)



First harmonic at $\frac{\lambda}{4}$



3rd harmonic $\frac{3\lambda}{4}$

1st length = 50 cm

3rd harmonic length 150 cm

126. The magnetic susceptibility is negative for :

(1) paramagnetic and ferromagnetic materials (2) diamagnetic material only

(3) paramagnetic material only (4) ferromagnetic material only

126. (2)

Theory

127. An electron or mass m and a photon have same energy E The ratio of de-Broglie wavelengths associated with them is

(1) $\frac{1}{c}\left(\frac{2m}{E}\right)^{\frac{1}{2}}$ (2) $\frac{1}{c}\left(\frac{E}{2m}\right)^{\frac{1}{2}}$ (3) $\left(\frac{E}{2m}\right)^{\frac{1}{2}}$ (4) $c(2eE)^{\frac{1}{2}}$

127. (2)

$\lambda_{electron} = \frac{h}{\sqrt{2ME}}$ ...(1)

For λ_{photon}

$E = h\nu = \frac{hc}{\lambda_{photon}}$ ...(2)

from these two ratio obtained by dividing these (2)

$\lambda_1 : \lambda_2 = \frac{1}{c}\left[\frac{E}{2M}\right]^{1/2}$

128. A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F} = (2t\hat{i} + 3t^2\hat{j})N$, where $\hat{i}$ and $\hat{j}$ are unit vectors along x and y axis. What power will be developed by the force at the time t?

(1) $(2t + 3t^5)W$ (2) $(2t^2+3t^3)W$ (3) $(2t^2+4t^4)$ W (4) $(2t^3+3t^4)W$

128. (1)

$M = 1$ kg

$a = \frac{F}{M} = \frac{2t}{(1)}\hat{i} + \frac{3t^2}{1}\hat{j}$

$V = \int adt = \int 2t\,dt\ 1 + \int 3t^2 dt$

$V = t^2\ \hat{i} + t^3\hat{j}$

$Power = F.V. = (2ti + 3t^2\hat{j}).(t^2\ i + t^3\hat{j})$

$power = 2t^3 + 3t^5$

129, The charge flowing through a resistance R varies with time t as $Q=at - bt^2$, where a and b are positive constants The total heat produced in R is :

(1) $\frac{a^3R}{b}$ (2) $\frac{a^3R}{6b}$ (3) $\frac{a^3R}{3b}$ (4) $\frac{a^3R}{2b}$

129. (2)

$Q = at - bt^2$

$i = \frac{dQ}{dt} = a - 2bt$ $\qquad i = 0\ t = \frac{a}{2b}$

$H = \int_0^t i^2Rdt = \frac{a^3R}{6b} \quad \Rightarrow \quad \int_0^t I^2\,Rdt$

$it = \int_0^{a/2b} (a-2bt)^2Rdt = = a^2t + \frac{4b^2t^3}{3} - \frac{4bat^2}{2}$

$Put\ t = \frac{a}{2b} \quad \Rightarrow \quad H = \frac{a^3R}{6b}$

130. A npn transistor is connected in common emitter configuration in a given amplifier. A load resistanc e of 800 Ω is connected in the collector circuit and the voltage drop across-it is 0.8 V. If the current amplification factor is 0.96 and the input resistance
of the circuit is 192 Ω, the voltage gain and the power gain of the amplifier will respectively be:

(1) 4,3.69 (2) 4, 3.84 (3) 3.69,3.84 (4) 4, 4

130. (2) Voltage gain = [current gain] [resistance gain]

$[.96]\ \frac{800}{192}$

power gain = [current gain] [resistance gain]

[.96] [4] = 3.84

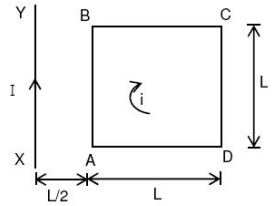
131. A piece of ice falls from a height h so that it melts com pletely. Only one - quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of h is:
[Latent heat of ice is 3.4×10^5 J/ kg and g = 10 N/ kg]

(1) 68 km (2) 34km (3) 544km (4) 136 km

131. (4) $\frac{Mgh}{4} = mL$

$h = \frac{4L}{g} = 136\ km$

132. A square loop A BCD carrying a current i, is placed near and coplanar with a long straight conductor XV carrying a current I, the net force on the loop will



(1) $\frac{\mu_0 IiL}{2\pi}$ (2) $\frac{2\mu_0 Ii}{2\pi}$ (3) $\frac{\mu_0 Ii}{2\pi}$ (4) $\frac{2\mu_0 IiL}{3\pi}$

132. (2)

F_{BC} cancels F_{AD}

$F_{Net} = F_{AB} - F_{CD} = \frac{\mu_0 IiL}{2\pi\left(\frac{L}{2}\right)} - \frac{\mu_0 IiL}{2\pi\left(\frac{3L}{2}\right)} = \frac{2\mu_0 Ji}{3\pi} = \frac{2\mu_0 Ii}{3\pi}$

133. A uniform rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_2, is attached to the free end of the rope. A trans verse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the puLse when it reaches the top of the rope is A_2. The ratio λ_2/λ_1 is:

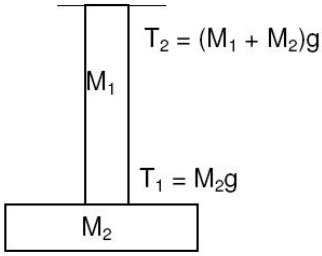
(1) $\sqrt{\frac{m_1 + m_2}{m_1}}$ (2) $\sqrt{\frac{m_1}{m_2}}$ (3) $\sqrt{\frac{m_1 + m_2}{m_2}}$ (4) $\sqrt{\frac{m_2}{m_1}}$

133. (3)

$\lambda \propto v \propto \sqrt{\frac{T}{m/\ell}}$

$\lambda_1 \propto \sqrt{M_2}$ Tension = M_2g

$\lambda_2 \propto \sqrt{M_2 + M_1}$ Tension = M_2g



$\frac{\lambda_2}{\lambda_1} = \sqrt{\frac{M_1 + M_2}{M_2}}$

134. A black body is at a temperature of 5760 K. The energy of radiation emitted by the body at wavelength 250 nm is U_1, at wavelength 500 nm is U_2 and that at 1000 nm is U_3. Wien's constant, b = 2.88x 10® nmK. Which of the following is correct ?

(1) $U_2 > U_1$ (2) $U_1 = 0$ (3) $U_3 = 0$ (4) $U_1 > U_2$

134. (4)

$\lambda_{min} T = b$

$\lambda \propto \frac{1}{T}$

$u \propto (T)^4 \propto \frac{1}{(\lambda)^4}$

so

$u_1 > u_2$

135. Out of the following options which one can be used to produces propagating electromagnetic wave?

(1) An accelerating charge (2) A charge moving at constant velocity

(3) A stationary charge (4) A chargeless particle

135. (1)

Theory

136. Which one of the following characteristics is associated with adsorption?

(1) ΔG and ΔS are negative but ΔH is positive (2) ΔG is negative but ΔH and ΔS are positive

(3) ΔG, ΔH and ΔS all are negative (4) ΔG and ΔH are negative but ΔS is positive

136. (3)

Sol. The physical and chemical adsorption is accompanied with decrease in FREE ENERGY, ENTHALPY and ENTROPY.

137. The pressure of H_2 required to make the potential of H_2-electrode zero in pure water at 298 K is

(1) 10^{-4} atm (2) 10^{-14} atm (3) 10^{-12} atm (4) 10^{-10} atm

137. (2)

Sol. Hydrogen ion concentration in pure water at 298 K = 10^{-7}m. Reduction potential of hydrogen electrode is given by.

$$E_{H^+/H_2} = -\frac{0.0591}{2}\log\frac{P_{H_2}}{\left[H^+\right]^2}$$

$$E_{H^+/H_2} = 0 \text{ if } P_{H_2} = \left[H\right]^2 = 10^{-14}\text{atm}$$

138. The addition of a catalyst during a chemical reaction alters which of the following quantities?

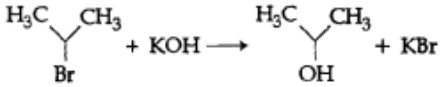
(1) Activation energy (2) Entropy (3) Internal energy (4) Enthalpy

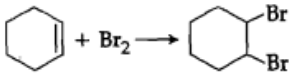
138. (1)

Sol. The addition of a catalyst during a chemical reaction alters the activation energy.

139. For the following reactions

(1) $CH_3CH_2CH_2Br + KOH \rightarrow CH_3CH = CH_2 + KBr + H_2O$

(2) 

(3) 

Which of the following statements is correct?

(1) (a) is substitution, (b) and (c) are addition reactions.

(2) (a) and (b) are elimination reactions and (c) is addition reaction.

(3) (a) is elimination, (b) is substitution and (c) is addition reaction.

(4) (a) is elimination, (b) and (c) are substitution reactions.

139. (3)

Sol. Reactions (a), (b) and (c) are elimination, substitution and addition respectively.

140. The product formed by the reaction of an aldehyde with a primary amine is

(1) Aromatic acid (2) Schiff base (3) Ketone (4) Carboxylic acid

140. (2)

Sol. Aldehyde reacts with a primary amine to form schiff base

$$R - CH = O + H_2N - R' \longrightarrow R - \underset{(\text{Schiff base})}{CH = N} - R' + H_2O$$

141. The correct statement regarding the basicity of arylamines is

(1) Arylamines are generally more basic than alkylamines, because the nitrogen atom in arylamines is sp-hybridized.

(2) Arylamines are generally less basic than alkylamines because the nitrogen lone-pair electrons are delocalized by interaction with the aromatic ring π electron system.

(3) Arylamines are generally more basic than alkylamines because the nitrogen lone-pair electrons are not delocalized by interaction with the aromatic ring π electron system.

(4) Arylamines are generally more basic than alkylamines because of aryl group.

141. (2)

Sol. Arylamines are less basic than alkylamines because the lone pair of electrons on N-atom is involved in resonance with the benzene ring.

142. Equal moles of hydrogen and oxygen gases are placed in a container with a pin-hole through which both can escape. What fraction of the oxygen escapes in the time required for one-half of the hydrogen to escape?

(1) 1/2 (2) 1/8 (3) 1/4 (4) 3/8

142. (2)

Sol. Let the initial moles of each of H_2 and O_2 be 1. Number of moles of H_2 diffused in certain time = 0.5. Number of moles of O_2 diffused (say x) in the same time is given by $\frac{r_{O_2}}{r_{H_2}} = \frac{x}{0.5} = \frac{\sqrt{2}}{\sqrt{32}} = \frac{1}{4} \Rightarrow = \frac{1}{8}$

143. The correct statement regarding the comparison of staggered and eclipsed conformations of ethane, is

(1) The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.

(2) The staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain.

(3) The eclipsed conformation of ethane is more stable than staggered conformation, because eclipsed conformation has no torsional strain.

(4) The eclipsed conformation of ethane is more stable than staggered conformation even through the eclipsed conformation has torsional strain.

143. (1)

Sol. The staggered conformation of ethane is more stable than eclipsed conformation because staggered conformation has no torsional strain.

144. In which of the following options the order of arrangement does not agree with the variation of property indicated against it?

(1) Li < Na < K < Rb (increasing metallic radius)

(2) Al^{3} + < Mg^{2+} < Na^{+} < F^{-} (increasing ionic size)

(3) B < C < N < O (increasing first ionisation enthalpy)

(4) I < Br < Cl < F (increasing electron gain enthalpy)

144. (3 & 4)

Sol. The correct order of first ionisation enthalpy is B < C < O < N

The correct order of electron gain enthalpy is I < Br < F < Cl

145. The rate of a first-order reaction is 0.04 mol $l^{-1}s^{-1}$ at 10 seconds are 0.03 mol $l^{-1}s^{-1}$ at 20 seconds after initiation of the reaction. The half-life period of the reaction is

(1) 54.1 s (2) 24.1 s (3) 34.1 s (4) 44.1 s

145. (2)

Sol. Rate of a first order reaction at 10 min and 20 min is given by

$R_{10} = k[A]_{10} = 0.04$ mol L^{-1} s^{-1}

$R_{20} = k[A]_{20} = 0.03$ mol $L^{-1}s^{-1}$

$$\frac{[A]_{10}}{[A]_{20}} = \frac{4}{3} = e^{(20-10)k} = e^{10k}$$

On solving, $k = \frac{2.303 \times 0.125}{10} s^{-1}$

Half life, $f_{1/2} = \frac{0.693 \times 10}{2.303 \times 0.125} = 24.1 s$

146. When copper is heated with conc. HNO_3 it produces :

(1) $Cu(NO_3)_2$ and N_2O (2) $Cu(NO_3)_2$ and NO_2

(3) $Cu(NO_3)_2$ and NO (4) $Cu(NO_3)_2$, NO and NO=2

146. (2)

Sol. Copper reacts with conc. HNO_3 to give $Cu(NO_3)_2$ and NO_2

$$Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$$

147. In a protein molecule various amino acids are linked together by

(1) dative bond (2) α-glycosidic bond (3) β-glycosidic bond (4) peptide bond

147. (4)

Sol. In a protein molecule various amino acids are linked together by peptide bond.

148. Fog is a colloidal solution of

(1) Gas in gas (2) Liquid in gas (3) Gas in liquid (4) solid in gas

148. (2)

Sol. Fog is a colloid of liquid dispersed in gas.

149. Match items of Column I with the items Column II and assign the correct code

Column I	**Column II**
(a) Cyanide process	(i) Ultrapure Ge
(b) Froth floatation process	(ii) Dressing of ZnS
(c) Electrolytic reduction	(iii) Extraction of A
(d) Zone refining	(iv) Extraction of A
	(v) Purification of

Code

	(a)	(b)	(c)	(d)
(1)	(iii),	(iv),	(v),	(i)
(2)	(iv),	(ii),	(iii),	(i)
(3)	(ii),	(iii),	(i),	(v)
(4)	(i),	(ii),	(iii),	(iv)

149. (2)

Sol. (a) cyanide process is applicable for Au

(b) Froth floatation process is applicable for sulphide ores like ZnS.

(c) Electrolytic reduction is done for 'Al'

(d) Zone refining process is used for the extraction of ultrapure metals like Ge, Si, etc.

150. Which one given below is a non-reducing sugar?

(1) Sucrose (2) Maltose (3) Lactose (4) Glucose

150. (1)

Sol. Sucrose is a non reducing sugar.

151. The correct statement regarding RNA and DNA respectively is

(1) The sugar component in RNA 2'-deoxyribose and the sugar component DNA is arabinose.

(2) The sugar component in RNA is arabinose and the sugar component in DNA is 2'-deoxyribose

(3) The sugar component in RNA is ribose the sugar component in DNA 2'-deoxyribose.

(4) The sugar component in RNA is arabinose and the sugar component in DNA is ribose

151. (3)

Sol. The sugar in RNA is ribose and the sugar in DNA is 2'-deoxyribose.

152. The correct thermodynamic conditions for spontaneous reaction at all temperatures is

(1) $\Delta H < 0$ and $\Delta S < 0$ (2) $\Delta H <$ and $\Delta S = 0$ (3) $\Delta H > 0$ and $\Delta S < 0$ (4) $\Delta H < 0$ and $\Delta S > 0$

152. (4)

Sol. $\Delta G = \Delta H - T\Delta S$

For a spontaneous process, $\Delta G = -ve$. So, $\Delta H < 0$ and $\Delta S > 0$

153. Which is the correct statement for the given acids?

(1) Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid

(2) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid

(3) Both are diprotic acids

(4) Both are triprotic acids.

153. (2)

Sol. Phosphinic acid (H_3PO_2) is monoprotic acid and phosphonic acid (H_3PO_3) is diprotic acid.

154. MY and NY_3, two nearly insoluble salts, have the same K_{sp} values of 6.2×10^{-13} at room temperature. Which statement would be true in regard to MY and NY_3?

(1) The addition of the salt of KY to solution of MY and NY_3 will have no effect on their solubilities.

(2) The molar solubilities of MY and NY_3 in water are identical.

(3) The molar solubility of MY in water is less than that of NY_3.

(4) The salts MY and NY_3 are more soluble in 0.5 M KY than in pure water.

154. (3)

Sol. If s and s' are the solubilities of MY and NY_3 respectively, then

$$s = \sqrt{6.2 \times 10^{-13}} = 7.87 \times 10^{-7}\,M$$

$$s' = \left(\frac{6.2 \times 10^{-13}}{27}\right)^{1/4} = 3.89 \times 10^{-4}\,M$$

155. Which of the following is an analgesic?

(1) Chloromycetin (2) Novalgin (3) Penicillin (4) Streptomycin

155. (2)

Sol. Novalgin is analgesic, rest are antibiotics.

156. The pair of electron in the given carbanion, $CH_3C \equiv C^{\ominus}$, is present in which of the following orbitals?

(1) sp (2) 2p (3) sp^3 (4) sp^2

156. (1)

Sol. $CH_3 - \underset{\text{Hybridization sp}}{C \equiv C^{\ominus}}$ (⇅)

The lone pair is present in 'sp' hybridized orbital of 'C'.

157. Among the following, the correct order of acidity is

(1) $HClO_4 < HClO_2 < HClO < HClO_3$ (2) $HClO_3 < HClO_4 < HClO_2 < HClO$

(3) $HClO < HClO_2 < HClO_3 < HClO_4$ (4) $HClO_2 < HClO < HClO_3 < HClO_4$

157. (3)

Sol. Stability of conjugate base :

$$\bar{C}lO_4^- > \bar{C}lO_3^- > \bar{C}lO_2^- > \bar{C}lO^-$$

158. Which one of the following statements is correct when SO_2 is passed through acidified $K_2Cr_2O_7$ solution?

(1) Green $Cr_2(SO_4)_3$ is formed. (2) The solution turns blue

(3) The solution is decolourized (4) SO_2 is reduced

158. (1)

Sol. $$K_2Cr_2O_7 + H_2SO_4 + 3SO_2 \longrightarrow \underset{(\text{green})}{Cr_2(SO_4)_3} + K_2SO_4 + H_2O$$

159. Predict the correct order among the following

(1) lone pair – bond pair > bond pair – bond pair > lone pair – lone pair

(2) lone pair – lone pair > lone pair – bond pair > bond pair – bond pair

(3) lone pair – lone pair > bond pair – bond pair > lone pair – bond pair

(4) bond pair – bond pair > lone pair – bond pair > lone pair – lone pair

159. (2)

Sol. According to VSEPR theory : lone pair – lone pair > lone pair – bond pair > bond pair – bond pair

160. Two electrons occupying the same orbital are distinguished by

(1) Spin quantum number (2) Principal quantum number

(3) Magnetic quantum number (4) Azimuthal quantum number

160. (1)

Sol. $m_s = \pm\frac{1}{2}$ for 2 electrons having rest same quantum numbers.

According to Pauli's exclusion principle, no two electrons of same spin can occupy the same orbital.

161. The product obtained as a result of a reaction of nitrogen with CaC_2 is

(1) Ca_2CN (2) $Ca(CN)_2$ (3) $CaCN$ (4) $CaCN_3$

161. (Bonus)

Sol. $CaC_2 + N_2 \longrightarrow CaCN_2 + C$

162. Natural rubber has

(1) Random cis-and trans-configuration (2) All cis-configuration

(3) All trans-configuration (4) Alternate cis-and trans – configuration

162. (2)

Sol. Natural rubber is polymer of Cis-isoprene units.

163. Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules?

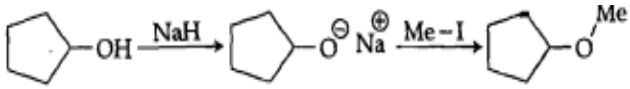
(1) $F_2 > Cl_2 > Br_2 > I_2$ (2) $I_2 > Br_2 > Cl_2 > F_2$ (3) $Cl_2 > Br_2 > F_2 > I_2$ (4) $Br_2 > I_2 > F_2 > Cl_2$

163. (3)

Sol. Bond dissociation energy

	Cl_2	>	Br_2	>	F_2	>	I_2
B.E (kJ / mol)	242.6		192.8		158.8		151.1

164. The reaction



Can be classified as

(1) Williamson alcohol synthesis reaction (2) Williamson ether synthesis reaction

(3) Alcohol formation reaction (4) Dehydration reaction

164. (2)

Sol. $ROH \xrightarrow{NaH} RO^- \xrightarrow{R'-X} R-O-R'$

The given reaction is Williamson ether synthesis.

165. Lithium has a bcc structure. Its density is 530 kg m^{-3} and its atomic mass is 6.94 g mol^{-1}. Calculate the edge length of a unit cell of Lithium metal. ($N_A = 6.02 \times 10^{23}$ mol^{-1})

(1) 264 pm (2) 154 pm (3) 352 pm (4) 527 pm

165. (3)

Sol. $d = \frac{Z \times M}{a^3 \times N_A}$

$a^3 = \frac{2 \times 6.94}{530 \times 10^{-3} \times 6.02 \times 10^{23}} = \frac{13.88}{530 \times 10^{-3} \times 6.02 \times 10^{23}}$

$a = 352pm$

166. The ionic radii of A^+ and B^- ions are 0.98×10^{-10} m and 1.81×10^{-10}m. The coordination number of each ion in AB is

(1) 2 (2) 6 (3) 4 (4) 8

166. (2)

Sol. $\frac{r^+}{r^-} = 0.54 \Rightarrow C.N = 6$

167. At 100°C the vapour pressure of a solution of 6.5 g of a solute in 100 g water is 732 mm. If $K_b = 0.52$, the boiling point of this solution will be

(1) 103°C (2) 101°C (3) 100°C (4) 102°C

167. (2)

Sol. $\frac{P^o - P_s}{P_s} = \frac{n_{solute}}{n_{solvent}} = \frac{6.5/M}{100/18}$

$\frac{760-732}{732} = \frac{6.5\times 18}{100\times M}$

$M = \frac{6.5\times 18\times 732}{28\times 100} = 30.58$

$\Delta T_b = K_b.m = 0.52\times \frac{6.5}{\frac{30.58}{0.1}} = 1.1^oC$

$T_b = 101.1^oC$

168. The electronic configurations of Eu (Atomic No. 63), Gd(Atomic No. 64) and Tb (atomic No. 65) are

(1) $[Xe]4f^7 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

(2) $[Xe]4f^7 6s^2$, $[Xe]4f^8 6d^1 6s^2$ and $[Xe]4f^8 5d^1 6s^2$

(3) $[Xe]4f^6 5d^1 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^9 6s^2$

(4) $[Xe]4f^6 5d^1 6s^2$, $[Xe]4f^7 5d^1 6s^2$ and $[Xe]4f^8 5d^1 6s^2$

168. (1)

Sol. Stability of half filled '*f* 'sub-shell.

169. Which of the following statements about hydrogen is incorrect?

(1) Dihydrogen does not act as a reducing agent

(2) Hydrogen has three isotopes of which tritium is the most common

(3) Hydrogen never acts as cation in ionic salts.

(4) Hydronium ion, H_3O^+ exists freely in solution.

169. (1 & 2)

170. In the reaction $H-C\equiv CH \xrightarrow[(2)CH_3CH_2Br]{(1)NaNH_2/liq.NH_3} X \xrightarrow[(2)CH_3CH_2Br]{(1)NaNH_2/liq.NH_3} Y$, X and Y are

(1) X = 1-Butyne; Y = 2-Hexyne (2) X = 1-Butyne; Y = 3-Hexyne

(3) X = 2-Butyne; Y = 3-Hexyne (4) X = 2-Butyne; Y = 2-Hexyne

170. (2)

Sol. $H-C\equiv CH \xrightarrow{(1)NaNH_2/liq.NH_3} H-C\equiv C^- \xrightarrow{(2)CH_3CH_2Br} H-C\equiv C-CH_2-CH_3$

$\xrightarrow{(1)NaNH_2/liq.NH_3} {}^-C\equiv C-CH_2-CH_3 \xrightarrow{(2)CH_3CH_2Br} CH_3-CH_2-C\equiv C-CH_2-CH_3\,(Y)$

171. Consider the following liquid – vapour equilibrium.

$$Liquid \rightleftharpoons Vapour$$

Which of the following relations is correct?

(1) $\frac{d\ln P}{dT} = \frac{\Delta H_v}{RT^2}$ (2) $\frac{d\ln G}{dT^2} = \frac{\Delta H_v}{RT^2}$ (3) $\frac{d\ln P}{dT} = \frac{-\Delta H_v}{RT}$ (4) $\frac{d\ln P}{dT^2} = \frac{-\Delta H_v}{T^2}$

171. (1)

Sol. $\frac{d\ln P}{dT} = \frac{\Delta H_v}{RT^2}$ [Clausius – Clapeyron equation]

172. Which of the following statements about the composition of the vapour over an ideal 1 : 1 molar mixture of benzene and toluene is correct? Assume that the temperature is constant at 25°C. (Given, Vapour pressure data at 25°C, benzene = 12.8 kPa, toluene = 3.85 kPa)

(1) Not enough information is given to make a prediction

(2) The vapour will contain a higher percentage of benzene

(3) The vapour will contain a higher percentage of toluene

(4) The vapour will contain equal amounts of benzene and toluene.

172. (2)

Sol. $y_B = \frac{p_B}{p_T} = \frac{p_B^0 X_B}{p_A^0 X_A + p_B^0 X_B}$

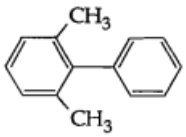
$y_{Benzene} = \frac{12.8 \times \frac{1}{2}}{\frac{1}{2}(12.8 + 3.85)}$

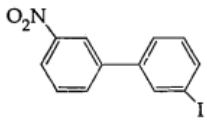
$y_{Benzene} = 0.77$

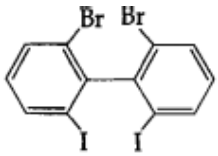
$y_{toluene} = 0.23$

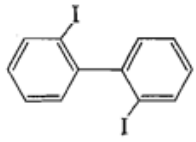
$\therefore y_{Benzene} > y_{Toluene}$

173. Which of the following biphenyls is optically active?

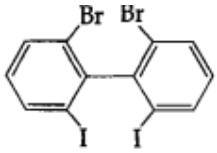
(1) 

(2) 

(3) 

(4) 

173. (3)

Sol. 

It has no plane of sym and centre of sym.

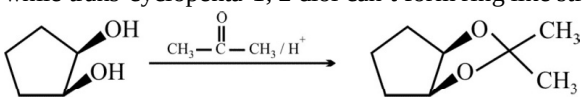
174. Which of the following reagents would distinguish cis-cyclopenta-1, 2-diol from the trans-isomer?

(1) Aluminium isopropoxide (2) Acetone

(3) Ozone (4) MnO_2

174. (2)

Sol. Cis-cyclopenta-1, 2 diol forms a ring like structure called isopropylidene derivative with acetone in acidic medium, while trans-cyclopenta-1, 2 diol can't form ring like structure.



175. The correct statement regarding a carbonyl compound with a hydrogen atom on its alphacarbon, is

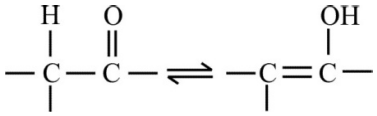
(1) A carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as keto-enol tautomerism.

(2) A carbonyl compound with a hydrogen atom on its alpha-carbon never equilibrates with its corresponding enol.

(3) A carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as aldehyde-ketone equilibration.

(4) A carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as carbonylation.

175. (1)

Sol. 

Carbonyl compounds with α-hydrogen atom readily equilibrates into its enol form due to acidic nature of α-hydrogen atom. This is known as keto-enol tautomerism.

176. Consider the molecules CH_4, NH_3 and H_2O. Which of the given statements is false?

(1) The H – C – H bond angle in CH_4 is larger than the H – N – H bond angle in NH_3

(2) The H – C – H bond angle in CH_4, the H – N – H bond angle in NH_3, and the H – O – H bond angle in H_2O are all greater than 90°.

(3) The H – O – H bond angle in H_2O is larger than the H – C – H bond angle in CH_4

(4) The H – O – H bond angle in H_2O is smaller than the H – N – H bond angle in NH_3.

176. (3)

Sol.

Molecule	CH_4	NH_3	H_2O
Bond angle	109.5°	107°	104.5°

177. Match the compounds given in Column I with the hybridisation and shape given in Column II and mark the correct option

Column I	**Column II**
(a) XeF_6	(i) Distorted octahedral
(b) XeO_3	(ii) Square planar
(c) $XeOF_4$	(iii) Pyramidal
(d) XeF_4	(iv) Square pyramidal

Code

	(a)	(b)	(c)	(d)
(1)	(iv)	(i)	(ii)	(iii)
(2)	(i)	(iii)	(iv)	(ii)
(3)	(i)	(ii)	(iv)	(iii)
(4)	(iv)	(iii)	(i)	(ii)

177. (2)

Sol. (a) XeF_6 : H = sp^3d^3; 6B.P + 1 L.P – distorted octahedral

(b) XeO_3 : H = sp^3 ; 3B.P + 1 LP – Pyramidal

(c) $XeOF_4$: H = sp^3d^2 ; 5B.P + 1 LP – square pyramidal

(d) XeF_4 : H = sp^3d^2 : 4B.P + 2LP – square planar

178. Consider the nitration of benzene using mixed conc. H_2SO_4 and HNO_3. If a large amount of $KHSO_4$ is added to the mixture, the rate of nitration will be

(1) Doubled (2) Faster (3) Slower (4) Unchanged

178. (3)

Sol. Addition of large amount of $KHSO_4$ to the nitrating mixture reduces the rate of nitration by lowering the conc. of NO_2^+ ion.

179. Which of the following statements is false?

(1) Mg^{2+} ions are important in the green parts of plants.

(2) Mg^{2+} ions form a complex with ATP

(3) Ca^{2+} ions are important in blood clotting

(4) Ca^{2+} ions are not important in maintaining the regular beating of the heart.

179. (4)

Sol. Ca^{2+} ions are important in maintaining the regular heart beat.

180. Which of the following has longest C – O bond length? (Free C – O bond length in CO is 1.128 Å).

(1) $\left[Mn(CO)_6\right]^+$ (2) $Ni(CO)_4$ (3) $\left[Co(CO)_4\right]^{\ominus}$ (4) $\left[Fe(CO)_4\right]^{2-}$

180. (4)

Sol. Since Fe in $[Fe(CO_4]^{2-}$ has 2 –ve charges, its tendency to use its filled orbital to overlap with the vacant anti-bonding MO of CO is high, so C — O bond length in this complex is the longest.