

## **Botany - Section A**

1.

Which of the following is not a characteristic of facilitated transport in plants?

1. Requirement of special membrane proteins
2. Being non-selective
3. Transport saturates
4. It is a downhill transport

2.

The enzyme recombinase is required at which stage of meiosis?

1. Pachytene
2. Zygotene
3. Diplotene
4. Diakinesis

3.

During which stage of sewage treatment microbes are used?

1. Primary treatment
2. Secondary treatment
3. Tertiary treatment
4. All of these

4.

Pollen tube releases the two male gamete into the:

1. One male gamete in cytoplasm of synergids and other in cytoplasm of central cell
2. Both in cytoplasm of central cell
3. Cytoplasm of Antipodal cell
4. Both in cytoplasm of synergids

5.

Mycoplasma are not possessing which of the following features?

1. Lack cell wall
2. Pleomorphic
3. Can't survive without oxygen
4. Except 2 all are correct

6.

Slime moulds are/have

1. Saprophytes
2. Plasmodium under unfavorable conditions
3. No walls in spores
4. More than one option is correct

7.

Which of the following is a variety of cauliflower?

1. Himgiri
2. Pusa swarnim
3. Pusa snowball K-1
4. Pusa Komal

8.

Net primary productivity

1. For oceans is 60% of biosphere productivity
2. Depends upon photosynthetic capacity of producers.
3. Remains constant in temperate area throughout the year
4. Is limited by light in marine habitats only

9.

Which of the following is not a part of dissolved materials in waste water?

1. Nitrate
2. Ammonia, sodium
3. Phosphate, calcium
4. Bacteria

10.

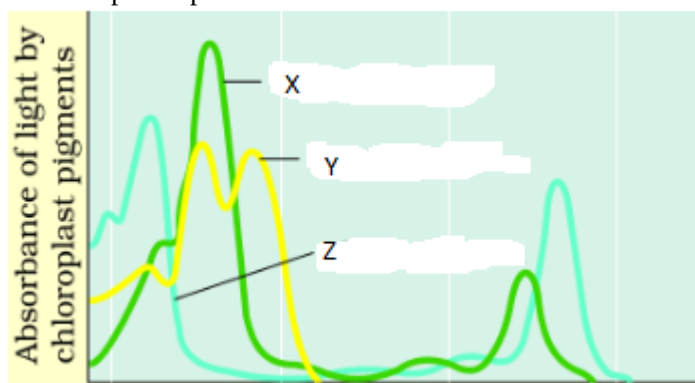
Consider the following statements regarding fermentation of glucose -

- I. There is a partial breakdown of glucose
  - II. There is no gain of ATP
  - III. NADH is oxidized to  $\text{NAD}^+$  slowly
- Which of the above statements are true?

1. I and II only
2. I and III only
3. II and III only
4. I, II, and III

11.

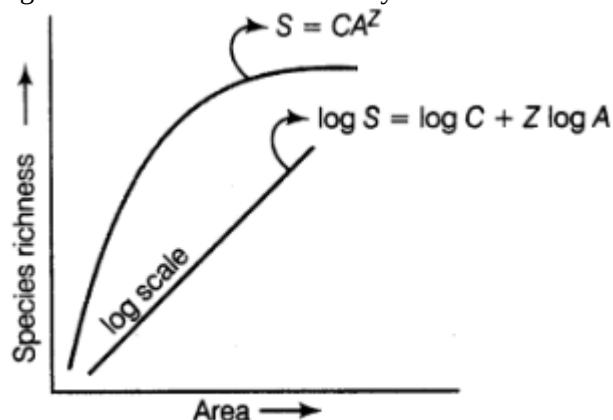
In the given diagram X, Y and Z respectively represent the absorption spectrum of:



1. Chlorophyll a, Chlorophyll b and Carotenoids
2. Chlorophyll b, Chlorophyll a and Carotenoids
3. Chlorophyll b, Carotenoids and Chlorophyll a
4. Chlorophyll a, Carotenoids and Chlorophyll b

12.

The following graph shows the species area relationship. Regression coefficient if shown by:

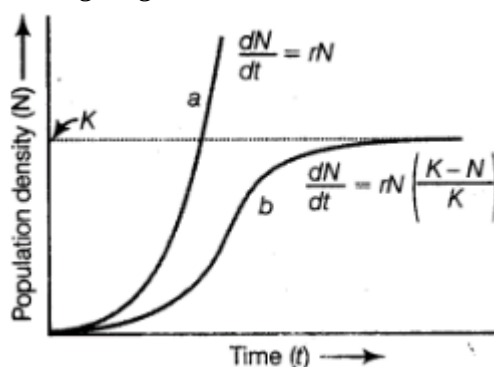


Showing species area relationship

1. S
2. C
3. Z
4. log S

13.

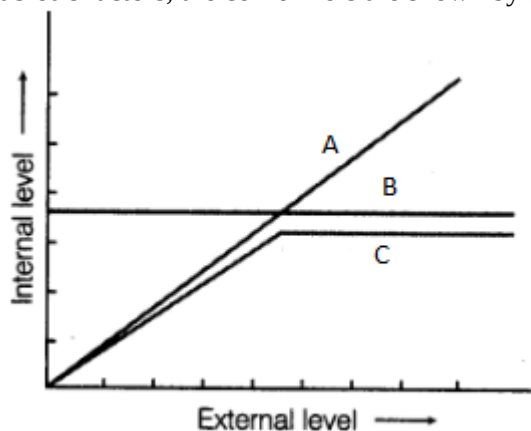
What is true about the population growth curves shown in the figure given below:



- I. Curve a is seen when resources are not limiting
  - II. Curve b is seen when resources are limiting
  - III.  $[K-N]/K$  is the carrying capacity
1. I and II only
  2. I and III only
  3. II and III only
  4. I, II and III

14.

In the following representation of organism response to abiotic factors, the conformers are shown by the letter:



1. A
2. B
3. C
4. Both B and C

16.

During mid 1960s, the purification and chemical characterisation of which of the following PGR was performed?

1. ABA
2. GA
3. Auxin
4. Cytokinins

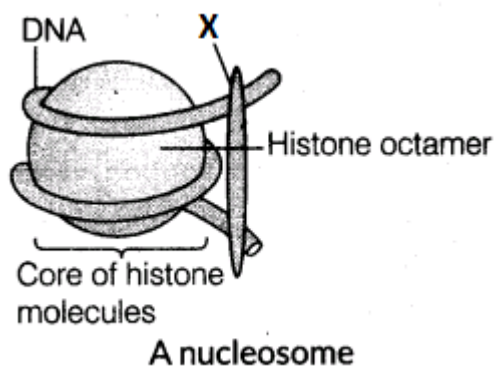
17.

Natural reservoir of phosphorus is:

1. Animal bones
2. Rock
3. Fossils
4. Sea water

15.

Which histone is represented by the letter X in the given diagram?



1. H 1
2. H 2 A
3. H 2 B
4. H 3

18.

The spreading of living pteridophyte is limited and is restricted to narrow geographical region because of

1. Growth requirements of gametophyte (cool, damp and shady places).
2. Requirement of water for fertilisation.
3. Absence of stomata in leaf and absence of vascular tissue.
4. Both 1 and 2.

19.

Mendel's work remained unrecognised till 1900. Which of the following was not a reason for this?

1. His work was widely publicised and it brought bad name to Mendel
2. His concept of factors as stable and discrete units that did not 'blend' was not accepted.
3. His approach of using mathematics to explain biological phenomena was unacceptable.
4. He could not provide any physical proof for the existence of factors or say what they were made of.

20.

Reproduction cannot be:

1. Asexual
2. Characteristics of living organisms
3. Synonymous of growth in multicellular organism
4. A form of fragmentation

21.

In pea plant, the intermediate size of starch grains is due to

1. Dominant epistasis
2. Codominance
3. Incomplete dominance
4. Recessive epistasis

22.

Select incorrect option w.r.t. sickle cell anaemia

1. It is an example of point mutation
2. it occurs due to base substitution i.e. transition
3. Glumatic acid is replaced by Valine at sixth position in a polypeptide chain
4. Mutant haemoglobin molecule undergoes polymerization under low oxygen tension

23.

The part of chromosome beyond secondary constriction is known as

1. Chromomere
2. Satellite
3. Kinetochore
4. Centromere

24.

Which of the following plastid store fats?

1. Elaioplast
2. Aleuroplast
3. Proteinoplast
4. Amyloplast

25.

In pollen banks, pollens are stored at

1.  $-196^{\circ}\text{C}$  of liquid nitrogen
2.  $+20^{\circ}\text{C}$  of liquid nitrogen
3.  $0^{\circ}\text{C}$  of liquid nitrogen
4.  $4^{\circ}\text{C}$  of liquid nitrogen

26.

Elongated or tube-like cells with thick and lignified walls and tapering ends is

1. Tracheids
2. Vessel
3. Sieve tube
4. Collenchyma

27.

Read the given statement and choose the correct option to fill up the blanks A and B. Chara is generally \_\_\_\_A\_\_\_\_ whereas Marchantia is \_\_\_\_B\_\_\_\_.

**A**

**B**

- |               |            |
|---------------|------------|
| 1. Dioecious  | Monoecious |
| 2. Monoecious | Dioecious  |
| 3. Monoecious | Monoecious |
| 4. Dioecious  | Dioecious  |

28. Formation of one molecule of sucrose by  $C_3$  cycle will require
1.  $12CO_2$ ,  $12NADPH + H^+$  and  $18ATP$
  2.  $12CO_2$ ,  $24NADPH + H^+$  and  $36ATP$
  3.  $12CO_2$ ,  $24NADPH + H^+$  and  $24ATP$
  4.  $12CO_2$ ,  $12NADPH + H^+$  and  $24ATP$
29. Choose the correct set of mineral element and enzymes required for the given below equation.
- $$\text{Pyruvic acid} + \text{CoA} + \text{NAD}^+ \rightarrow \text{Acetyl CoA} + \text{CO}_2 + \text{NADH} + \text{H}^+$$
1.  $Mn^{2+}$ , pyruvate decarboxylase
  2.  $Mg^{2+}$ , pyruvate dehydrogenase
  3.  $Mn^{2+}$ , pyruvate dehydrogenase
  4.  $Cu^{2+}$ , pyruvate decarboxylase
30. RNA may not be a suitable genetic material in organisms because of
1. Presence of  $2'-OH$  in sugar
  2. Chemically less reactive nature
  3. Structurally more stable nature
  4. Slow rate of mutation
31. Who proposed semiconservative mode of replication in DNA?
1. Meselson and Stahl
  2. Watson and Crick
  3. Calm
  4. Taylor
32. VNTR belongs to a class of satellite DNA and its size in a genome varies from 0.1 to \_\_\_\_
1. 20 kb
  2. 30 kb
  3. 40 kb
  4. 50 kb
33. Edible part in mango is : -
1. Mesocarp
  2. Epicarp
  3. Endocarp
  4. Epidermis
34. Main function of lenticel is : -
1. Transpiration
  2. Guttation
  3. Gaseous exchange
  4. Bleeding
35. Which one of the following mineral elements plays an important role in biological nitrogen fixation : -
1. Copper
  2. Manganese
  3. Zinc
  4. Molybdenum

## Botany - Section B

36.

In a diploid cell, at which stage of cell cycle, the amount of DNA is doubled?

1.  $G_1$  and  $G_2$  phase
2.  $G_0$  phase
3. S,  $G_2$  and M phase
4. S phase

37.

### Column-I

I. *Aspergillus niger*

II. *Lactobacillus*

III. *Clostridium butylicum*

IV. *Trichoderma polysporum*

### Column-II

A. Lactic acid

B. Butyric acid

C. Citric acid

D. Cyclosporin A

Which of the combinations is correct?

- |    | I | II | III | IV |
|----|---|----|-----|----|
| 1. | B | A  | D   | C  |
| 2. | C | A  | B   | D  |
| 3. | A | B  | C   | D  |
| 4. | D | B  | A   | C  |

38.

Which of the following is commonly known as 'imperfect fungi'?

1. Phycomycetes
2. Ascomycetes
3. Basidiomycetes
4. Deuteromycetes

39.

Hairy leaves in several plants are not associated with resistance to insect pests in

1. Resistance to jassids in cotton
2. Cereal leaf beetle in wheat
3. Resistance to aphids in brassica
4. Both 2 and 3

40.

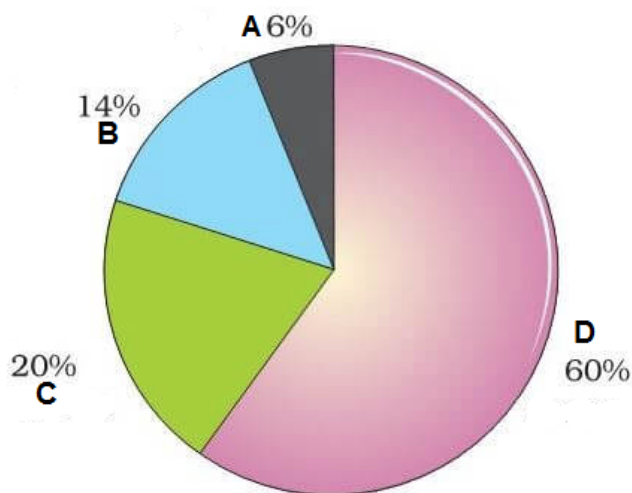
Montreal Protocol

Find the wrong information about it.

1. An International Treaty
2. Was signed at Montreal (canada)
3. To control the emission of Ozone depleting substances
4. Was effective in 1987

41.

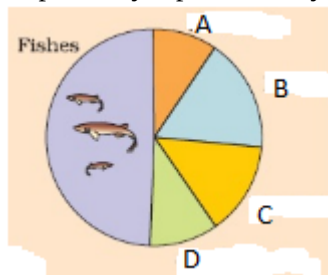
The following pie chart shows the relative contribution of radiatively active gases to greenhouse effect. The contribution of  $N_2O$  is shown by:



1. A
2. B
3. C
4. D

42.

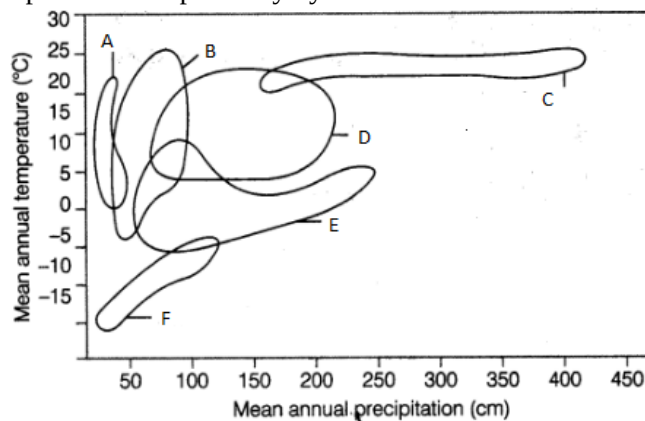
In the given pie chart showing the global biodiversity of vertebrates, the Amphibians and the Birds are respectively represented by:



1. B and D
2. A and C
3. A and B
4. D and B

43.

The following diagram shows the biome distribution with respect to annual temperature and precipitation. Grassland, Temperate forest and Coniferous forest are represented respectively by:



1. A, C and F
2. B, D and E
3. B, E and F
4. A, D and F

44.

For all natural and synthetic compounds involved in growth, which of the following term is used

1. Auxin
2. Auxin
3. GA3
4. GAs

45.

Half-leaf experiment, where a part of leaf is enclosed in a test tube containing KOH is performed to show that

1.  $H_2O$  is required for photosynthesis
2.  $CO_2$  is required for photosynthesis
3. Light is required for photosynthesis
4.  $H_2O$  is source of  $O_2$  released during photosynthesis

46.

Glycerol and Fatty acids are the result of breaking down of Fats. During cellular respiration,

1. Fatty acids enter at the step of formation of BPGA
2. Fatty acids enter as acetyl CoA
3. Fatty acids enter as PGAL
4. Fatty acids enter as Pyruvate

47.

Choose odd one w.r.t. composition of cell wall of algae

1. Cellulose, galactans
2. Mannans, minerals
3. Hemicellulose, pectin
4. Cellulose, minerals

48.

Functionally cross-pollination but genetically similar to autogamy is

1. Xenogamy
2. Geitonogamy
3. Chasmogamy
4. Cleistogamy

49.

Oogamy is associated with formation of

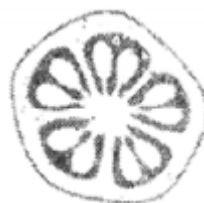
1. Non-flagellated male gamete
2. Motile zygote always inside the female sex organ
3. Egg as female gamete
4. Zygote outside the female body

50.

Which one of the following diagrams represents the placentation in Dianthus ?



1.



2.



3.



4.

## Zoology - Section A

51.

Enzymes enhance the rate of reaction by

1. Forming a reactant-product complex
2. Changing the equilibrium point of the reaction
3. Combining with the product as soon as it is formed
4. Lowering the activation energy of the reaction



52.

Tricuspid Valves are present between

1. left atria and aorta
2. right atria and right ventricle
3. left atria and left ventricle
4. both 1 and 2

53.

Amino acids, glucose, electrolytes like  $\text{Na}^+$  are absorbed by:

1. Active transport
2. Passive transport
3. Facilitated transport
4. Osmosis

54.

A Cross bridge is formed in between

1. Myosin head and active site of actin
2. Active site of Myosin and head of actin
3. Both 1 and 2
4. Between G actin and F actin

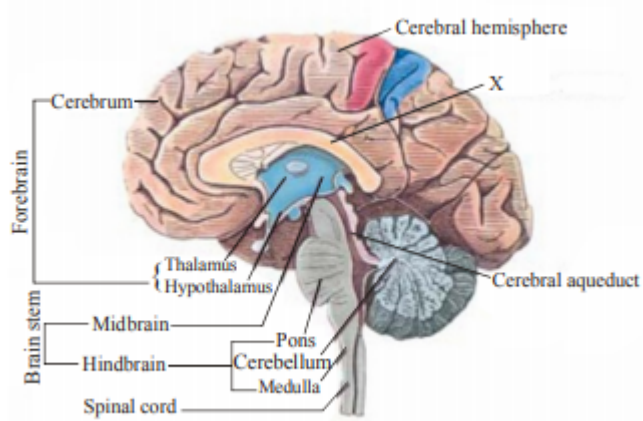
55.

The membrane closest to the brain is the \_\_\_\_\_.

1. dura mater
2. pia mater
3. arachnoid meninx
4. denticulate ligament

56.

The structure marked as X in the following diagram showing sagittal section of the human brain would be:



1. Corpora quadrigemina
2. Limbic system
3. Corpus callosum
4. Hippocampal gyrus

57.

Which of the following act as a secondary messenger in hormonal action?

1. cAMP
2. ADP
3. NAD
4. ATP

58.

Atrial systole increases the flow of blood into the ventricles by about:

1. 10 %
2. 30 %
3. 50 %
4. 70 %

59.

Consider the following characters regarding an evolutionary agent:

- I. It is a random binomial sampling error in the gene pool
- II. It is brought about by chance alone
- III. It acts on a small population

What is this evolutionary agent?

- 1. Mutation
- 2. Recombination
- 3. Genetic drift
- 4. Gene flow

60.

Maximum number of existing transgenic animals is of

- 1. mice
- 2. cow
- 3. pig
- 4. fish

61.

The first movements of the foetus and appearance of hair on its head are usually observed during which month of pregnancy?

- 1. Fourth month
- 2. Fifth month
- 3. Sixth month
- 4. Third month

62.

What triggers activation of protoxin to active Bt toxin of *Bacillus thuringiensis* in boll worm?

- 1. Acidic pH of stomach
- 2. Body temperature
- 3. Moist surface of midgut
- 4. Alkaline pH of gut

63.

The given diagram is of



- 1. Cnidoblast
- 2. Cnidocytes
- 3. Choanocytes
- 4. Both 1 and 2

64.

The human ribs are termed as 'bicephalic' because:

- 1. They attach to other bones both dorsally and ventrally
- 2. They have two articulation surfaces on their dorsal end
- 3. They have two articulation surfaces on their ventral end
- 4. They articulate with the help of cartilage at both ends

65.

Which is not a common mode of action between LNG20 and oral pill?

- 1. Inhibition of ovulation
- 2. Suppression of sperm motility and reduction of fertilizing ability of sperm
- 3. Alteration in quality of cervical mucus
- 4. Inhibition of implantation

66.

Which of the following structure can not be seen in ovary during post ovulatory phase?

- (i) Primary follicle.
- (ii) Tertiary follicle.
- (iii) Corpus luteum.
- (iv) Primary polar body.

- 1. (i) and (ii) only
- 2. (ii) and (iv) only
- 3. (ii) only
- 4. (iii) and (iv) only

67. In case of snake bite the injection which is given to patient is example of -
1. passive immunity
  2. active immunity
  3. both 1 and 2
  4. natural immunity
68. Which of the following enzymes is used in case of fungus to cause, release of DNA along with other macromolecules?
1. Lysozyme
  2. Cellulose
  3. Chitinase
  4. Amylase
69. Which of the following steps is/are catalysed by Taq polymerase in a PCR?
1. Denaturation of template DNA
  2. Annealing of primers to template DNA
  3. Extension of primer end on template DNA
  4. All of these
70. ECG is a graphical representation of electrical activity of the heart during a cardiac cycle in which the end of T-wave marks
1. End of ventricular systole
  2. End of ventricular diastole
  3. Beginning of ventricular systole
  4. Both 2 & 3
71. When more than one adaptive radiations takes place in an isolated geographical area, one can call this
1. Divergent evolution
  2. Convergent evolution
  3. Parallel evolution
  4. Co-evolution
72. Choose the correct match w.r.t. cranial capacity
1. Neanderthal man – 1800 cc
  2. *Homo habilis* – 650 cc
  3. *Homo erectus* – 200 cc
  4. *Australopithecus* – 900 cc
73. When moving in a car that up speeding up or slowing down, the sense of linear acceleration is provided by
1. Organ of Corti
  2. Cristae
  3. Macula
  4. Semicircular canals
74. Only protein deficiency is a characteristics symptom of
1. Marasmus
  2. Kwashiorkor
  3. Indigestion
  4. Proteinemia
75. Renin is released by
1. JG cells
  2. Endothelial cells
  3. Podocytes
  4. Cells of Filtration membrane

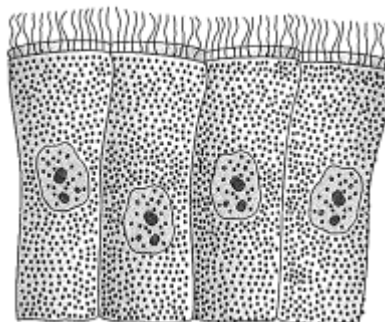
76.

Which of the following option is completely permeable to water and impermeable to electrolytes?

1. Descending limb of loop of Henle
2. Ascending limb of loop of Henle
3. Loop of Henle
4. DCT

79.

Choose the correct option w.r.t the location of this tissue



77.

Urea is transported back to the interstitium by

1. Collecting Tubule
2. DCT
3. PCT
4. LOH

1. In ducts of glands
2. In tubular part of kidney
3. In the inner surface of hollow organs like bronchioles and fallopian tubes
4. In the walls of blood vessels and air sacs of lung

78.

Which of the following structure in male reproductive system acts as a link between rete testis and epididymis ?

1. Vas deferens
2. Vasa efferentia
3. Epididymis
4. Inguinal canal

80.

Oxygen dissociation curve of haemoglobin will shift to right of normal curve if

1. Temperature decreases
2.  $\text{CO}_2$  decreases
3. pH decreases
4. BPG is low

81.

Difficulty in breathing causing wheezing is due to

1. Emphysema
2. Asthma
3. Tuberculosis
4. Atelectasis

- |   |   |
|---|---|
| <p>82.</p> <p>Odd one w.r.t. pancreatic juice is</p> <ol style="list-style-type: none"> <li>1. Procarboxypeptidases</li> <li>2. Lipases</li> <li>3. Enterokinase</li> <li>4. Nucleases</li> </ol>               | <p>87.</p> <p>The extinct reptile group from which mammals directly evolved is:</p> <ol style="list-style-type: none"> <li>1. Sauropsids</li> <li>2. Pelycosaur</li> <li>3. Thecodonts</li> <li>4. Therapsids</li> </ol>  |
| <p>83.</p> <p>Anemia and blockage of intestinal passage can be seen in</p> <ol style="list-style-type: none"> <li>1. Ringworm</li> <li>2. Ascariasis</li> <li>3. Filariasis</li> <li>4. Amoebiasis</li> </ol>   | <p>88.</p> <p>The type of joint between the carpal bones is:</p> <ol style="list-style-type: none"> <li>1. Ball and Socket</li> <li>2. Hinge</li> <li>3. Pivot</li> <li>4. Gliding</li> </ol>   |
| <p>84.</p> <p>Which hormone is concerned with the concentration of urine :</p> <ol style="list-style-type: none"> <li>1. Oxytocin</li> <li>2. Vasopressin</li> <li>3. Prolactin</li> <li>4. Cortisol</li> </ol> | <p>89.</p> <p>Which of the following is true for roundworms and flatworms</p> <ol style="list-style-type: none"> <li>1. Bilateral symmetry</li> <li>2. Triploblastic body plan</li> <li>3. Internal Fertilisation</li> <li>4. All of these</li> </ol>   |
| <p>85.</p> <p>Which gland decreases in size with increasing age :</p> <ol style="list-style-type: none"> <li>1. Thyroid</li> <li>2. Adrenal</li> <li>3. Thymus</li> <li>4. Pituitary</li> </ol>                 | <p>90.</p> <p>Those that are better fit in an environment; leave more progeny than other's, this statement explain -</p> <ol style="list-style-type: none"> <li>1. Lamarck use and disuse theory</li> <li>2. Hugo de Vries mutation theory</li> <li>3. Founder effect</li> <li>4. Natural selection theory of Charles Darwin</li> </ol> |

## Zoology - Section B

- 86.
- Which of the following property cannot be attributed to red Fibres?
1. Less myoglobin
  2. More mitochondria
  3. Aerobic process for energy
  4. Both 1 and 3

- |   |  |
|---|--|
| <p>91. One pair of anal styles arises from which segment of the abdomen of cockroach?</p> <ol style="list-style-type: none"> <li>1. 9<sup>th</sup> segment of male</li> <li>2. 9<sup>th</sup> segment of female</li> <li>3. 10<sup>th</sup> segment of male</li> <li>4. 10<sup>th</sup> segment of both male and female</li> </ol>  | <p>95. The technique called gamete intrafallopian transfer (GIFT) is recommended for those females :</p> <ol style="list-style-type: none"> <li>1. who cannot provide suitable environment for fertilisation</li> <li>2. who cannot produce an ovum</li> <li>3. who cannot retain the foetus inside uterus</li> <li>4. whose cervical canal is too narrow to allow passage for the sperms</li> </ol> |
| <p>92. Trachea divides into right and left primary bronchi at the level of</p> <ol style="list-style-type: none"> <li>1. 2<sup>nd</sup> thoracic vertebrae</li> <li>2. 5<sup>th</sup> thoracic vertebrae</li> <li>3. 7<sup>th</sup> thoracic vertebrae</li> <li>4. 10<sup>th</sup> thoracic vertebrae</li> </ol>  | <p>96. After ovulation follicles convert into :</p> <ol style="list-style-type: none"> <li>1. Corpus luteum</li> <li>2. Corpus albicans</li> <li>3. Corpus cavernosa</li> <li>4. Corpus callosum</li> </ol>  |
| <p>93. Choose the incorrect match w.r.t parts of a nephron and their function.</p> <ol style="list-style-type: none"> <li>1. Proximal convoluted tubule – Reabsorption of <math>\text{Na}^+</math> and <math>\text{K}^+</math> ions</li> <li>2. Bowman's capsule – Glomerular filtration</li> <li>3. Distal convoluted tubule – Absorption of glucose</li> <li>4. Henle's loop – Conservation of water</li> </ol> | <p>97. Malignant tertian malaria is caused by Plasmodium:</p> <ol style="list-style-type: none"> <li>1. vivax</li> <li>2. malariae</li> <li>3. falciparum</li> <li>4. ovale</li> </ol>   |
| <p>94. The haemoglobin content per 100 ml of blood of a normal healthy human adult is -</p> <ol style="list-style-type: none"> <li>1. 25-30 g</li> <li>2. 17-20g</li> <li>3. 12-16 g</li> <li>4. 5-11</li> </ol>  | <p>98. Melatonin is secreted by :</p> <ol style="list-style-type: none"> <li>1. Pineal gland</li> <li>2. Skin</li> <li>3. Pituitary Gland</li> <li>4. Thyroid</li> </ol>   |
|   | <p>99. Which of the following statement is correct for node of Ranvier of nerve : -</p> <ol style="list-style-type: none"> <li>1. Neurilemma is discontinuous</li> <li>2. Myelin sheath is discontinuous</li> <li>3. Both neurilemma &amp; Myelin sheath are discontinuous</li> <li>4. Covered by myelin sheath</li> </ol>   |

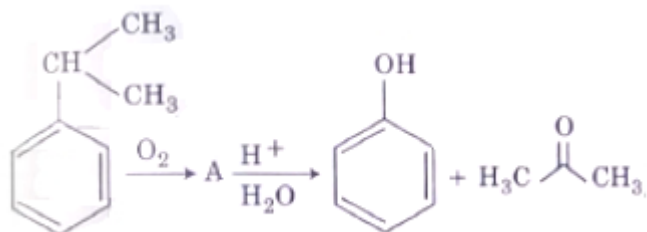
100.

Which of the following enzymes are used to join bits of DNA :-

1. Ligase
2. Primase
3. DNA polymerase
4. Endonuclease

103.

The structure of intermediate A in the following reaction is:



## Chemistry - Section A

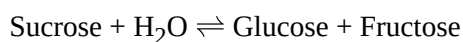
101.

The Lassaigne's extract is boiled with con.  $\text{HNO}_3$  while testing for halogens, because it -

1. Helps in the precipitation of  $\text{AgCl}$
2. Increases the solubility product of  $\text{AgCl}$
3. Increases the concentration of  $\text{NO}_3^-$  ions
4. Decomposes  $\text{Na}_2\text{S}$  and  $\text{NaCN}$ , if formed.

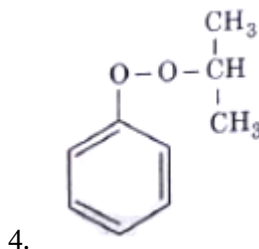
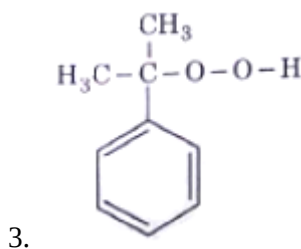
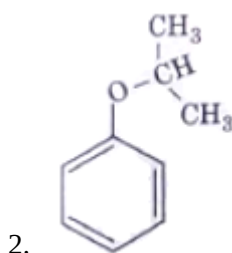
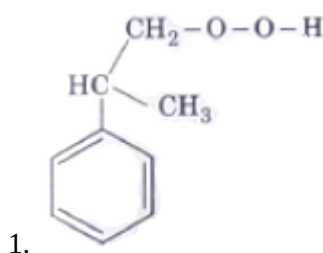
102.

Hydrolysis of sucrose is given by the following reaction



If the equilibrium constant ( $K_c$ ) is  $2 \times 10^{13}$  at 300 K, the value of  $\Delta_r G^\ominus$  at the same temperature will be:

1.  $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln (2 \times 10^{13})$
2.  $8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln (3 \times 10^{13})$
3.  $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln (4 \times 10^{13})$
4.  $-8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln (2 \times 10^{13})$



104.

The gas that share 50 % of green house effect responsible for global warming is :

1. SO<sub>2</sub>
2. SO<sub>3</sub>
3. CO<sub>2</sub>
4. Water vapour

105.

Which of the following conclusions could not be derived from Rutherford's  $\alpha$ -particle scattering experiment?

1. Most of the space in the atom is empty
2. The radius of the atom is about  $10^{-10}$  m while that of nucleus is  $10^{-15}$  m
3. Electrons move in circular path of fixed energy called orbits
4. Electrons and the nucleus are held together by electrostatic forces of attraction

106.

Molecule having highest dipole moment is :

1. CO<sub>2</sub>
2. HI
3. H<sub>2</sub>O
4. SO<sub>2</sub>

107.

The entropy change can be calculated by using the expression  $\Delta S = \frac{q_{rev}}{T}$ . When water freezes in a glass beaker, the correct statement among the following is -

1.  $\Delta S$  (system) decreases but  $\Delta S$  (surroundings) remains the same
2.  $\Delta S$  (system) increases but  $\Delta S$  (surroundings) decreases
3.  $\Delta S$  (system) decreases but  $\Delta S$  (surroundings) increases
4.  $\Delta S$  (system) decreases but  $\Delta S$  (surroundings) also decreases

108.

The pH of neutral water at 25°C is 7.0. As the temperature increases, ionisation of water increases, however, the concentration of H<sup>+</sup> ions and OH<sup>-</sup> ions are equal. The pH of pure water at 60°C is-

1. Equal to 7.0
2. Greater than 7.0
3. Less than 7.0
4. Equal to zero

109.

Which of the following is not an example of redox reaction?

1.  $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$
2.  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
3.  $2\text{K} + \text{F}_2 \rightarrow 2\text{KF}$
4.  $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$

110.

Metal hydrides are ionic, covalent or molecular in nature. Among LiH, NaH, KH, RbH, CsH, the correct order of increasing ionic character is

1.  $\text{LiH} > \text{NaH} > \text{CsH} > \text{KH} > \text{RbH}$
2.  $\text{LiH} < \text{NaH} < \text{KH} < \text{RbH} < \text{CsH}$
3.  $\text{RbH} > \text{CsH} > \text{NaH} > \text{KH} > \text{LiH}$
4.  $\text{KH} < \text{NaH} < \text{RbH} < \text{LiH} < \text{CsH}$



111.

Which of the carbonates given below is unstable in air and is kept in  $\text{CO}_2$  atmosphere to avoid decomposition?

1.  $\text{BeCO}_3$
2.  $\text{MgCO}_3$
3.  $\text{CaCO}_3$
4.  $\text{BaCO}_3$

112.

Catenation i.e., linking of similar atoms depends on the size and electronic configuration of atoms. The

the tendency of catenation in group 14 elements follows the order-

1.  $\text{C} > \text{Si} > \text{Ge} > \text{Sn}$
2.  $\text{C} \gg \text{Si} > \text{Ge} \approx \text{Sn}$
3.  $\text{Si} > \text{C} > \text{Sn} > \text{Ge}$
4.  $\text{Ge} > \text{Sn} > \text{Si} > \text{C}$

113.

Functional isomer is not possible for -

1. Alcohols
2. Aldehydes
3. Alkyl halides
4. Cyanides

114.

The unit of ebullioscopic constant is-

1.  $\text{K kg mol}^{-1}$  or  $\text{K (molality)}^{-1}$
2.  $\text{mol kg K}^{-1}$  or  $\text{K}^{-1}$  (molality)
3.  $\text{kg mol}^{-1} \text{K}^{-1}$  or  $\text{K}^{-1}$  (molality) $^{-1}$
4.  $\text{K mol kg}^{-1}$  or  $\text{K (molality)}$

115.

The cell that will measure the standard electrode potential of a copper electrode is :

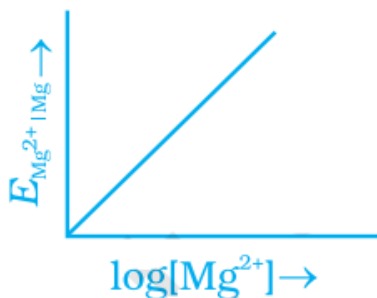
1.  $\text{Pt (s)} \mid \text{H}_2(\text{g}, 0.1 \text{ bar}) \mid \text{H}^+(\text{aq}, 1\text{M}) \parallel \text{Cu}^{2+}(\text{aq}, 1 \text{ M}) \mid \text{Cu}$
2.  $\text{Pt (s)} \mid \text{H}_2(\text{g}, 1 \text{ bar}) \mid \text{H}^+(\text{aq}, 1\text{M}) \parallel \text{Cu}^{2+}(\text{aq}, 2 \text{ M}) \mid \text{Cu}$
3.  $\text{Pt (s)} \mid \text{H}_2(\text{g}, 1 \text{ bar}) \mid \text{H}^+(\text{aq}, 1\text{M}) \parallel \text{Cu}^{2+}(\text{aq}, 1 \text{ M}) \mid \text{Cu}$
4.  $\text{Pt (s)} \mid \text{H}_2(\text{g}, 0.1 \text{ bar}) \mid \text{H}^+(\text{aq}, 0.1 \text{ M}) \parallel \text{Cu}^{2+}(\text{aq}, 1\text{M}) \mid \text{Cu}$

116.

Electrode potential for Mg electrode varies according to the equation  $E_{\text{Mg}^{2+}|\text{Mg}} = E_{\text{Mg}^{2+}|\text{Mg}}^0 - \frac{0.059}{2} \log \frac{1}{[\text{Mg}^{2+}]}$ .

The graph of  $E_{\text{Mg}^{2+}|\text{Mg}}$  vs  $\log [\text{Mg}^{2+}]$  among the following is -

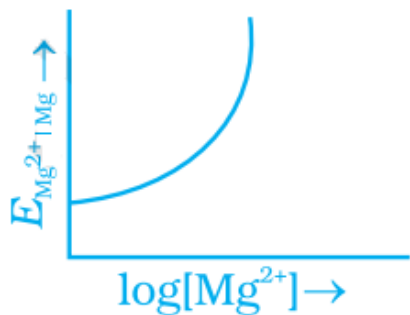
1.



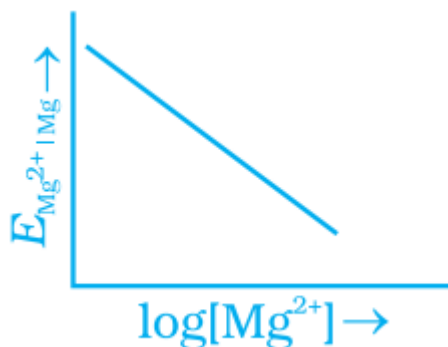
2.



3.



4.



117.

Activation energy of a chemical reaction can be determined by -

1. Determining the rate constant at standard temperature.
2. Determining the rate constant at two temperatures.
3. Determining probability of collision.
4. Using the catalyst.

118.

Which of the following are peroxyacids of sulphur?

1.  $\text{H}_2\text{SO}_5$  and  $\text{H}_2\text{S}_2\text{O}_8$
2.  $\text{H}_2\text{SO}_5$  and  $\text{H}_2\text{S}_2\text{O}_7$
3.  $\text{H}_2\text{S}_2\text{O}_7$  and  $\text{H}_2\text{S}_2\text{O}_8$
4.  $\text{H}_2\text{S}_2\text{O}_6$  and  $\text{H}_2\text{S}_2\text{O}_7$

119.

There are 14 elements in the actinoid series. Which of the following elements does not belong to this series?

1. U
2. Np
3. Tm
4. Fm

120.

Which of the following complexes formed by  $\text{Cu}^{++}$  ions is most stable?

1.  $\text{Cu}^{2+} + 4\text{NH}_3 \rightarrow [\text{Cu}(\text{NH}_3)_4]^{+2}$   $\log K = 11.6$
2.  $\text{Cu}^{2+} + 4\text{CN}^- \rightarrow [\text{Cu}(\text{CN})_4]^{2-}$   $\log K = 27.3$
3.  $\text{Cu}^{2+} + 2\text{en}^- \rightarrow [\text{Cu}(\text{en})_2]^{2+}$   $\log K = 15.4$
4.  $\text{Cu}^{2+} + 4\text{H}_2\text{O} \rightarrow [\text{Cu}(\text{H}_2\text{O})_4]^{2+}$   $\log K = 8.9$

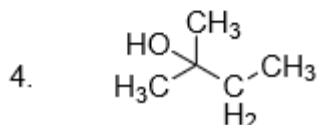
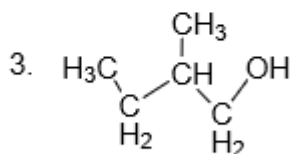
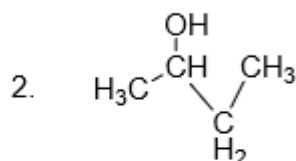
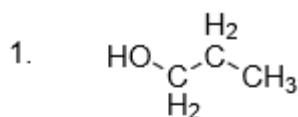
121.

When 0.1 mol  $\text{CoCl}_3(\text{NH}_3)_5$  is treated with an excess of  $\text{AgNO}_3$ , 0.2 mol of  $\text{AgCl}$  are obtained. The conductivity of the solution will correspond to-

1. 1:3 electrolyte
2. 1:2 electrolyte
3. 1:1 electrolyte
4. 3:1 electrolyte

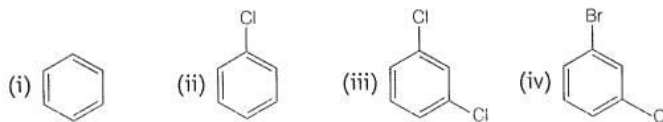
122.

Which of the following alcohols will yield the corresponding alkyl chloride on reaction with concentrated  $\text{HCl}$  at room temperature?



123.

Arrange the following compounds in the increasing order of their densities.



1. (i) < (ii) < (iii) < (iv)
2. (i) < (iii) < (iv) < (ii)
3. (iv) < (iii) < (ii) < (i)
4. (ii) < (iv) < (iii) < (i)

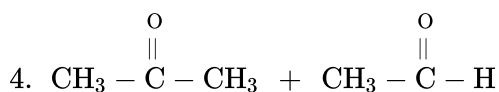
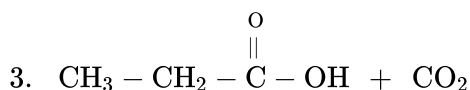
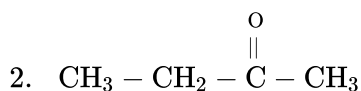
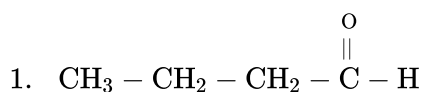
124.

Monochlorination of toluene in sunlight followed by hydrolysis with aq.  $\text{NaOH}$  yields-

1. o-cresol
2. m-cresol
3. 2, 4- dihydroxytoluene
4. benzyl alcohol

125.

Addition of water to alkynes occurs in acidic medium and in the presence of  $\text{Hg}^{2+}$  ions as a catalyst. Which of the following products will be formed on addition of water to but-1-yne under these conditions?



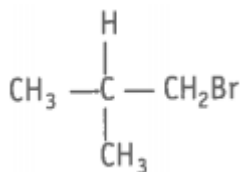
126.

Proteins are found to have two different types of secondary structures via  $\alpha$ -helix and  $\beta$ -pleated sheet structure. The  $\alpha$ -helix structure of a protein is stabilized by-

1. Peptide bonds
2. Van der waals forces
3. Hydrogen bonds
4. Dipole-dipole interactions

127.

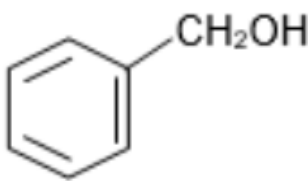
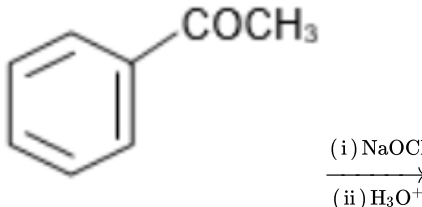
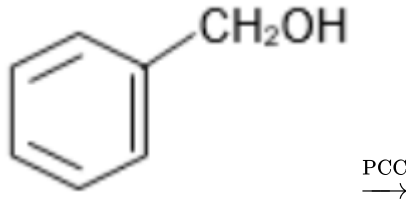
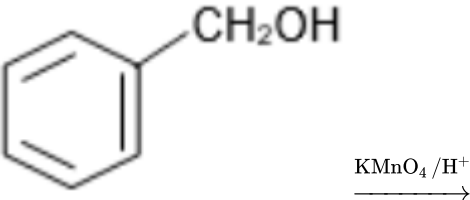
Arrange the following alkyl halides in decreasing order of the rate of  $\beta$ -elimination reaction with alcoholic KOH.



- A.
- B.  $\text{CH}_3 - \text{CH}_2 - \text{Br}$
- C.  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{Br}$
1.  $A > B > C$
  2.  $C > B > A$
  3.  $B > C > A$
  4.  $A > C > B$

128.

The reaction that does not give benzoic acid as the major product is

1.   $\xrightarrow{\text{K}_2\text{Cr}_2\text{O}_7}$
2.   $\xrightarrow[\text{(ii) H}_3\text{O}^+]{\text{(i) NaOCl}}$
3.   $\xrightarrow{\text{PCC}}$
4.   $\xrightarrow{\text{KMnO}_4/\text{H}^+}$

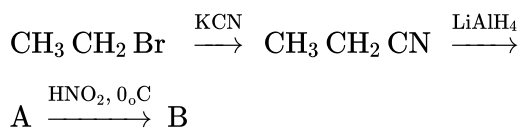
129.

In a cyclotrimetaphosphoric acid molecule, how many single and double bonds are present?

1. 3 double bonds; 9 single bonds
2. 6 double bonds; 6 single bonds
3. 3 double bonds; 12 single bonds
4. Zero double bonds; 12 single bonds

130.

The molecular formulae of A and B in the following reaction are -



1.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ , and  $\text{CH}_3\text{CH}_2\text{CH}_3$
2.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$ , and  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
3.  $\text{CH}_3\text{CH}_2\text{CH}=\text{NH}$ , and  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
4.  $\text{CH}_3\text{CH}_2\text{CH}=\text{NH}$ , and  $\text{CH}_3\text{CH}_2\text{CH}_3$

131.

Among the following, the species has unequal bond lengths is-

1.  $\text{BF}_4^-$
2.  $\text{XeF}_4$
3.  $\text{SF}_4$
4.  $\text{SiF}_4$

132.

The solubility of  $\text{Ca(OH)}_2$  in water is-

[Given: The solubility product of  $\text{Ca(OH)}_2$  in water =  $5.5 \times 10^{-6}$ ]

1.  $1.77 \times 10^{-6}$
2.  $1.11 \times 10^{-6}$
3.  $1.11 \times 10^{-2}$
4.  $1.77 \times 10^{-2}$

133.

Match List-I with List-II

List-I Electronic configuration of elements	List-II $\Delta_1$ in $\text{kJ mol}^{-1}$
(a) $1s^2 2s^2$	(i) 801
(b) $1s^2 2s^2 2p^4$	(ii) 899
(c) $1s^2 2s^2 2p^3$	(iii) 1314
(d) $1s^2 2s^2 2p^1$	(iv) 1402

Choose the most appropriate answer from the options given below -

1. (a)  $\rightarrow$  (ii), (b)  $\rightarrow$  (iii), (c)  $\rightarrow$  (iv), (d)  $\rightarrow$  (i)
2. (a)  $\rightarrow$  (i), (b)  $\rightarrow$  (iv), (c)  $\rightarrow$  (iii), (d)  $\rightarrow$  (ii)
3. (a)  $\rightarrow$  (i), (b)  $\rightarrow$  (iii), (c)  $\rightarrow$  (iv), (d)  $\rightarrow$  (ii)
4. (a)  $\rightarrow$  (iv), (b)  $\rightarrow$  (i), (c)  $\rightarrow$  (ii), (d)  $\rightarrow$  (iii)

134.

A car tyre is filled with nitrogen gas at 35 psi at  $27^\circ\text{C}$ . It will burst if pressure exceeds 40 psi. The temperature in  $^\circ\text{C}$  at which the car tyre will burst is-

(Rounded-off to the nearest integer)

1. 65
2. 70
3. 75
4. 77

135.

The molecular formula of a commercial resin used for exchanging ions in water softening is  $C_8H_7SO_3Na$  (Mol. Wt. 206). The maximum uptake of  $Ca^{2+}$  ions by the resin when expressed in mole per gram resin is-

1.  $\frac{1}{103}$
2.  $\frac{1}{206}$
3.  $\frac{2}{309}$
4.  $\frac{1}{412}$

139.

The electronic configurations of the elements A, B, and C are given below.

- $$A = 1s^2 2s^2 2p^6$$
- $$B = 1s^2 2s^2 2p^6 3s^2 3p^3$$
- $$C = 1s^2 2s^2 2p^6 3s^2 3p^5$$

The stable form of A may be represented by the formula :

1. A
2.  $A_2$
3.  $A_3$
4.  $A_4$

## Chemistry - Section B

136.

The addition of HCl does not suppress the ionization of:

1. Acetic acid
2. Benzoic acid
3.  $H_2S$
4.  $H_2SO_4$

140.

During hearing of a court case, the judge suspected that some changes in the documents had been carried out. He asked the forensic department to check the ink used at two different places. The technique that can give the best results is -

1. Column chromatography
2. Solvent extraction
3. Distillation
4. Thin layer chromatography

137.

$R_3SiCl$  on complete hydrolysis forms-

1.  $R_3SiOH$
2.  $R_3Si-O-SiR_3$
3.  $R_3Si=O$
4. None of the above

141.

Which of the following oxides behaves as a conductor or insulator depending upon temperature?

1.  $TiO$
2.  $SiO_2$
3.  $TiO_3$
4.  $MgO$

138.

Benzoyl chloride is prepared from benzoic acid by-

1.  $Cl_2, hv$
2.  $SO_2$
3.  $SOCl_2$
4.  $Cl_2, H_2O$

142.

Incorrect statement among the following is-

1. Two different solutions of sucrose of the same molality prepared in different solvents will have the same depression in freezing point.

2. The osmotic pressure of a solution is given by the equation  $\pi = CRT$

(where C is the molarity of the solution)

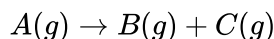
3. Decreasing order of osmotic pressure for 0.01 M aqueous solutions of



4. The vapour pressure exerted by a volatile component of a solution is directly proportional to its mole fraction in the solution.

143.

Consider a first-order gas-phase decomposition reaction given below



The initial pressure of the system before decomposition of A was  $P_i$ . After the lapse of time, 't' total pressure of the system increased by X units and became  $P_t$ . The rate constant k for the reaction is given as -

1.  $k = \frac{2.303}{t} \log \frac{P_i}{P_i - x}$

2.  $k = \frac{2.303}{t} \log \frac{P_i}{2P_i - P_t}$

3.  $k = \frac{2.303}{t} \log \frac{P_i}{2P_i + P_t}$

4.  $k = \frac{2.303}{t} \log \frac{P_i}{P_i + x}$

144.

On the basis of data given below, the gas which shows the least adsorption on a definite amount of charcoal is-

Gas	CO <sub>2</sub>	SO <sub>2</sub>	CH <sub>4</sub>	H <sub>2</sub>
<b>Critical temp./K</b>	304	630	190	33

1. CO<sub>2</sub>

2. SO<sub>2</sub>

3. CH<sub>4</sub>

4. H<sub>2</sub>

145.

In the preparation of compounds of Xe, Bartlett had taken  $\text{O}_2^+ \text{PtF}_6^-$  as a base compound. This is because-

1. Both O<sub>2</sub> and Xe have the same size.

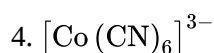
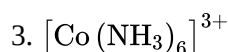
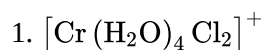
2. Both O<sub>2</sub> and Xe have the same electron gain enthalpy.

3. Both O<sub>2</sub> and Xe have almost the same ionisation enthalpy.

4. Both Xe and O<sub>2</sub> are gases.

146.

Indicate the complex ion which shows geometrical isomerism-



147.

Which of the following is not a semisynthetic polymer?

1. Cis-polyisoprene
2. Cellulose nitrate
3. Cellulose acetate
4. Vulcanised rubber

148.

Which of the following enhances the leathering property of soap?

1. Sodium carbonate
2. Sodium rosinate
3. Sodium stearate
4. Trisodium phosphate

149.

Arrange the following hydrogen halides in order of their increasing reactivity with propene.

1.  $\text{HCl} > \text{HBr} > \text{HI}$
2.  $\text{HBr} > \text{HI} > \text{HCl}$
3.  $\text{HI} > \text{HBr} > \text{HCl}$
4.  $\text{HCl} > \text{HI} > \text{HBr}$

150.

The copper matte contains-

1. Sulphides of copper (I) and iron (II)
2. Sulphides of copper (II) and iron (III)
3. Sulphides of copper(II) and iron (II)
4. Sulphides of copper (I) and iron (III)

## Physics - Section A

151.

In Bohr model of hydrogen atom, the ratio of periods of revolution of an electron in  $n=2$  and  $n=1$  orbits is:

1. 2 : 1
2. 4 : 1
3. 8 : 1
4. 16 : 1

152.

In a potentiometer circuit, a cell of EMF 1.5 V gives a balance point at 36 cm length of wire. If another cell of EMF 2.5 V replaces the first cell, then at what length of the wire, the balance point occurs?

1. 64 cm
2. 62 cm
3. 60 cm
4. 21.6 cm

153.

The wavelength of the photon emitted by a hydrogen atom when an electron makes a transition from  $n=2$  to  $n=1$  state is:

1. 194.8 nm
2. 913.3 nm
3. 490.7 nm
4. 121.8 nm

154.

A current through a wire depends on time as  $i = \alpha_0 t + \beta t^2$  where  $\alpha_0 = 20 \text{ A/s}$  and  $\beta = 8 \text{ As}^{-2}$ .

Find the charge crossed through a section of the wire in 15 s.

1. 2250 C
2. 11250 C
3. 2100 C
4. 260 C



155.

Moment of inertia (M.I.) of four bodies, having same mass and radius, are reported as ;

$I_1$  = M.I. of thin circular ring about its diameter.

$I_2$  = M.I. of circular disc about an axis perpendicular to the disc and going through the centre,

$I_3$  = M.I. of solid cylinder about its axis and

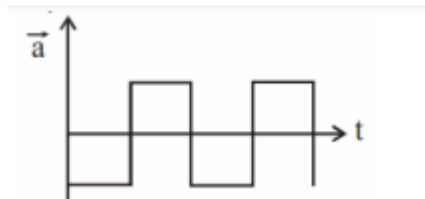
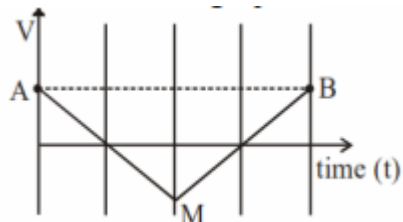
$I_4$  = M.I. of solid sphere about its diameter.

Then :

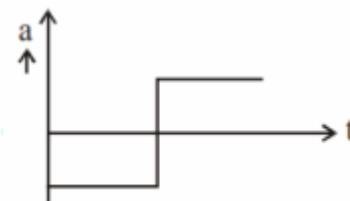
1.  $I_1 + I_3 < I_2 + I_4$
2.  $I_1 + I_2 = I_3 + \frac{5}{2}I_4$
3.  $I_1 = I_2 = I_3 > I_4$
4.  $I_1 = I_2 = I_3 < I_4$

156.

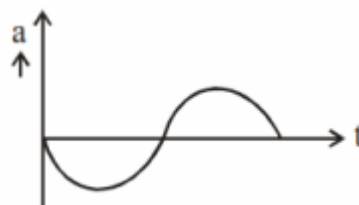
If the velocity-time graph has the shape AMB, what would be the shape of the corresponding acceleration-time graph?



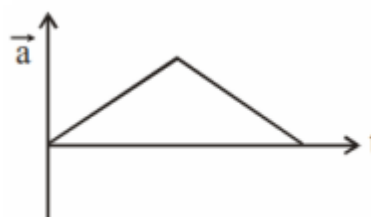
1.



2.



3.



4.

157.

Two equal capacitors are first connected in series and then in parallel. The ratio of the equivalent capacities in the two cases will be:

1. 4 : 1
2. 2 : 1
3. 1 : 4
4. 1 : 2

158.

If an emitter current is changed by 4 mA, the collector current changes by 3.5 mA. The value of  $\beta$  will be :

1. 7
2. 0.5
3. 0.875
4. 3.5

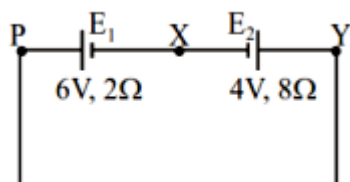
161.

An  $\alpha$ -particle and a proton are accelerated from rest by a potential difference of 200 V. After this, their de-Broglie wavelengths are  $\lambda_\alpha$  and  $\lambda_p$  respectively. The ratio  $\frac{\lambda_p}{\lambda_\alpha}$  is:

1. 3.8
2. 8
3. 7.8
4. 2.8

159.

A cell  $E$  of emf 6V and internal resistance  $2\Omega$  is connected with another cell  $E_2$  of emf 4V and internal resistance  $8\Omega$  (as shown in the figure). The potential difference across points X and Y is :



1. 10.0 V
2. 3.6 V
3. 5.6V
4. 2.0 V

162.

A diatomic gas, having  $C_p = \frac{7}{2}R$  and  $C_v = \frac{5}{2}R$  is heated at constant pressure. The ratio  $dU : dQ : dW$  is :

1. 5 : 7 : 3
2. 5 : 7 : 2
3. 3 : 7 : 2
4. 3 : 5 : 2

160.

If the time period of a two meter long simple pendulum is 2s, the acceleration due to gravity at the place where pendulum is executing S.H.M. is :

1.  $\pi^2 \text{ ms}^{-2}$
2.  $2\pi^2 \text{ ms}^{-2}$
3.  $9.8 \text{ ms}^{-2}$
4.  $16 \text{ m/s}^2$

163.

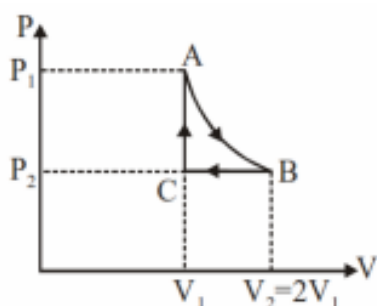
$n$  moles of a perfect gas undergoes a cyclic process ABCA (see figure) consisting of the following processes.

A  $\rightarrow$  B : Isothermal expansion at temperature  $T$  so that the volume is doubled from  $V_1$  to  $V_2 = 2V_1$  and pressure changes from  $P_1$  to  $P_2$

B  $\rightarrow$  C : Isobaric compression at pressure  $P_2$  to initial volume  $V_1$ .

C  $\rightarrow$  A : Isochoric change leading to change of pressure from  $P_2$  to  $P_1$ .

Work done in the isothermal process is:



1. 0
2.  $nRT \left( \ln 2 + \frac{1}{2} \right)$
3.  $nRT \ln 2$
4.  $nRT \left( \ln 2 - \frac{1}{2} \right)$

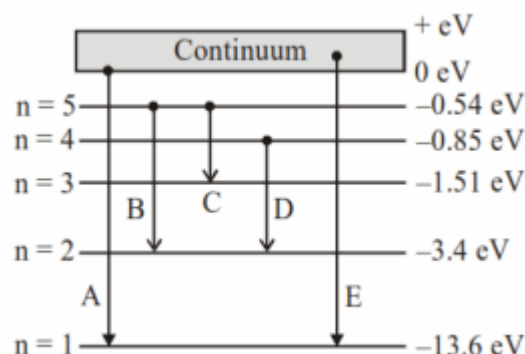
164.

Two stars of masses  $m$  and  $2m$  at a distance  $d$  rotate about their common centre of mass in free space. The distance of the centre of mass from the heavier mass is:

1.  $\frac{d}{3}$
2.  $\frac{2d}{3}$
3.  $\frac{4d}{3}$
4.  $\frac{5d}{3}$

165.

In the given figure, the energy levels of hydrogen atom have been shown along with some transitions marked A, B, C, D and E. Transitions A and B represent, respectively:



1. The ionization potential of hydrogen and second member of Balmer series
2. The first member of the Lyman series and the second member of the Paschen series.
3. The series limit of the Lyman series and the third member of the Balmer series.
4. The series limit of Lyman series and the second member of Paschen series.

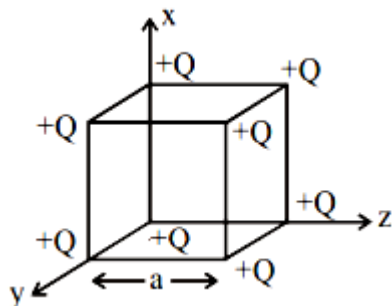
166.

Each side of a cubic box made of metal sheet is 'a' at room temperature 'T'. The coefficient of linear expansion of the metal sheet is ' $\alpha$ '. The metal sheet is heated uniformly by a small temperature  $\Delta T$  so that its new temperature is  $T + \Delta T$ . Calculate the coefficient of volume expansion of the metal sheet.

1.  $\alpha$
2.  $2\alpha$
3.  $3\alpha$
4.  $4\alpha$

167.

A cube of side 'a' has point charges +Q located at each of its vertices. Then the electric field at the centre of cube is :



1.  $\frac{-Q}{3\sqrt{3}\pi\epsilon_0 a^2}$
2. 0
3.  $\frac{2Q}{3\sqrt{3}\pi\epsilon_0 a^2}$
4.  $\frac{Q}{3\sqrt{3}\pi\epsilon_0 a^2}$

168.

Work done by a gas molecule in an isolated system is given by,  $W = \alpha\beta^2 e^{-\frac{x^2}{\alpha}}$ , where x is the displacement, T is the temperature,  $\alpha$  and  $\beta$  are constants.

Then the dimension of  $\beta$  will be :

1.  $[M^{\frac{1}{2}} L^0 T^{-1}]$
2.  $[MLT^{-2}]$
3.  $[M^2 L T^2]$
4.  $[M^0 L T^0]$

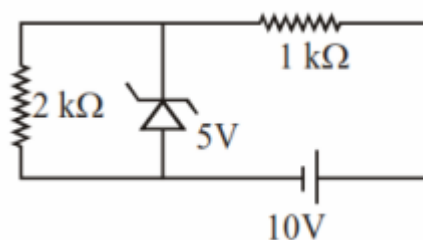
169.

An electromagnetic wave of frequency 5 GHz, is travelling in a medium whose relative electric permittivity and relative magnetic permeability both are 2. Its velocity in this medium is:

1.  $1.5 \times 10^7 \text{ m/s}$
2.  $1.5 \times 10^8 \text{ m/s}$
3.  $3 \times 10^7 \text{ m/s}$
4.  $3 \times 10^8 \text{ m/s}$

170.

In connection with the circuit drawn below, the value of current flowing through  $2 \text{ k}\Omega$  resistor in  $10^{-4} \text{ A}$  is:



1. 20
2. 25
3. 30
4. 35

171.

A common transistor radio set requires 12 V (D.C.) for its operation. The D.C. source is constructed by using a transformer and a rectifier circuit, which are operated at 220 V (A.C.) on standard domestic A.C. supply. The number of turns of secondary coil are 24, then the number of turns of primary are-

1. 110
2. 330
3. 440
4. 550

172.

Two satellites A and B of masses 200 kg and 400 kg are revolving round the earth at height of 600 km and 1600 km respectively. If  $T_A$  and  $T_B$  are the time periods of A and B respectively, then the ratio  $\frac{T_A}{T_B}$  is-



[Given : radius of earth = 6400 km, mass of earth =  $6 \times 10^{24}$  kg]

1.  $\left(\frac{7}{8}\right)^3$
2.  $\left(\frac{7}{8}\right)^{\frac{3}{2}}$
3.  $\left(\frac{7}{8}\right)^{\frac{2}{3}}$
4.  $\left(\frac{7}{8}\right)^{\frac{1}{3}}$

173.

A proton, a deuteron and an  $\alpha$ -particle are moving perpendicularly with same momentum in a uniform magnetic field. The ratio of radii of their circular paths is:

1. 2 : 2 : 1
2. 4 : 2 : 1
3. 2 : 1 : 1
4. 1 : 1 : 2

174.

The electric field in a region is given  $\vec{E} = \frac{4}{5}\hat{j}$  N/C. Then the electric flux (in SI units) through the rectangular surface of area 5 m<sup>2</sup> (parallel to x - z plane) is-

1. 1
2. 2
3. 3
4. 4

175.

Images of the same size are formed by a convex lens when the object is placed at 20 cm or at 10 cm from the lens. The focal length of the convex lens is:

1. 5 cm
2. 10 cm
3. 15 cm
4. 20 cm

176.

The potential energy (U) of a diatomic molecule is a function dependent on r (interatomic distance) as  $U = \frac{\alpha}{r^{10}} - \frac{\beta}{r^5} - 3$  where,  $\alpha$  and  $\beta$  are positive constants. The equilibrium distance between two atoms will be-

1.  $\left(\frac{2\alpha}{\beta}\right)^{1/7}$
2.  $\left(\frac{2\alpha}{\beta}\right)^{1/3}$
3.  $\left(\frac{2\alpha}{\beta}\right)^{1/4}$
4.  $\left(\frac{2\alpha}{\beta}\right)^{1/5}$

177.

The percentage increase in the speed of transverse waves produced in a stretched string if the tension is increased by 4%, will be-

1. 1%
2. 2%
3. 3%
4. 4%

178.

If  $\vec{P} \times \vec{Q} = \vec{Q} \times \vec{P}$ , the angle between  $\vec{P}$  and  $\vec{Q}$  is-

1.  $45^\circ$
2.  $90^\circ$
3.  $135^\circ$
4.  $180^\circ$

179.

A large number of water drops, each of radius  $r$ , combine to have a drop of radius  $R$ . If the surface tension is  $T$  and mechanical equivalent of heat is  $J$ , the rise in heat energy per unit volume will be:

1.  $\frac{2T}{J} \left( \frac{1}{r} - \frac{1}{R} \right)$
2.  $\frac{2T}{rJ}$
3.  $\frac{3T}{rJ}$
4.  $\frac{3T}{J} \left( \frac{1}{r} - \frac{1}{R} \right)$

180.

A container is divided into two chambers by a partition. The volume of first chamber is 4.5 litre and second chamber is 5.5 litre. The first chamber contain 3.0 moles of gas at pressure 2.0 atm and second chamber contain 4.0 moles of the same gas at pressure 3.0 atm. After the partition is removed and the mixture attains equilibrium, then, the common equilibrium pressure existing in the mixture is-

1. 2 atm
2. 2.55 atm
3. 3 atm
4. 3.5 atm

181.

An airplane, with its wings spread 10 m is flying at a speed of 180 km/h in a horizontal direction. Earth's magnetic field at that point is  $4 \times 10^{-4}$  Wb/m<sup>2</sup> and the angle of dip is  $30^\circ$ . The emf induced between the tips of the plane wings will be :

1. 100 mV
2. 150 mV
3. 200 mV
4. 250 mV

182.

A tuning fork A of unknown frequency produces 5 beats/s with a fork of known frequency 340 Hz. When fork A is filed, the beat frequency decreases to 2 beats/s. What is the original frequency of fork A?

1. 342 Hz
2. 345 Hz
3. 335 Hz
4. 338 Hz

183.

A radioactive sample is undergoing  $\alpha$ -decay. At any time  $t_1$ , its activity is  $A$ , and another time  $t_2$ , the activity is  $\frac{A}{e}$ . What is the average life time for the sample?

1.  $\frac{1}{t_2 - t_1}$
2.  $\frac{t_1 - t_2}{\ln 5}$
3.  $t_2 - t_1$
4.  $\frac{\ln(t_2 - t_1)}{2}$

184.

A beam of protons with speed  $4 \times 10^5 \text{ ms}^{-1}$  enters a uniform magnetic field of 0.3 T at an angle of  $60^\circ$  to the magnetic field. The pitch of the resulting helical path of protons is close to: (Mass of the proton =  $1.67 \times 10^{-27} \text{ kg}$ , charge of the proton =  $1.69 \times 10^{-19} \text{ C}$ )

1. 12 cm
2. 4 cm
3. 5 cm
4. 2 cm

185.

One end of a uniform wire of length  $L$  and weight  $W_0$ , is attached rigidly to a point in the roof and weight  $W_1$  is suspended from its lower end. If  $S$  is the area of cross-section of the wire, the stress in the wire at a height  $L/4$  from its lower end is:

1.  $W_1/S$
2.  $[W_1 + (W_0/4)]/S$
3.  $[W_1 + (3W_0/4)]/S$
4.  $(W_1 + W_0)/S$

## Physics - Section B

186.

$\gamma$ -decay occurs (always) when:

1. Energy is released due to conversion of proton into neutron
2. Energy is released due to conversion of neutron into proton
3. Energy is released due to de-excitation of nucleus
4. None of these

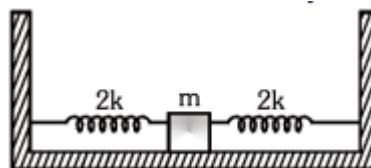
187.

In a ferromagnetic material, below the curie temperature, a domain is defined as:

1. a macroscopic region with zero magnetization.
2. a macroscopic region with consecutive magnetic dipoles oriented in opposite directions.
3. a macroscopic region with randomly oriented magnetic dipoles.
4. a macroscopic region with saturation magnetization.

188.

Two identical springs of spring constant ' $2k$ ' are attached to a block of mass  $m$  and to fixed support (see figure). When the mass is displaced from the equilibrium position on either side, it executes simple harmonic motion. The time period of oscillation of this system is:



1.  $2\pi\sqrt{\frac{m}{k}}$
2.  $\pi\sqrt{\frac{m}{2k}}$
3.  $2\pi\sqrt{\frac{m}{2k}}$
4.  $\pi\sqrt{\frac{m}{k}}$

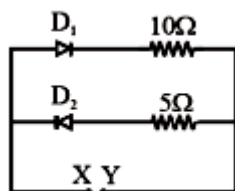
189.

In a Young's double slit experiment, the width of the one of the slit is three times the other slit. The amplitude of the light coming from a slit is proportional to the slit width. Find the ratio of the maximum to the minimum intensity in the interference pattern.

1. 1 : 4
2. 3 : 1
3. 4 : 1
4. 2 : 1

190.

A 5V battery is connected across the points X and Y. Assume  $D_1$  and  $D_2$  to be normal silicon diodes. Find the current supplied by the battery if the +ve terminal of the battery is connected to point X. [Given: Barrier potential of Silicon = 0.7 V]



1.  $\sim 0.5$  A
2.  $\sim 1.5$  A
3.  $\sim 0.86$  A
4.  $\sim 0.43$  A

191.

The coefficient of static friction between a wooden block of mass 0.5 kg and a vertical rough wall is 0.2. A horizontal force is applied on the block to keep it adhere to the wall. Which of the following forces will be sufficient? [ $g = 10 \text{ ms}^{-2}$ ]

1. 30 N
2. 35 N
3. 28 N
4. All of the above

192.

A resonance circuit having inductance and resistance  $2 \times 10^{-4} \text{ H}$  and  $6.28 \Omega$  respectively oscillates at 10 MHz frequency. The value of quality factor of this resonator is-

1. 1000
2. 1500
3. 2000
4. 2500

193.

A hydraulic press can lift 100 kg when a mass 'm' is placed on the smaller piston. If the area of the larger piston is increased by 4 times and that of the smaller piston is decreased by 4 times keeping the same mass 'm' on the smaller piston, how much weight can now be lifted?

1. 1200 kg
2. 1600 kg
3. 2000 kg
4. 2400 kg

194.

A ball moving with a speed of 9 m/s collides elastically with another identical ball at rest. After the collision, the second ball moves with a speed of 5 m/s along the original direction. Final velocity of the first ball is-

1. 4 m/s along original direction
2. 5 m/s along original direction
3. 4 m/s opposite to original direction
4. 5 m/s opposite to original direction

195.

512 identical drops of mercury are charged to a potential of 2V each. The drops are joined to form a single drop. The potential of this drop is-

1. 32 V
2. 64 V
3. 96 V
4. 128 V



196.

Two particles having masses 4 g and 16 g respectively are moving with equal kinetic energies. The ratio of the magnitudes of their linear momentum is  $n : 2$ . The value of  $n$  will be-

1. 1
2. 2
3. 3
4. 4

197.

The trajectory of a projectile in a vertical plane is  $y = \alpha x - \beta x^2$ , where  $\alpha$  and  $\beta$  are constants and  $x$  &  $y$  are respectively the horizontal and vertical distances of the projectile from the point of projection. The angle of projection  $\theta$  :

1.  $\tan^{-1} \alpha$
2.  $\tan^{-1} \beta$
3.  $\tan^{-1} 2\beta$
4.  $\tan^{-1} 2\alpha$

198.

A cord is wound round the circumference of wheel of radius  $r$ . The axis of the wheel is horizontal and the moment of inertia about it is  $I$ . A weight  $mg$  is attached to the cord at the end. The weight falls from rest. After falling through a distance ' $h$ ', the square of angular velocity of wheel will be :

1.  $\frac{2mgh}{I+2mr^2}$
2.  $\frac{2mgh}{I+mr^2}$
3.  $2gh$
4.  $\frac{2gh}{I+mr^2}$

199.

Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion (A) : For a simple microscope, the angular size of the object equals the angular size of the image.

Reason (R) : Magnification is achieved as the small object can be kept much closer to the eye than 25 cm and hence it subtends a large angle.

In the light of the above statements, choose the most appropriate answer from the options given below :

1. A is true but R is false
2. Both A and R are true but R is NOT the correct explanation of A.
3. Both A and R are true and R is the correct explanation of A
4. A is false but R is true

200.

A wire of  $1\Omega$  has a length of 1m. It is stretched till its length increases by 25%. The percentage change in resistance to the nearest integer is :

1. 56%
2. 25%
3. 12.5%
4. 76%

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