Botany - Section A

1.

In a cereal grain, the single cotyledon of an embryo is represented by:

1. coleorhiza
2. scutellum
3. prophyll
4. coleoptile

2.

The cells coming from which region actually gets differentiated and matured?

1. Region of Maturation
2. Region of Elongation
3. Region of Root cap
4. Region of Root hair

3.

Which of the following has chlorophyll in it's fleshy cylindrical stem to carry out photosynthesis?

1. Euphorbia
2. Opuntia
3. Citrus
4. Watermelon

4.

Australian Acacia has not

1. Small leaves
2. Expanded Petioles
3. Photosynthetic petiole
4. Long lived leaves

5.

Which of the following is not a source of edible oil?

1. Soyabean
2. Groundnut
3. Sesbania
4. All of these

6.

The type of placentation in plants in which ovary is unilocular but it becomes two-chambered due to the formation of the false septum is

1. Free central
2. Basal
3. Parietal
4. Marginal

7.

In mango and coconut plants, the fruit

1. Has hard and stony endocarp
2. Is developed from a polycarpellary superior ovary
3. Is developed from the apocarpous ovary
4. Is multi seeded

8.

Choose the incorrect statement w.r.t. racemose inflorescence

1. Acropetally arranged flowers
2. Growing point or shoot apex is consumed
3. Centripetal anthesis
4. Flowers may be unisexual or bisexual

9.

Lignin is a component of the secondary walls of:-

1. Epidermis

2. Collenchyma

3. Sclerenchyma

4. Parenchyma

10.

Match the column I with column II

	Column I		Column II
a.	Xylem parenchyma	(i)	Absent in most of the monocots
b.	Sclereids	(ii)	Long cylindrical tube-like structure
c.	Phloem parenchyma	(iii)	Food and tannins
d.	Vessel	(iv)	Fruit walls of nuts

1. a(i), b(ii), c(iii), d(iv)

2. a(iii), b(iv), c(i), d(ii)

3. a(ii), b(iv), c(iii), d(i)

4. a(iii), b(ii), c(i), d(iv)

11.

Hypodermis in dicot stem is composed of

1. Paraenchyma

2. Collenchyma

3. Sclerenchyma

4. Both 1. and 3.

12.

Periderm includes

1. Only cork cambium

2. Cork cambium and cork only

3. Cork and secondary cortex

4. Cork, Cork cambium and secondary cortex

13.

Regeneration of damaged growing grass following grazing is largely due to :

1. Lateral meristem

2. Apical meristem

3. Intercalary meristem

4. Secondary meristem

14.

Grass leaves curl inwards during very dry weather. Select the most appropriate reason from the following :

1. Tyloses in vessels

2. closure of stomata

3. Flaccidity of bulliform cells

4. Shrinkage of air spaces in spongy mesophyll

15.

The transverse section of a plant shows following anatomical features :

(a) Large number of scattered vascular bundles surrounded by bundle sheath.

(b) Large conspicuous parenchymatous ground tissue.

(c) Vascular bundles conjoint and closed.

(d) Phloem parenchyma absent.

ldentify the category of plant and its part :

1. Monocotyledonous root

2. Dicotyledonous stem

3. Dicotyledonous root

4. Monocotyledonous stem

16.

Match the stage of meiosis in column I to their characteristic features in column II and select the correct option using the codes given below

Column l	Column ll
A. pachytene	1. pairing of homologous chromosomes
B. Metaphase-l	2. Terminalisation of chiasmata
C. Diakinesis	3. Crossing-over takes place
D. Zygotene	4. Chromosomes align at equatorial plate

The correct option:

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

17.

Select the wrong statement:

1. Cell growth is a continuous process

2. Cytoplasmic content increase occurs only during one specific stage in the cell cycle

3. DNA synthesis occurs only during one specific phase of cell cycle

4. None of these

18.

A picture of dividing *Drosophila* cell through a microscope shows that the cell contains 8 chromosomes, each consisting of two chromatids. The picture must have been taken during:

1. Mitotic metaphase

2. Mitotic Anaphase

3. Meiotic Anaphase II

4. Meiotic Telophase II

19.

The first living cell was described by

1. Anton Von Leeuwenhoek

2. Robert Brown

3. Robert Hooke

4. Both A and B

20.

It is said that elemental composition of living organisms and that of inanimate objects (like earth's crust) are similar in the sense that all the major elements are present in both. Then what would be the difference between these two groups? Choose a correct answer from among the following.

1. Living organisms have more gold in them than inanimate objects

2. Living organisms have more water in their body than inanimate objects

3. Living organisms have more carbon, oxygen and hydrogen per unit mass than inanimate objects

4. Living organisms have more calcium in them than inanimate objects

21.

Which of the following is the function of mesosomes?

1. help in cell wall formation

2. help in DNA replication and its distribution

3. help in respiration, secretion processes and increase surface area

4. All of the above

22.

Which of the following is correct except

1. Pili and Fimbriae play role in motility

2. Flagella, pili, and fimbriae are surface structures

3. pili and fimbriae help in attachment to surfaces

4. Both A and C

23.

The classification of bacteria into Gram positive and Gram negative had been possible due to

1. difference in cell envelopes

2. differences in staining procedure

3. differences in decolorising process

4. All of the above

24.

Which of the following is true about cell wall except

1. determines shape of the cell

2. prevent cell from bursting and collapsing

3. selective permeable in nature

4. provides strong structural support

25.

The sequence of events by which a cell duplicates its genome, synthesises other constituents of cells and eventually divides into daughter cells is termed as:

1. Interphase

2. M-phase

3. Karyokinesis + Cytokinesis

4. Cell cycle

26.

Which of the following is not a phase of Karyokinesis?

1. Interkinesis

2. Prophase

3. Metaphase

4. Anaphase

27.

The plane of alignment of chromosomes at metaphase is referred as

1. Metaphase line

2. Metaphase plate

3. Metaphase area

4. Metaphase shape

28.

The Cytokinesis of plant cell is not same as that of animal cell because of

1. Inextensible cell wall

2. Cell membrane differences

3. Intermediate Filaments

4. Nuclear envelope

29.

The specialised kind of cell division that reduces the chromosome number by half results in the production of haploid phase in the life cycle is

1. Meiosis

2. Mitosis

3. Amitosis

4. Karyomitosis

30.

In a mitotic cycle, the correct sequence of phases is

1. S, G_1, G_2, M

2. G_1, S, G_2, M

3. M, G_1, G_2, S

4. G_1, G_2, S, M

31.

Starch gives blue colour with iodine because of

1. It exists in globular form

2. I_2 gets hold in helical form

3. It has blue colour pigment

4. All of the above

32.

Which amongst the following secondary metabolites is a drug?

1. Ricin

2. Cellulose

3. Curcumin

4. Lemon grass oil

33.

Which of the following is **incorrect** statement w.r.t. carbohydrates?

1. Mannose and galactose are polymers of glucose

2. Cellulose acetate is used in fabrics, cellulosic plastics and shatter proof glasses

3. Most of sugars show Benedict's test but not sucrose

4. Sucrose is composed of glucose and fructose and is a non-reducing sugar

34.

All the following statements about cellulose are correct but one is wrong. Which one is **wrong**?

1. Cellulose is homopolymer

2. It is the most abundant organic molecule in the biosphere

3. It has β-1-4 glycosidic bonds

4. It is a branched polymer of β- glucose, can hold iodine in the helical portion giving blue black colour with it

35.

Which of the following is a primary metabolite?

1. Carotenoid

2. Glucose

3. Morphine

4. Cellulose

Botany - Section B

36.

In some plants a slender lateral branch arises from the base of the main axis and growing aerially for sometime, it archs downwards to touch the ground.

Find the odd one with respect to statement.

1. Mint

2. Jasmine

3. Grass

4. All of these

37.

Which of the following is not a characteristic of calyx of solanaceae family?

1. Ten sepals

2. United sepals

3. Persistent

4. Valvate

38.

Characters like a hypogynous and pentamerous flower, gamopetalous, superior ovary with axile placentation and epipetalous condition are shown by angiospermic family _____

1. Fabaceae

2. Solanaceae
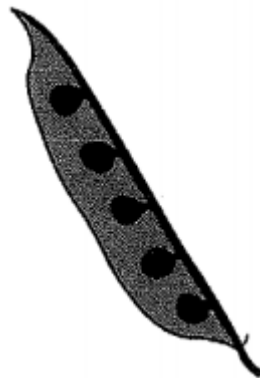
3. Asteraceae

4. Liliaceae

39.

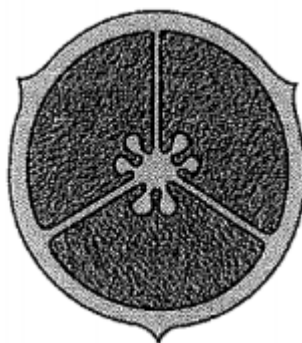Swollen leaf base in the leguminous plants is called as

1. Phyllode

2. Pulvinus

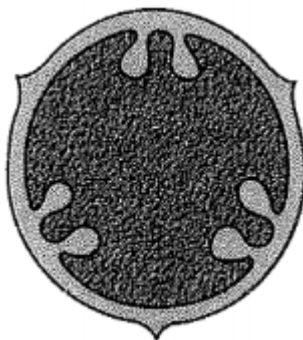3. Cladode

4. Phylloclade

40.

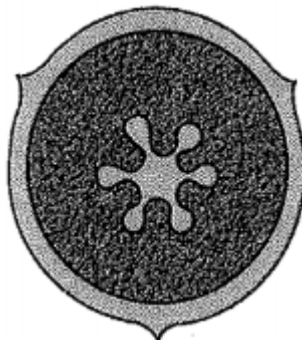Which of the following type of placentation is found in Dianthus?
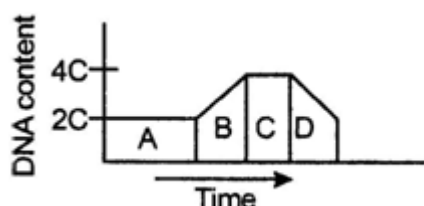

a.

b.

c.

d.

1. a

2. b

3. c

4. d

41.

Which one of the following are elongated single-celled water-conducting dead structures with bordered pits?

1. Tracheids

2. Vessels

3. Sclerenchyma fibres

4. Sclereids

42.

The above graph shows the change in DNA content during various phases (A to D) in a typical mitotic cell cycle. Identify the phases:

	A	B	C	D
1.	G_2	G_1	S	M
2.	G	S	G_2	M
3.	G_1	S	G_2	M
4.	M	G_1	S	G_2

43.

Interkinesis

1. Long lasting in some cells

2. Involves S phase

3. In between Meiosis I

4. No DNA replication

44.

The cell shown in the given diagram is in:

1. Early prophase

2. Late prophase

3. Metaphase

4. Telophase

45.

Which one is correct about S-phase (synthetic phase)?
I. It occurs between G1 and G2
II. It marks the period during which DNA replicates
III. At the end of this phase DNA is doubled but the number of chromosomes remains unchanged
IV. As the DNA is doubled in this phase number of chromosomes is also doubled
V. Centrioles replicate in this phase
VI. Amount of DNA changes from 2C to 4C
VII. It is pre G2 and post G1 phase

1. I, II, IV, V, VI, VII are correct

2. I, II, III, V, VI, VII are correct

3. All are correct

4. Only IV is correct

46.

Mitotic divisions result in continuous growth of plants throughout their life in the

1. Meristematic tissue

2. Apical and lateral cambium

3. Both A and B

4. Cells of maturation zone of root

47.

What does result in dyad of cells?

1. Telophase II

2. Telophase I

3. Cytokinesis I

4. Meiosis II

48.

Cellulose is present in

1.cotton fibres

2.Paper

3.Cell wall of plants

4.All of these

49.

Inulin is a polymer of

1. One glucose and one fructose molecules

2. Many fructose molecules

3. One glucose and galactose molecules

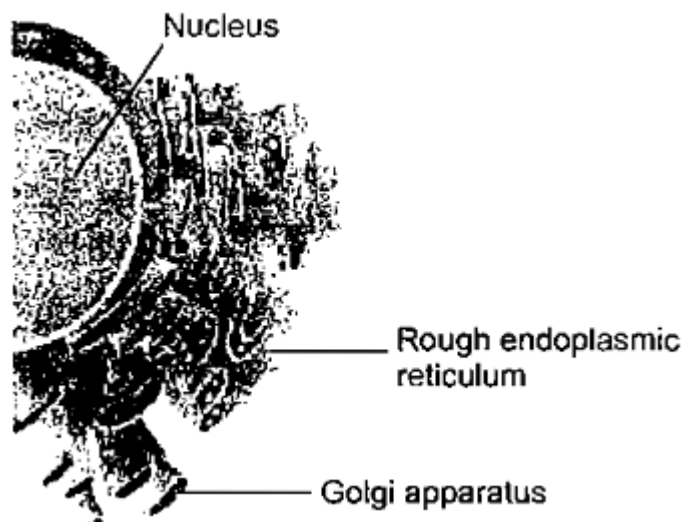4. many N-acetylglucosamine molecules

50.

Which of the following are not secondary metabolites in plants?

1. Vinblastin, curcumin

2. Rubber, gums

3. Morphine, codeine

4. Amino acids, glucose

Zoology - Section A

51.

Which one of the following organelle in the figure correctly matches with its function?

1. Rough endoplasmic reticulum, formation of glycoproteins

2. Golgi apparatus, protein synthesis

3. Golgi apparatus, formation of carbohydrates

4. Rough endoplasmic reticulum, protein synthesis

52.

DNA is present in

1. chromosomes and dictyosomes

2. chloroplasts and lysosomes

3. mitochondria and chloroplasts

4. mitochondria and endoplasmic reticulum

53.

During meiosis I in human, one of the daughter cells receives:

1. Only maternal chromosomes

2. A mixture of maternal and paternal chromosomes

3. The same number of chromosomes as a diploid cell

4. A sister chromatid from each chromosome

54.

The division time for the human cell is

(1) 24 hr

(2) 1 hr

(3) 23 hr

(4) 90 minutes

55.

What is true about ribosomes?

1. The prokaryotic ribosomes are 80S, where S stands for sedimentation coefficient

2. These are composed of ribonucleic acid and proteins

3. These are found only in eukaryotic cells

4. These are self-splicing introns of some RNAs

56.

Which of the following statement is true?

1. Centriole is well developed in animals

2. Centrioles lie perpendicular to each other in centrosome

3. 9+0 arrangement of microtubules is present in centrioles

4. All of the above

57.

The plasma membrane of human RBC contains

1. 70% phospholipids and 30% sterols

2. 52% proteins and 40% lipids

3. 40% proteins and 52% lipids

4. 90% water and 10% integral proteins

58.

Antiparallel strands of a DNA molecule means that

1. The phosphate groups of two DNA strands, at their ends, share the same position

2. The phosphate groups at the start of two DNA strands are in opposite position (pole)

3. One strand turns clockwise

4. One strand turns anti-clockwise

59.

Enzyme often has additional parts in their structures that are made up of molecules other than proteins. When this additional chemical part is an organic molecule, it is called

1. cofactor

2. coenzyme

3. substrates

4. Both 1 and 2

60.

In proteins, amino acids are linked by a type of

1. Acetyl bond

2. Peptide bond

3. Ester bond

4. Glycosidic bond

61.

In polysaccharides the individual monosaccharides are linked by

1. Phosphodiester bond

2. Amide bond

3. Ester bond

4. Glycosidic bond

62. Proteins are _____ of amino acids

1. homopolymer

2. heteropolymer

3. Neither homopolymer nor heteropolymer

4. None of these

63.

Types of amino acids depend on

1. Carboxyl group

2. Amino group

3. Alkyl group

4. Hydrogen

64.

Which of the following is true about Glycerol

1.It is trihydroxy propane

2.Fatty acids are esterified with glycerol

3.It forms the backbone of phospholipids

4.All of these

65.

When chemical analysis of living tissue was done using trichloroacetic acid, then filtrate formed was

1. acid-insoluble fraction

2. acid-soluble fraction

3. retentate

4. Both 1 and 3

66.

Which of the following is correct?

1. Enzyme has a active site so that a highly reactive enzyme-substrate complex is produced.

2. ES complex is short lived.

3. The formation of ES complex is essential for catalysis.

4. All of these

67.

The substrate of enzyme succinic dehydrogenase is

1. succinate

2. malonate

3. malate

4. mannose

68.

Which of the following is an inorganic compound?

1. Prosthetic group

2. Coenzymes

3. Metal ions

4. Apoenzymes

69.

When the co-factor is removed from the enzyme, its catalytic activity:

1. remains same

2. is increased

3. is greatly reduced

4. is lost

70.

Which group of the amino acid contributes essentially to the chemical and physical properties of amino acids?

1.Amino group

2.Carboxyl group

3.Alkyl group (R group)

4.All of these

71.

Which of the following class of enzyme catalyse the linking together of 2 compounds?

1.Lyases

2.Ligases

3.Hydrolases

4.Transferases

72.

Which of the following is **incorrect** w.r.t. enzymes?

1. An active site of an enzyme is a pocket into which the substrate fits

2. Enzymes through their active site, catalyse reactions at a high rate

3. Inorganic catalysts work efficiently at high temperature and high pressure
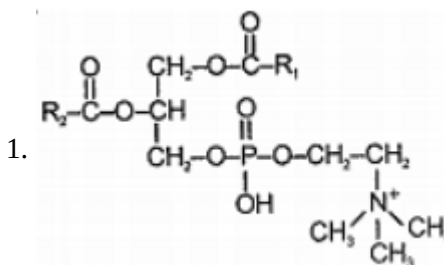
4. Enzymes retain their catalytic power even at high temperatures

73.

Chitin is found in exoskeletons of arthropods. It is

1. Simple glycoproteinaceous compound

2. Complex homopolysaccharides

3. Complex homopolypeptide

4. Chemically modified alcoholic sugars

74.

Which of the following is incorrect match of the compounds shown?

|		
1.		A steroid, deficiency of which causes hypersensitivity to a variety of stimuli and airway obstruction in the lungs of new born.
2.		It is found in animals only. It is precursor of hormones such as progesterone, testosterone, estradiol and cortisol
3.		Found in RNA but absent in DNA
4.		Alcoholic amino acid. The 'R' group contains hydroxyl methyl
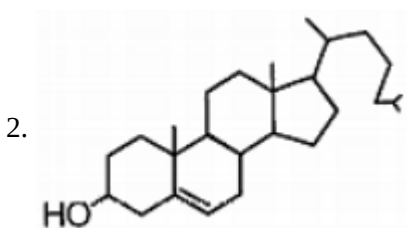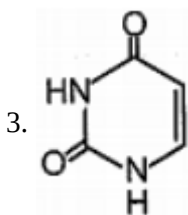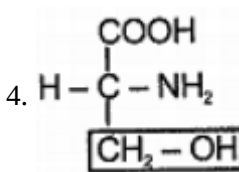
75.

Which of the following combines with a non-protein prosthetic group to form a functional enzyme?
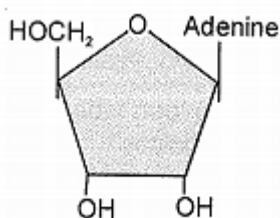
1. Holoenzyme

2. Apoenzyme

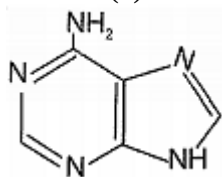3. Coenzyme

4. Proenzyme

76.

Given below is diagrammatic representation of small molecular weight organic compounds in living tissues
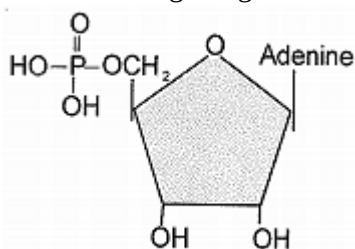
(a)

(b)

(c)

Choose the option which is **correct** identification of structures labelled as 1, 2 and 3

a	b	c
1. Nucleoside	Nucleotide	Adenine
2. Nucleotide	Nucleoside	Guanine
3. Nucleoside	Nucleotide	Guanine
4. Nucleotide	Nucleoside	Adenine

77.

Which of the following is **not** a protein?

1. GLUT-4

2. Collagen

3. Inulin

4. Antibody

78.

In the given graph if Y-axis represents reaction velocity, then X-axis can represent
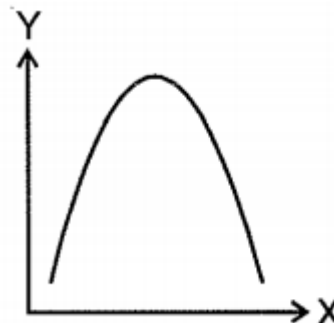
1.pH

2.Temperature

3.Substrate concentration

4.Either 1 or 2

79.

All the following statements are correct about enzymes, but one is wrong. Select the incorrect.

1. Almost all enzymes are proteins

2. There are some carbohydrates which behave like enzymes and are called ribozyme

3. Enzymes obtained from thermophilic organisms retain their catalytic power even up to 80-90°C

4. Ribozyme was discovered by *Altman et al*.

80.

An amino acid under certain conditions has both positive and negative charges simultaneously in the same molecule. Such a form of amino acid is called

1. acidic form

2. basic form

3. aromatic form

4. zwitterionic form

81.

The most abundant chemical in living organisms could be

1. protein
2. water
3. sugar
4. nucleic acid

82.

Proteins perform many physiological functions. For example, some functions as enzymes. One of the following represents an additional function that some proteins discharge

1. Antibiotics
2. Pigment conferring colour to skin
3. Pigments making coloursof flowers
4. Hormones

83.

The primary structure of a protein molecule has

1. two ends
2. one end
3. three ends
4. no ends

84.

Match List-I with List-II.

List-I	List-II
(a) Protein	I. C-C double bonds
(b) Unsaturated fatty acid	II. Phosphodiester bonds
(c) Nucleic acid	III. Glycosidic bonds
(d)Polysaccharides	IV. Peptide bonds

Choose the correct answer from the options given below.

   (a) (b) (c) (d)

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

85.

Following are the statements with reference to 'lipids'.

(a) Lipids having only single bonds are called unsaturated fatty acids.

(b) Lecithin is a phospholipid.

(c) Trihydroxy propane is glycerol.

(d) Palmitic acid has 20 carbon atoms including carboxyl carbon.

(e) Arachidonic acid has 16 carbon atoms.

Choose the correct answer from the options given below.

1. (b) and (c) only
2. (b) and (e) only
3. (a) and (b) only
4. (c) and (d) only

Zoology - Section B

86.

What are Singer and Nicolson known for?

1. One-gene-one-enzyme hypothesis
2. Plasma membrane modifications
3. Fluid-mosaic model of plasma membrane
4. Structure of DNA

87.

Cytoskeleton comprises of

1. Microtubule

2. Microfilament

3. Intermediate filament

4. All of the these

88.

Adenosine, Guanosine, thymidine, uridine, cytidine are all _____ but adenylic acid, guanylic acid, uridylic acid, cytidylic acid are _____:

1. Nucleotides, nucleosides

2. Nucleosides, nucleotides

3. Nucleotides, nucleic acids

4. Nucleotides, nucleases

89.

Quaternary structure of proteins are formed by

1. primary structure of proteins

2. Secondary structure of proteins

3. Tertiary structure of proteins

4. Quaternary structure of proteins

90.

Which of the following compound is present in least amount in cell?

1. Water

2. nucleic acids

3. Carbohydrates

4. Lipids

91.

Nucleotide is made up of

1. Heterocyclic compound, Monosaccharide, Phosphoric acid.

2. Nitrogenous base, hexose sugar, phosphate.

3. Heterocyclic compound and pentose sugar only.

4. Heterocyclic compound and nucleoside.

92.

Which of the following is incorrect?

1.The substrate binds to the active site of the enzyme

2.The binding of the substrate induces the enzyme to alter its shape.

3.The active site of the enzyme when it is in close proximity of the substrate breaks the chemical bonds of the substrate.

4.None of these

93.

Enzyme that catalyses the cleavage of specific covalent bond and removal of groups without hydrolysis belongs to which class of enzyme?

1. Lyases

2. Hydrolases

3. Transferases

4. Ligases

94.

Select the **true** statement

1. Haem is the prosthetic group and it is a part of the active site of the enzyme peroxidase and catalase

2. Lyase enzymes catalyse hydrolysis of ester, ether and peptide, glycosidic bonds

3. Enzymes generally function in a broad range of temperature and pH

4. Inhibition of succinate dehydrogenase enzyme by malonate results in decrease of V_{max} while K_m value remains unaffected

95.

Which of the following is a basic amino acid?

1. Tyrosine

2. Phenylalanine

3. Lysine

4. Tryptophan

96.

Amino acids differ from each other mainly at R group. If R group of proteinaceous amino acid is hydroxy methyl, the amino acid would be

1. Glycine

2. Alanine

3. Serine

4. Tyrosine

97.

Amino acids have both an amino group and a carboxyl group in their structure. Which amongst the following is an amino acid?

1. Formic acid

2. Glycerol

3. Glycolic acid

4. Glycine

98.

When we homogenise any tissue in an acid, the acid-soluble pool represents

1. cytoplasm

2. cell membrane

3. nucleus

4. mitochondria

99.

A homopolymer has only one type of building block called monomer repeated 'n' number of times. A heteropolymer has more than one type of monomer. Proteins are heteropolymers usually made of

1. 20 types of monomers

2. 40 types of monomers

3. 30 types of monomers

4. only one type of monomer

100.

Glycogen is a homopolymer made of

1. glucose units

2. galactose units

3. ribose units

4. amino acids

Chemistry - Section A

101.

Following reaction occurs at $25^\circ C$:

$2NO_{(g)}$, $(1 \times 10^{-5}$ atm) + $Cl_2(g)$, (1×10^{-2} atm) $\rightleftharpoons$ $2NOCl_{(g)}$, (1×10^{-2} atm) ΔG^o is-
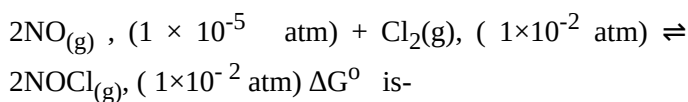
1. -45.65 kJ

2. -28.53 kJ

3. -22.82 kJ

4. -57.06 kJ

102.

A: At Boyle's temperature, the compressibility factor of gas approaches unity.

R: At Boyle's temperature the real gas obeys ideal gas law.

1. Both Assertion & Reason are true and the reason is the correct explanation of the assertion.

2. Both Assertion & Reason are true but the reason is not the correct explanation of the assertion.

3. Assertion is a true statement but Reason is false.

4. Both Assertion and Reason are false statements.

103.

$E^{\ominus}$ values of some redox couples are given below. On the basis of these values choose the correct option.

$E^{\ominus}$ values : Br_2 / Br^- = + 1.90 ; Ag^+ / Ag = + 0.80

Cu^+ / Cu = + 0.34 ; I_2/ I^- = + 0.54

1. Cu will reduce Br^-

2. Cu will reduce Ag

3. Cu will reduce I^-

4. Cu will reduce Br_2

104.

Oxidation state of nitrogen is incorrectly given for:

Compound	Oxidation state
1. $(Co(NH_3)_5Cl)Cl_2$	-3
2. NH_2OH	-1
3. $(N_2H_5)_2SO_4$	+2
4. Mg_3N_2	-3

105.

The oxidation state of Cr in CrO_6 is -

1. -6

2. +12

3. +6

4. +4

106.

When 0.1 mol of CH_3NH_2 $(K_b = 5 \times 10^{-4})$ is mixed with 0.08 mol of HCl and diluted to 1L, the H^+ ion concentration in the solution is-

1. 8×10^{-11} M

2. 6×10^{-5} M

3. 1.6×10^{-11} M

4. 8×10^{-2} M

107.

$(a)\ E^o_{K^+/K} = -2.93\ V\ ;\ E^o_{Ag^+/Ag} = 0.80\ V$

$(b)\ E^o_{Hg^{+2}/Hg} = 0.79V;\ E^o_{Mg^{+2}/Mg} = -2.37V$

$(c)\ E^o_{Cr^{+3}/Cr} = -0.74\ V$

Based on standard electrode potentials given above, the correct arrangement for increasing order of reducing power of elements is -

1. Ag < Hg < Cr < Mg < K

2. Ag > Cr > Mg > Hg > K

3. K > Mg < Cr < Hg > Ag

4. K< Mg < Cr < Hg < Ag

108.

Gases possess characteristic critical temperature which depends upon the magnitude of intermolecular forces between the particles. Following are the critical temperatures of some gases.

Gases	H_2	He	O_2	N_2
The critical temperature in Kelvin	33.2	5.3	154.3	126

From the above data, the order of liquefaction of the given gases is-

(write the order from the gas liquefying first)

1. H_2, He, O_2, N_2

2. He, O_2, H_2, N_2

3. N_2, O_2, He, H_2

4. O_2, N_2, H_2, He

109.

Atmospheric pressure recorded in different cities are as follows

Cities	p in N/m^2
Shimla	1.01×10^5
Bangalore	1.2×10^5
Delhi	1.02×10^5
Mumbai	1.21×10^5

The liquid will boil first at -

1. Shimla

2. Bangalore

3. Delhi

4. Mumbai

110.

How does the surface tension of a liquid vary with increase in temperature?

1. Remains same

2. Decreases

3. Increases

4. No regular pattern is followed

111.

Match the following graphs of an ideal gas with their coordinates.

Graphical representation	X and Y coordinates
A.	1. pV vs V
B.	2. p vs V
C.	3. p vs $\frac{1}{V}$
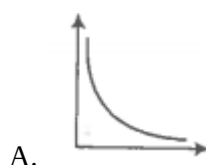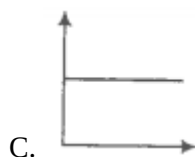
Codes

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

112.

The ionisation constant of an acid, K_a is the measure of strength of an acid. The K_a values of acetic acid, hypochlorous acid and formic acid are 1.74×10^{-5}, 3.0×10^{-8} and 1.8×10^{-4} respectively. The correct order of pH of 0.1 mol dm^{-3} solutions of these acids is -

1. Acetic acid > hypochlorous acid > formic acid

2. Hypochlorous acid < acetic acid > formic acid

3. Formic acid > hyochlorous acid > acetic acid

4. Formic acid < acetic acid < hypochlorous acid

113.

Among the following, the mixture will produce a buffer solution when mixed in equal volumes is-

1. 0.1 mol dm^{-3} NH$_4$OH and 0.1 mol dm^{-3} HCl

2. 0.05 mol dm^{-3} NH$_4$OH and 0.1 mol dm^{-3} HCl

3. 0.1 mol dm^{-3} NH$_4$OH and 0.05 mol dm^{-3} HCl

4. 0.1 mol dm^{-3} CH$_3$COONa and 0.1 mol dm^{-3} NaOH

114.

K_a for $CH_3 COOH$ is 1.8×10^{-5} and K_b for $NH_4 OH$ is 1.8×10^{-5}. The pH of ammonium acetate will be -

1. 7.005

2. 4.75

3. 7.0

4. Between 6 and 7

115.

Among water, ether, and acetone, water has the maximum boiling point and ether has the minimum boiling point. The correct order of vapour pressure of water, acetone and ether at $30\,°C$ is-

1. Water<ether<acetone

2. Water<acetone<ether

3. Ether<acetone<water

4. Acetone<ether<water

116.

Standard electrode potentials are

$Fe^{+2}/Fe\ E° \ = \ -0.44$

$Fe^{+3}/Fe^{+2}\ E° \ = 0.77$

If Fe^{+2} , Fe^{+3} and Fe block are kept together, then :-

1. Fe^{+3} increases

2. Fe^{+3} decreases

3. $\frac{Fe^{+2}}{Fe^{+3}}$ remains unchanged

4. Fe^{+2} decreases

117.

As per Charles's law ,–273° C is the lowest possible temperature because-

1. All gases get liquefied before reaching a temperature of – 273° C.

2. All gases get liquefied after reaching a temperature of – 273° C.

3. All gases have a critical temperature of –273° C.

4. None of the Above.

118.

1.0 mol of a monoatomic ideal gas is expanded from state (1) to state (2) as shown in the graph below:
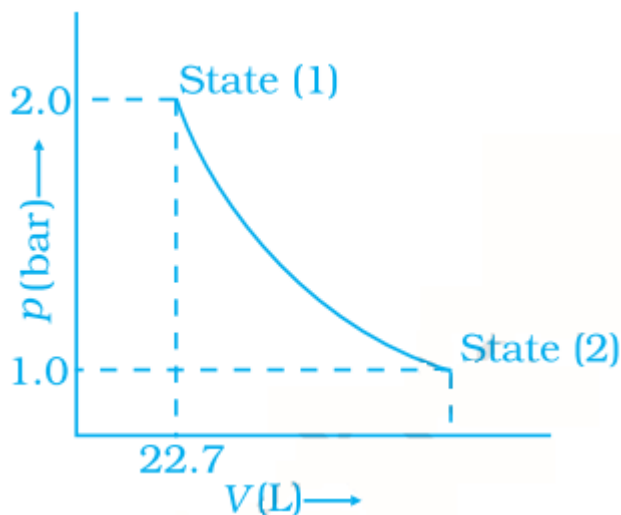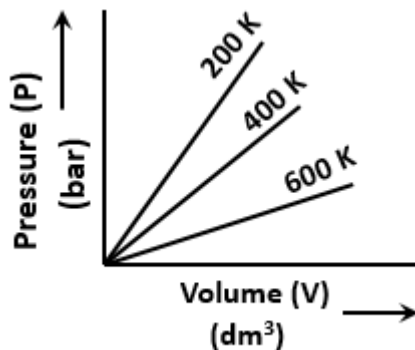

The work done for the expansion of gas from state (1) to state (2) at 298 K will be
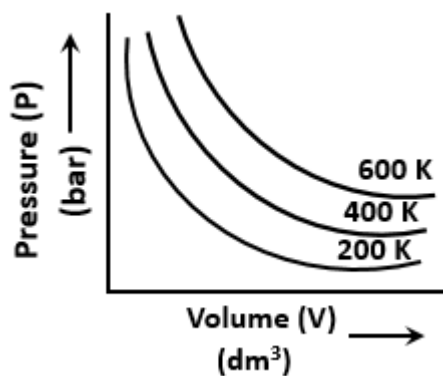
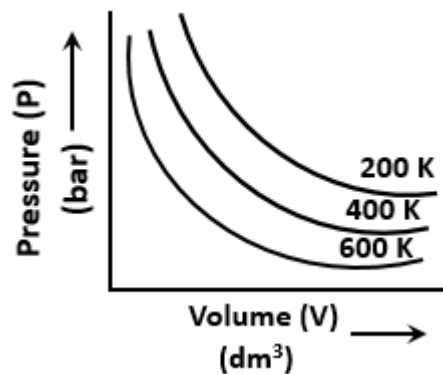1. 1617.6 J

2. -1617.6 J

3. 1717.6 J

4. -1717.6 J

119.

Choose the correct option for graphical representation of Boyle's law, which shows a graph of pressure vs. volume of a gas at different temperatures :
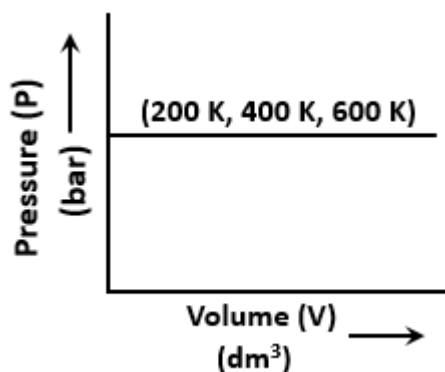
1.

2.

3.

4.

120.

Assertion (A): When Cu (II) and sulphide ions are mixed, they react together extremely quickly to give a solid.

Reason (R): The equilibrium constant of $Cu^{2+}(aq) + S^{2-}(aq) \rightleftharpoons CuS(s)$ is high because the solubility product is low.

The correct option is-

1. Both (A) and (R) are true and (R) is the explanation for (A)

2. Both (A) and (R) are false

3. (A) is false and (R) is true

4. Both (A) and (R) are true but (R) is not the explanation for (A)

121.

The oxidation states of iron atoms in compounds (A), (B) and (C), respectively, are x, y and z. The sum of x, y and z is_____.

$Na_4[Fe(CN)_5NOS]$ $Na_4[FeO_4]$ $[Fe_2(CO)_9]$

   (A)   (B)   (C)
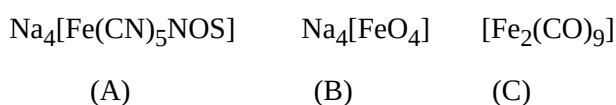
1. 4

2. 5

3. 6

4. 7

122.

The internal energy change (in kJ) when 90g of water undergoes complete evaporation at 100ºC is -

(Given : ΔH_{vap} for water at 373 K = 41 kJ/mol, R = $8.314 \ JK^{-1}mol^{-1}$)

1. 154.5

2. 168.5

3. 176.5

4. 189.5

123.

For one mole of an ideal gas, which of these statements must be true ?
(I) U and H each depends only on temperature
(II) Compressibility factor z is not equal to 1
(III) $C_{P, m} - C_{V, m} = R$
(IV) $dU = C_V dT$ for any process

1. (I), (III) and (IV)
2. (II), (III) and (IV)
3. (III) and (IV)
4. (I) and (III)

124.

If the equilibrium constant for $A \rightleftharpoons B + C$ is $K_{eq}^{(1)}$ and that of $B + C \rightleftharpoons P$ is $K_{eq}^{(2)}$, the equilibrium constant for $A \rightleftharpoons P$ is :

1. $K_{eq}^{(2)} - K_{eq}^{(1)}$

2. $K_{eq}^{(1)} \times K_{eq}^{(2)}$

3. $K_{eq}^{(1)} + K_{eq}^{(2)}$

4. $K_{eq}^{(2)} / K_{eq}^{(1)}$

125.

Five moles of an ideal gas at 1 bar and 298 K is expanded into vacuum to double the volume. The work done is-
1. $-RT \ln V_2/V_1$
2. $C_V(T_2 - T_1)$
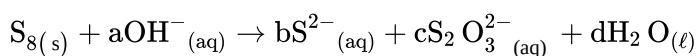3. zero
4. $-RT(V_2 - V_1)$

126.

At 1990 K and 1 atm pressure, there are an equal number of Cl_2 molecules and Cl atoms in the reaction mixture. The value K_P for the reaction $Cl_{2(g)} \rightleftharpoons 2 Cl_{(g)}$ under the above conditions is $x \times 10^{-1}$. The value of x is-

1. 4

2. 8

3. 5

4. 10

127.

The reaction of sulphur in alkaline medium is the below

$$S_{8(s)} + aOH^-_{(aq)} \rightarrow bS^{2-}_{(aq)} + cS_2O_3^{2-}_{(aq)} + dH_2O_{(\ell)}$$

The values of 'a' is-

1. 10

2. 12

3. 14

4. 17

128.

For the reaction $A_{(g)} \rightarrow (B)_{(g)}$, the value of the equilibrium constant at 300 K and 1 atm is equal to 100.0. The value of $\Delta_r G$ for the reaction at 300 K and 1 atm in J mol^{-1} is – xR, where x is-

(R = 8.31 J mol^{-1} K^{-1} and ln 10 = 2.3)

1. 1400

2. 1380

3. 1360

4. 1340

129.

The volume occupied by 4.75 g of acetylene gas at 50°C and 740 mmHg pressure is-

[Given R = 0.0826 L atm K–1 mol^{-1}]

1. 6 L

2. 5 L

3. 8 L

4. 10 L

130.

The solubility product of PbI_2 is 8.0×10^{-9} . The solubility of lead iodide in 0.1 molar solution of lead nitrate is x × 10^{-6} mol/L. The value of x is-
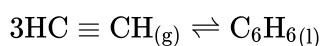
(Rounded off to the nearest. integer) [Given : $\sqrt{2} = 1.41$]

1. 154

2. 423

3. 282

4. 141

131.

Assuming ideal behaviour, the magnitude of log K for the following reaction at 25°C is

x × 10^{-1} . The value of x is-.

$$3HC \equiv CH_{(g)} \rightleftharpoons C_6H_{6(l)}$$

$$\left[\text{Given:} \right.$$

$$\Delta_f G^\circ \left(HC \equiv CH \right) = -2.04 \times 10^5 \text{ J mol}^{-1}$$

$$\Delta_f G^\circ (C_6H_6) = -1.24 \times 10^5 \text{ J mol}^{-1}$$

$$R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1} \left. \right]$$

1. 860

2. 875

3. 855

4. 895

132.

3.12 g of oxygen is adsorbed on 1.2 g of platinum metal. The volume of oxygen adsorbed per gram of the

adsorbent at 1 atm and 300 K in L is-

[R = 0.0821 L atm K^{-1} mol^{-1}]

1. 4 L

2. 3 L

3. 1 L

4. 2 L

133.

The average S–F bond energy in kJ mol^{-1} of SF_6 is-

[Given: The values of standard enthalpy of formation of $SF_6(g)$, $S(g)$, and $F(g)$ are -1100, 275, and 80 kJ mol^{l-1} respectively.]

1. 309 kJ mol^{-1}

2. 313 kJ mol^{-1}

3. 305 kJ mol^{-1}

4. 318 kJ mol^{-1}

134.

The reaction of cyanamide, $NH_2CN_{(s)}$ with oxygen was run in a bomb calorimeter and ΔU was found to be -742.24 kJ mol^{-1} . The magnitude of $\Delta H_{298}(KJ)$ for the reaction

$NH_2CN_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow N_{2(g)} + O_{2(g)} + H_2O_{(l)}$ is -
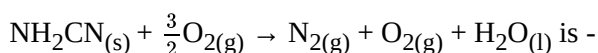
[Assume ideal gases and R = 8.314 J mol^{-1} K^{-1}]

1. 741 KJ

2. 745 KJ

3. 720 KJ

4. 734 KJ

135.

The oxidation states of two S-atoms in $Na_2 S_2O_3$ are -

1. +2 and +4

2. +3 and -2

3. +4 and -2

4. +6 and -2

Chemistry - Section B

136.

In the equilibrium,

$2SO_2(g) + O_2 (g) \rightleftharpoons 2SO_3(g)$, the partial pressure of SO_2, O_2 and SO_3 are 0.662, 0.101 and 0.331 atm respectively. What should be the partial pressure of oxygen so that the equilibrium concentration of SO_2 and SO_3 are equal.

1. 0.4 atm

2. 1.0 atm

3. 0.8 atm

4. 0.25 atm

137.

Redox reaction among the following is -

1. $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$

2. $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$

3. $Mg(OH)_2 + 2NH_4Cl \rightarrow MgCl_2 + 2NH_4OH$

4. $Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$

138.

The reaction during which nitrogen gets oxidised is-

1. $NH_4^+ \rightarrow N_2$

2. $NO_3^- \rightarrow NO$
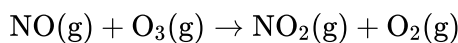
3. $NO_2 \rightarrow NO_2^-$

4. $NO_3^- \rightarrow NH_4^+$

139.

Identify the option which is correct with respect to Vanderwaal constant-a & b for gases.

1. $aNH_3 < aH_2 \& bH_2 > bHe$

2. a CO_2 > a H_2 & bCO_2 >b H_2

3. $aH_2O > aH_2 \& bH_2 < bHe$

4. $aNH_3 < a\ He\ \&\ b\ CO_2 > bH_2$

140.

Given

$$NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g)$$
$$\Delta H = -198.9 \text{ kJ / mol}$$
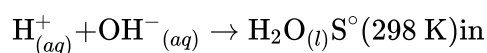$$O_3(g) \rightarrow 3/2 \, O_2(g); \quad \Delta H = -142.3 \text{ kJ / mol}$$
$$O_2(g) \rightarrow 2 \, O(g); \Delta H = +495.0 \text{ kJ / mol}$$

The enthalpy change (ΔH) for the following reaction is
$$NO(g) + O(g) \rightarrow NO_2(g)$$

1. -304.1 kJ/mol

2. +304.1 kJ/mol

3. -403.1 kJ/mol

4. +403.1 kJ/mol

141.

$$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)} S^\circ (298 \text{ K}) \text{in}$$

$$-10.7 JK^{-1} \qquad +70 JK^{-1} \, mol^{-1}$$

Standard entropy change for the above reaction is:

1. 60.3 JK^{-1} mol^{-1}

2. 80.7 JK^{-1} mol^{-1}

3. -70 JK^{-1} mol^{-1}

4. +10.7 JK^{-1} mol^{-1}

142.

The density of N$_2$ gas at 227°C and 5.00 atm pressure is-

(R = 0.082 L atm K^{-1} mol^{-1})

1. 1.40 g/L

2. 2.81 g/L

3. 3.41 g/L

4. 0.29 g/L

143.

If a gas expands at a constant temperature

i. The pressure decreases

ii. The kinetic energy of the molecules remains the same

iii. The kinetic energy of the molecules decreases

iv. The number of molecules of the gas increase

The correct conclusions are-

1. i, ii

2. i, ii, iii

3. i, ii, iv

4. ii, iii

144.

Equal weights of methane and oxygen are mixed in an empty container at $25\,^\circ$C. the fraction of the total pressure exerted by oxygen is

1. 1/2

2. 2/3

3. (1/3)×(273/298)

4. 1/3

145.

The reaction that has a value of ΔS° greater than zero among the following is-

1. $CaO(s) + CO_2 \rightarrow CaCO_3(s)$
2. $NaCl(aq) \rightarrow NaCl(s)$
3. $NaNO_3(s) \rightarrow Na^+(aq) + NO_3^-(aq)$
4. $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

146.

In water saturated air, the mole fraction of water vapour is 0.02. If the total pressure of the saturated air is 1.2 atm, the partial pressure of dry air is-

1. 1.17 atm

2. 1.76 atm

3. 1.27 atm

4. 0.98 atm

147.

Addition of small amount of argon at constant volume will not affect the equilibrium among the following-

1. $H_2(g) + I_2(g) \rightleftharpoons 2\,HI(g)$

2. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

3. $N_2(g) + 3H_2(g) \rightleftharpoons 2\,NH_3(g)$

4. The equilibrium will remain unaffected in all the three cases

148.

Identify disproportionation reaction

1. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

2. $CH_4 + 4\,Cl_2 \rightarrow CCl_4 + 4\,HCl$

3. $2F_2 + 2\,OH^- \rightarrow 2F^- + OF_2 + H_2O$

4. $2\,NO_2 + 2\,OH^- \rightarrow NO_2^- + NO_3^- + H_2O$
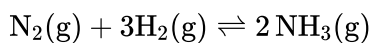
149.

At 27ºC latent heat of fusion of a compound is 2930 J/mol. Entropy change is :

1. 9.77 J/mol K

2. 10.77 J/mol K

3. 9.07 J/mol K

4. 0.977 J/mol K

150.

The reaction quotient (Q) for the reaction :

$N_2(g) + 3H_2(g) \rightleftharpoons 2\,NH_3(g)$

is given by $Q = \dfrac{[NH_3]^2}{\left[N_2\right][H_2]^3}$. The reaction will proceed from right to left if :

1. $Q = K_C$

2. $Q < K_C$

3. $Q > K_C$

4. $Q = 0$

(where K_C is the equilibrium constant)

Physics - Section A

151.

Young's moduli of two wires A and B are in the ratio 10 : 4. Wire A is 2 m long and has radius R. Wire B is 1.6 m long and has radius 2 mm. If the two wires stretch by the same length for a given load, then the value of R is close to:

1. $\sqrt{2}$ mm

2. $\dfrac{1}{\sqrt{2}}$ mm

3. $2\sqrt{2}$ mm

4. 2 mm

152.

A steel wire having a radius of 2.0 mm, carrying a load of 4 kg, is hanging from a ceiling. Given that $g = 3.1\pi\,ms^{-2}$, what will be the tensile stress that would be developed in the wire?

1. $5.2 \times 10^6\ N\ m^{-2}$

2. $6.2 \times 10^6\ N\ m^{-2}$

3. $4.8 \times 10^6\ N\ m^{-2}$

4. $3.1 \times 10^6\ N\ m^{-2}$

153.

A particle moves in one dimension from rest under the influence of a force that varies with the distance travelled by the particle as shown in the figure. The kinetic energy of the particle after it has travelled 3m is:
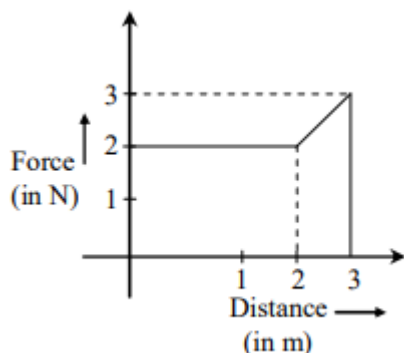
1. 2.5 J
2. 6.5 J
3. 4 J
4. 5 J

154.

The elastic limit of brass is 400 MPa. What should be the minimum diameter of a brass rod if it is to support a 400 π N load without exceeding its elastic limit?
1. 1 mm
2. 1.5 mm
3. 2 mm
4. 2.5 mm

155.

A body of mass 2 kg is driven by an engine delivering a constant power 1 J/s. The body starts from rest and moves in a straight line. After 9 seconds, the kinetic energy of the body is:

1. 4.5 J

2. 9 J

3. 13.5 J

4. 18 J

156.

Particle A of mass m_1 moving with velocity $(\hat{i} + \hat{j})$ ms^{-1} collides with another particle B of mass m_2 which is at rest initially. Let $\vec{V}_1 \ and \ \vec{V}_2$ be the velocities of particle A and B after collision respectively. If $m_1 = 2m_2$ and after collision $\vec{V_1} = \left(\hat{i} - \hat{j} \right) ms^{-1}$ then final velocity of particle B is:

1. $2\hat{i} + \hat{j}$
2. $2\hat{i} - \hat{j}$
3. $4\hat{j}$
4. $-4\hat{i}$

157.

Assertion (A): The escape velocities of planet A and B are same. But A and B are of unequal mass.

Reason (R): The product of their mass and radius must be same, $M_1R_1 = M_2R_2$

1. Both A and R are correct but R is NOT the correct explanation of A

2. A is correct but R is not correct

3. Both A and R are correct and R is the correct explanation of A

4. A is not correct but R is correct

158.

An object of mass m is suspended at the end of a massless wire of length L and area of cross-section, A. Young modulus of the material of the wire is Y. If the mass is pulled down slightly its frequency of oscillation along the vertical direction is:

1. $f = \frac{1}{2\pi} \sqrt{\frac{mA}{YL}}$

2. $f = \frac{1}{2\pi} \sqrt{\frac{YL}{mA}}$

3. $f = \frac{1}{2\pi} \sqrt{\frac{mL}{YA}}$

4. $f = \frac{1}{2\pi} \sqrt{\frac{YA}{mL}}$

159.

If the potential energy between two molecules is given by $U = -\frac{A}{r^6} + \frac{B}{r^{12}}$, then the potential energy, at equilibrium separation between molecules is:

1. $-\frac{A^2}{2B}$

2. $\frac{-A^2}{4B}$

3. 0

4. $-\frac{A^2}{3B}$

160.

Two bodies of the same mass are moving with the same speed, but in different directions in a plane. They have a completely inelastic collision and move together thereafter with a final speed which is half of their initial speed. The angle between the initial velocities of the two bodies (in degree) is:

1. 30°

2. 60°

3. 90°

4. 120°

161.

For a uniform rectangular sheet shown in the figure, if I_O and $I_{O'}$ be moments of inertia about the axes perpendicular to the sheet and passing through O (the centre of mass) and O' (corner point), then :
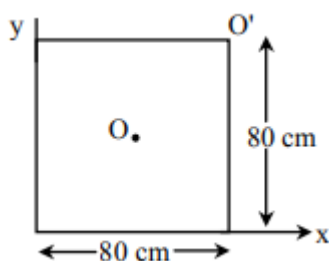
1. $I_{O'} = I_O$
2. $I_{O'} < I_O$
3. $I_{O'} > I_O$
4. Can't say

162.

A slender uniform rod of mass M and length l is pivoted at one end so that it can rotate in the vertical plane (see figure). There is negligible friction at the pivot. The free end is held vertically above the pivot and then released. The angular acceleration of the rod when it makes an angle θ with the vertical is:
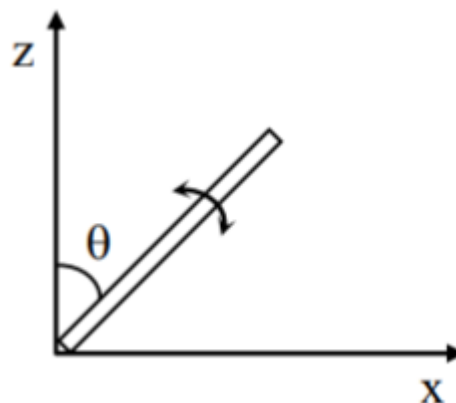
1. $\frac{3g}{2l} \sin \theta$

2. $\frac{2g}{3l} \sin \theta$

3. $\frac{3g}{2l} \cos \theta$

4. $\frac{2g}{3l} \cos \theta$

163.

A satellite is revolving in a circular orbit at a height 'h' from the earth's surface (radius of earth R; h << R). The minimum increase in its orbital velocity required, so that the satellite could escape from the earth's gravitational field, is close to (Neglect the effect of the atmosphere.)

1. $\sqrt{2gR}$

2. $\sqrt{gR}$

3. $\sqrt{gR/2}$

4. $\sqrt{gR}\left(\sqrt{2} - 1\right)$

164.

A bob of mass m attached to an inextensible string of length l is suspended from a vertical support. The bob rotates in a horizontal circle with an angular speed ω rad/s about the vertical. About the point of suspension:

1. angular momentum changes in magnitude but not in direction

2. angular momentum changes in direction but not in magnitude

3. angular momentum changes in both direction and magnitude

4. angular momentum is conserved

165.

The initial velocity v_i required to project a body vertically upward from the surface of the earth to reach a height of 10R, where R is the radius of the earth, described in terms of escape velocity v_e is:

1. $\sqrt{\frac{10}{11}} v_e$

2. $\sqrt{\frac{11}{10}} v_e$

3. $\sqrt{\frac{20}{11}} v_e$

4. $\sqrt{\frac{11}{20}} v_e$

166.

A planet revolving in elliptical orbit has :

(A) a constant velocity of revolution.
(B) has the least velocity when it is nearest to the sun.
(C) its areal velocity is directly proportional to its velocity.
(D) areal velocity is inversely proportional to its velocity.
(E) to follow a trajectory such that the areal velocity is constant.

Choose the correct answer from the options given below :

1. A only

2. D only

3. C only

4. E only

167.

Four identical solid spheres each of mass 'm' and radius 'a' are placed with their centers on the four corners of a square of side 'b'. The moment of inertia of the system about one side of the square where the axis of rotation is parallel to the plane of the square is :

1. $\frac{4}{5}\mathrm{ma}^2 + 2\,\mathrm{mb}^2$

2. $\frac{8}{5}ma^2 + mb^2$

3. $\frac{8}{5}\mathrm{ma}^2 + 2\,\mathrm{mb}^2$

4. $\frac{4}{5}ma^2$

168.
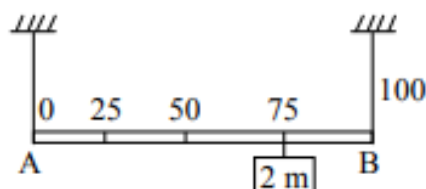
Shown in the figure is rigid and uniform one meter long rod AB held in horizontal position by two strings tied to its ends and attached to the ceiling. The rod is of mass 'm' and has another weight of mass 2 m hung at a distance of 75 cm from A. The tension in the string at A is:
1. 2 mg
2. 0.5 mg
3. 0.75 mg
4. 1 mg

169.

Two uniform circular discs are rotating independently in the same direction around their common axis passing through their centres. The moment of inertia and angular velocity of the first disc are 0.1 kg-m^2 and 10 rad s^{-1} respectively while those for the second one are 0.2 kg-m^2 and 5 rad s^{-1} respectively. At some instant, they get stuck together and start rotating as a single system about their common axis with some angular speed ω. Then ω is:

1. $\frac{5}{3}\ rad/s$

2. $\frac{10}{3}\ rad/s$

3. $\frac{15}{3}\ rad/s$

4. $\frac{20}{3}\ rad/s$

170.

A particle of mass m is moving along the x-axis with an initial velocity $u\hat{i}$. It collides elastically with a particle of mass 10m at rest and then moves with half its initial kinetic energy (see figure). The final velocity of the smaller mass is:
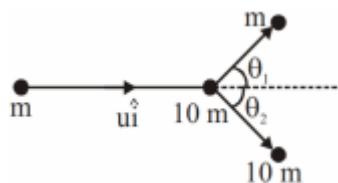
1. $\frac{u}{\sqrt{2}}$

2. $\frac{u}{2}$

3. $\frac{u}{2\sqrt{2}}$

4. $\frac{u}{4}$

171.

A person of 80 kg mass is standing on the rim of a circular platform of mass 200 kg rotating about its axis at 5 revolutions per minute (rpm). The person now starts moving towards the centre of the platform. What will be the rotational speed (in rpm) of the platform when the person reaches its centre?

1. 3

2. 5

3. 7

4. 9

172.

A cricket ball of mass 0.15 kg is thrown vertically up by a bowling machine so that it rises to a maximum height of 20 m after leaving the machine. If the part pushing the ball applies a constant force F on the ball and moves horizontally a distance of 0.2 m while launching the ball, the value of F (in N) is: (g = 10 m/s^2)
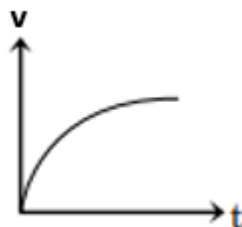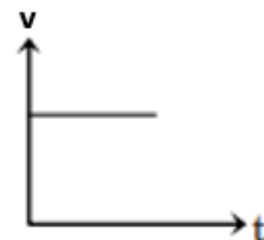
1. 50 N

2. 100 N

3. 150 N

4. 200 N

173.

A particle is moving unidirectionally on a horizontal plane under the action of a constant power supplying energy source. The velocity (v) – time (t) graph that describes the motion of the particle is (graphs are drawn schematically and are not to scale) :
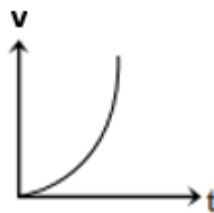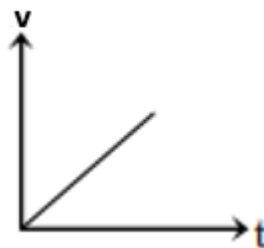

1.

2.

3.

4.

174.

A block of mass 1.9 kg is at rest at the edge of a table of height 1m. A bullet of mass 0.1 kg collides with the block and sticks to it. If the velocity of the bullet is 20 m/s in the horizontal direction just before the collision, then the kinetic energy just before the combined system strikes the floor is: [Take g = 10 m/s^2. Assume there is no rotational motion and loss of energy after the collision is negligible.]
1. 21 J
2. 23 J
3. 20 J
4. 19 J

175.

A massless equilateral triangle EFG of side 'a' (as shown in the figure) has three particles of mass m situated at its vertices. The moment of inertia of the system about the line EX perpendicular to EG in the plane of EFG is $\frac{N}{20} \, ma^2$ where N is an integer. The value of N is:
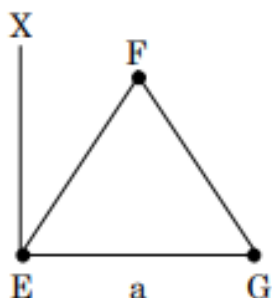
1. 15
2. 20
3. 25
4. 30

176.

A body is moving in a low circular orbit about a planet of mass M and radius R. The radius of the orbit can be taken to be R itself. Then the ratio of the speed of this body in the orbit to the escape velocity from the planet is:

1. $\sqrt{2}$

2. $\frac{1}{\sqrt{2}}$

3. 2

4. 1

177.

Consider two uniform discs of the same thickness and different radii $R_1 = R$ and $R_2 = \alpha R$ made of the same material. If the ratio of their moments of inertia, I_1 and I_2, respectively, about their axes is $I_1 : I_2 = 1 : 16$, then the value of α is :
1. $\sqrt{2}$
2. 4
3. 2
4. $2\sqrt{2}$

178.

A person pushes a box on a rough horizontal platform surface. He applies a force of 200 N over a distance of 15 m. Thereafter, he gets progressively tired and his applied force reduces linearly with distance to 100 N. The total distance through which the box has been moved is 30 m. What is the work done by the person during the first 15 m?

1. 1000 J
2. 2000 J
3. 3000 J
4. 4000 J

179.

A cube of metal is subjected to a hydrostatic pressure of 4 GPa. The percentage change in the volume of the cube is : (Given bulk modulus of metal, B = 8 × 10^{10} Pa)
1. 2.5
2. 5
3. 7.5
4. 10

180.

Consider a two particle system with particles having masses m_1 and m_2. If the first particle is pushed towards the centre of mass through a distance d, by what distance should be second particle be moved, so as to keep the centre of mass at the same position?

1. $\frac{m_2}{m_1}d$
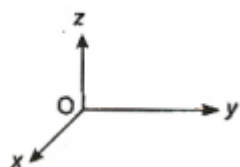
2. $\frac{m_1}{m_1+m_2}d$

3. $\frac{m_1}{m_2}d$

4. d

181.

Four point masses, each of value m, are placed at the corners, of a square ABCD of side l. The moment of inertia of this system about an axis passing through A and parallel to BD is:

1. $2\,ml^2$

2. $\sqrt{3}\,ml^2$

3. $3\,ml^2$

4. ml^2

182.

A force of $-F\,\hat{k}$ acts on O, the origin of the co-ordinate system. The torque about the point (1,-1) is:

1. $F\left(\hat{i}-\hat{j}\right)$

2. $-F\left(\hat{i}-\hat{j}\right)$

3. $F\left(\hat{i}+\hat{j}\right)$

4. $-F(\hat{i}+\hat{j})$

183.

Two identical particles move towards each other with velocity 2v and v respectively. The velocity of centre of mass is :

1. v

2. v / 3

3. v / 2

4. zero

184.

A solid sphere, a hollow sphere, and a ring are released from top of an inclined plane (frictionless) so that they slide down the plane. Then maximum acceleration down the plane is for (no rolling):

1. solid sphere

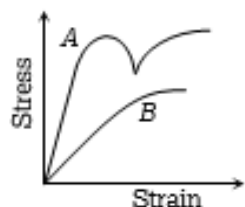2. hollow sphere

3. ring

4. all same

185.

Moment of inertia of a circular wire of mass M and radius R about its diameter is :

1. $MR^2/2$

2. MR^2

3. $2MR^2$

4. $MR^2/4$

Physics - Section B

186.

The diagram shows stress *v/s* strain curve for materials *A* and *B*. From the curves, we infer that:

1. *A* is brittle but *B* is ductile

2. *A* is ductile and *B* is brittle

3. Both *A* and *B* are ductile

4. Both *A* and *B* are brittle

187.

A stationary horizontal disc is free to rotate about its axis. When a torque is applied on it, its kinetic energy as a function of θ, where θ is the angle by which it has rotated, is given as $k\theta^2$. If its moment of inertia is I, then the angular acceleration of the disc is:

1. $\frac{k}{I}\theta$

2. $\frac{k}{2I}\theta$

3. $\frac{k}{4I}\theta$

4. $\frac{2k}{I}\theta$

188.

A uniform cable of mass 'M' and length 'L' is placed on a horizontal surface such that its $\left(\frac{1}{n}\right)^{th}$ part is hanging below the edge of the surface. To lift the hanging part of the cable upto the surface, the work done should be:

1. nMgL

2. $\frac{MgL}{2n^2}$

3. $\frac{2MgL}{n^2}$

4. $\frac{4MgL}{n^2}$

189.

The value of acceleration due to gravity at Earth's surface is 9.8 ms^{-2}. The altitude above its surface at which the acceleration due to gravity decreases to 4.9 ms^{-2}, is close to: (Radius of earth = 6.4×10^6 m)

1. 6.4×10^6 m
2. 2.6×10^6 m
3. 1.6×10^6 m
4. 9.0×10^6 m

190.

The ratio of the weights of a body on the Earth's surface to that on the surface of a planets is 9 : 4. The mass of the planet is $\frac{1}{9}$th of that of the Earth. If 'R' is the radius of the Earth, what is the radius of the planet ? (Take the planets to have the same mass density)

1. $\frac{R}{9}$

2. $\frac{R}{2}$

3. $\frac{R}{3}$

4. $\frac{R}{4}$

191.

A particle of mass 'm' is moving with speed '2v' and collides with a mass '2m' moving with speed 'v' in the same direction. After collision, the first mass is stopped completely while the second one splits into two particles each of mass 'm', which move at angle 45° with respect to the original direction. The speed of each of the moving particles will be:

1. $\sqrt{2}\,v$

2. $v/\left(2\sqrt{2}\right)$

3. $v/\sqrt{2}$

4. $2\sqrt{2}\,v$

192.

A thin smooth rod of length L and mass M is rotating freely with angular speed ω_0 about an axis perpendicular to the rod and passing through its center. Two beads of mass m and negligible size are at the center of the rod initially. The beads are free to slide along the rod. The angular speed of the system, when the beads reach the opposite ends of the rod, will be:

1. $\dfrac{M\omega_0}{M + 3m}$

2. $\dfrac{M\omega_0}{M + 2m}$

3. $\dfrac{M\omega_0}{M + m}$

4. $\dfrac{M\omega_0}{M + 6m}$

193.

Moment of inertia of a body about a given axis is 1.5 kg m². Initially, the body is at rest. In order to produce rotational kinetic energy of 1200 J, the angular acceleration of 20 rad/s^2 must be applied about the axis for a duration of :

1. 5 s
2. 3 s
3. 2.5 s
4. 2 s

194.

A Force $\overrightarrow{F} = \left(\hat{i} + 2\hat{j} + 3\hat{k} \right) N$ acts at a point $\left(4\hat{i} + 3\hat{j} - \hat{k} \right) m.$ Then the magnitude of the torque about the point $\left(\hat{i} + 2\hat{j} + \hat{k} \right)$ m will be $\sqrt{x}$ N-m. The value of x is:

1. 145

2. 195

3. 245

4. 295

195.

A particle is moving in a circular path of radius 'a' under the action of an attractive force such that the potential energy is given by $U = -\dfrac{k}{2r^2}$. The attractive force is:

1. $\dfrac{k}{4a^3}$

2. $\dfrac{k}{2a^3}$

3. $\dfrac{k}{a^3}$

4. $\dfrac{3}{2}\dfrac{k}{a^3}$

196.

A solid sphere of radius r made of a soft material of bulk modulus K is surrounded by a liquid in a cylindrical container. A massless piston of area a floats on the surface of the liquid, covering entire cross-section of cylindrical container. When a mass m is placed on the surface of the piston to compress the liquid, the fractional decrement in the radius of the sphere, $\left(\dfrac{dr}{r} \right)$, is:

1. $\dfrac{Ka}{mg}$

2. $\dfrac{Ka}{3\,mg}$

3. $\dfrac{mg}{3\,Ka}$

4. $\dfrac{mg}{Ka}$

197.

The linear mass density of a thin rod AB of length L varies from A to B as $\lambda\left(x \right) = \lambda_0 \left(1 + \dfrac{x}{L} \right)$, where x is the distance from A. If the mass M of the rod is $\dfrac{3\lambda_o L}{2}$, then its moment of inertia about an axis passing through A and perpendicular to the rod is :

1. $\dfrac{5}{12}ML^2$

2. $\dfrac{3}{7}ML^2$

3. $\dfrac{2}{5}ML^2$

4. $\dfrac{7}{18}ML^2$

198.

A body of mass m = 10^2 kg is moving in a medium and experiences a frictional force F = -kv^2. Its initial speed is 20 ms^{-1} and its speed at t = 10 s is 10 ms^{-1}. Then the value of k is:

1. 0.005 kg m^{-1}

2. 0.05 kg m^{-1}

3. .5 kg s^{-1}

4. 0.5 kg m^{-1}

199.

The variation of acceleration due to gravity g with distance d from centre of the earth is best represented by (R = Earth's radius):

1.

2.

3.

4.

200.

The longitudinal strain of a string is equal to twice the magnitude of lateral strain. Poisson's ratio of the material of string is:
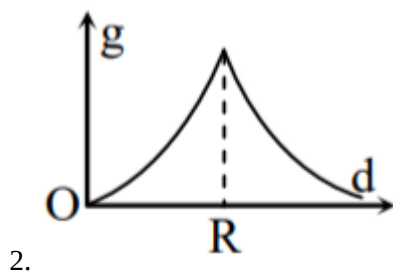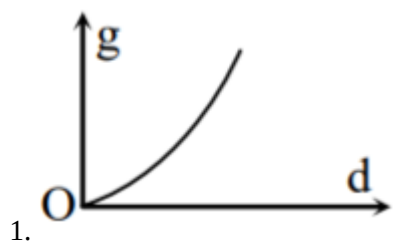
1. 0.4

2. 0.5

3. 0.1

4. 0.2

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