

Test Booklet Code

GHM

No.: 4223842

This Booklet contains 20 pages.

B

Do not open this Test Booklet until you are asked to do so.

**Important Instructions :**

1. The Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars on side-1 and side-2 carefully with blue/black ball point pen only.
2. The test is of 3 hours duration and Test Booklet contains 180 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 720.
3. Use Blue/Black Ball Point Pen only for writing particulars on this page/markings responses.
4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
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10. No candidate, without special permission of the Superintendent or Invigilator, would leave his/her seat.
11. The candidates should not leave the Examination Hall without handing over their Answer Sheet to the Invigilator on duty and sign the Attendance Sheet twice. Cases where a candidate has not signed the Attendance Sheet second time will be deemed not to have handed over Answer Sheet and dealt with as an unfair means case.
12. Use of Electronic/Manual Calculator is prohibited.
13. The candidates are governed by all Rules and Regulations of the Board with regard to their conduct in the Examination Hall. All cases of unfair means will be dealt with as per Rules and Regulations of the Board.
14. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.
15. The candidates will write the Correct Test Booklet Code as given in the Test Booklet/ Answer Sheet in the Attendance Sheet.

Name of the Candidate (in Capitals): ASHISH KUMAR SINGHRoll Number : in figures 64101022: in words Six thousand forty one lakh one thousand twenty twoCentre of Examination (in Capitals): KHWAJA MODEL SCHOOL CIVIL LINES AJMER RAJASTHANCandidate's Signature: Ashish kr. Singh Invigilator's Signature: [Signature]

Fascimile signature stamp of

Centre Superintendent

1. The addition of a catalyst during a chemical reaction alters which of the following quantities?

- (1) Internal energy
- (2) Enthalpy
- (3) Activation energy
- (4) Entropy

2. Predict the correct order among the following:

- (1) lone pair - lone pair > bond pair - bond pair > lone pair - bond pair
- (2) bond pair - bond pair > lone pair - bond pair > lone pair - lone pair
- (3) lone pair - bond pair > bond pair - bond pair > lone pair - lone pair
- (4) lone pair - lone pair > lone pair - bond pair > bond pair - bond pair

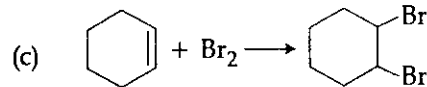
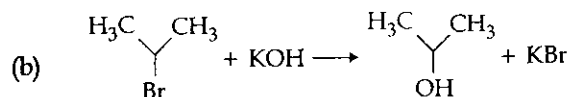
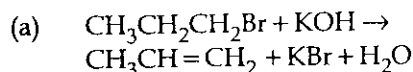
3. The correct statement regarding the basicity of arylamines is:

- (1) Arylamines are generally more basic than alkylamines because the nitrogen lone-pair electrons are not delocalized by interaction with the aromatic ring  $\pi$  electron system.
- (2) Arylamines are generally more basic than alkylamines because of aryl group.
- (3) Arylamines are generally more basic than alkylamines, because the nitrogen atom in arylamines is  $sp$ -hybridized.
- (4) Arylamines are generally less basic than alkylamines because the nitrogen lone-pair electrons are delocalized by interaction with the aromatic ring  $\pi$  electron system.

4. When copper is heated with conc.  $HNO_3$  it produces:

- (1)  $Cu(NO_3)_2$  and  $NO$
- (2)  $Cu(NO_3)_2$ ,  $NO$  and  $NO_2$
- (3)  $Cu(NO_3)_2$  and  $N_2O$
- (4)  $Cu(NO_3)_2$  and  $NO_2$

5. For the following reactions:



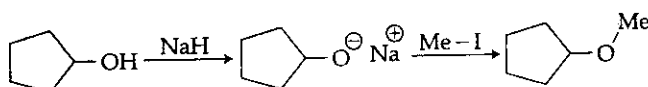
Which of the following statements is correct?

- (1) (a) is elimination, (b) is substitution and (c) is addition reaction.
- (2) (a) is elimination, (b) and (c) are substitution reactions.
- (3) (a) is substitution, (b) and (c) are addition reactions.  $\times$
- (4) (a) and (b) are elimination reactions and (c) is addition reaction.  $\times$

6. Two electrons occupying the same orbital are distinguished by:

- (1) Magnetic quantum number
- (2) Azimuthal quantum number
- (3) Spin quantum number
- (4) Principal quantum number

7. The reaction

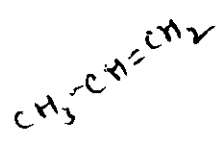


can be classified as:

- (1) Alcohol formation reaction
- (2) Dehydration reaction
- (3) Williamson alcohol synthesis reaction
- (4) Williamson ether synthesis reaction

8. The electronic configurations of Eu (Atomic No. 63), Gd (Atomic No. 64) and Tb (Atomic No. 65) are:

- (1)  $[Xe]4f^65d^16s^2$ ,  $[Xe]4f^75d^16s^2$  and  $[Xe]4f^96s^2$
- (2)  $[Xe]4f^65d^16s^2$ ,  $[Xe]4f^75d^16s^2$  and  $[Xe]4f^85d^16s^2$   $\times$
- (3)  $[Xe]4f^76s^2$ ,  $[Xe]4f^75d^16s^2$  and  $[Xe]4f^96s^2$
- (4)  $[Xe]4f^76s^2$ ,  $[Xe]4f^86s^2$  and  $[Xe]4f^85d^16s^2$   $\times$



9. At 100°C the vapour pressure of a solution of 6.5 g of a solute in 100 g water is 732 mm. If  $K_b = 0.52$ , the boiling point of this solution will be:

- (1) 100°C
- (2) 102°C
- (3) 103°C
- (4) 101°C

$$\frac{732 \times 100}{K_b \times 1000} \times \frac{6.5}{100}$$

$$= \frac{732 \times 100}{0.52 \times 1000} \times \frac{6.5}{100}$$

10. The correct statement regarding the comparison of staggered and eclipsed conformations of ethane, is:

- (1) The eclipsed conformation of ethane is more stable than staggered conformation, because eclipsed conformation has no torsional strain.
- (2) The eclipsed conformation of ethane is more stable than staggered conformation even though the eclipsed conformation has torsional strain.
- (3) The staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.
- (4) The staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain.

11. Which one of the following characteristics is associated with adsorption?

- (1)  $\Delta G$ ,  $\Delta H$  and  $\Delta S$  all are negative
- (2)  $\Delta G$  and  $\Delta H$  are negative but  $\Delta S$  is positive
- (3)  $\Delta G$  and  $\Delta S$  are negative but  $\Delta H$  is positive
- (4)  $\Delta G$  is negative but  $\Delta H$  and  $\Delta S$  are positive

12. Match the compounds given in column I with the hybridisation and shape given in column II and mark the correct option.

Column I		Column II	
(a) $XeF_6$	(i) distorted octahedral		
(b) $XeO_3$	(ii) square planar		
(c) $XeOF_4$	(iii) pyramidal		
(d) $XeF_4$	(iv) square pyramidal		

Code:

- |     |      |       |      |       |
|-----|------|-------|------|-------|
|     | (a)  | (b)   | (c)  | (d)   |
| (1) | (i)  | (ii)  | (iv) | (iii) |
| (2) | (iv) | (iii) | (i)  | (ii)  |
| (3) | (iv) | (i)   | (ii) | (iii) |
| (4) | (i)  | (iii) | (iv) | (ii)  |



13. The correct statement regarding a carbonyl compound with a hydrogen atom on its alpha-carbon, is:

- (1) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as aldehyde-ketone equilibration.
- (2) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as carbonylation.
- (3) a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding enol and this process is known as keto-enol tautomerism.
- (4) a carbonyl compound with a hydrogen atom on its alpha-carbon never equilibrates with its corresponding enol.

14. In a protein molecule various amino acids are linked together by:

- (1)  $\beta$  - glycosidic bond
- (2) peptide bond
- (3) dative bond
- (4)  $\alpha$  - glycosidic bond

15. Match items of Column I with the items of Column II and assign the correct code:

Column I		Column II	
(a) Cyanide process	(i) Ultrapure Ge		
(b) Froth floatation process	(ii) Dressing of ZnS		
(c) Electrolytic reduction	(iii) Extraction of Al		
(d) Zone refining	(iv) Extraction of Au		
	(v) Purification of Ni		

Code:

- |     |       |       |       |      |
|-----|-------|-------|-------|------|
|     | (a)   | (b)   | (c)   | (d)  |
| (1) | (ii)  | (iii) | (i)   | (v)  |
| (2) | (i)   | (ii)  | (iii) | (iv) |
| (3) | (iii) | (iv)  | (v)   | (i)  |
| (4) | (iv)  | (ii)  | (iii) | (i)  |

16. Which of the following is an analgesic?

- (1) Penicillin
- (2) Streptomycin
- (3) Chloromycetin
- (4) Novalgin

17. Which is the correct statement for the given acids ?

- (1) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid.  
 (2) Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid.  
 (3) Both are triprotic acids.  
 (4) Both are diprotic acids.

18. The pair of electron in the given carbanion,  $\text{CH}_3\text{C}\equiv\text{C}^-$ , is present in which of the following orbitals ?

- (1)  $sp^3$   
 (2)  $sp^2$   
 (3)  $sp$   
 (4)  $2p$

19. Consider the molecules  $\text{CH}_4$ ,  $\text{NH}_3$  and  $\text{H}_2\text{O}$ . Which of the given statements is false ?

- (1) The H-O-H bond angle in  $\text{H}_2\text{O}$  is larger than the H-C-H bond angle in  $\text{CH}_4$ .  
 (2) The H-O-H bond angle in  $\text{H}_2\text{O}$  is smaller than the H-N-H bond angle in  $\text{NH}_3$ .  
 (3) The H-C-H bond angle in  $\text{CH}_4$  is larger than the H-N-H bond angle in  $\text{NH}_3$ .  
 (4) The H-C-H bond angle in  $\text{CH}_4$ , the H-N-H bond angle in  $\text{NH}_3$ , and the H-O-H bond angle in  $\text{H}_2\text{O}$  are all greater than  $90^\circ$ .

20. Which one of the following statements is correct when  $\text{SO}_2$  is passed through acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  solution ?

- (1) The solution is decolourized.  
 (2)  $\text{SO}_2$  is reduced.  
 (3) Green  $\text{Cr}_2(\text{SO}_4)_3$  is formed.  
 (4) The solution turns blue.

21. The correct thermodynamic conditions for the spontaneous reaction at all temperatures is :

- (1)  $\Delta H > 0$  and  $\Delta S < 0$   
 (2)  $\Delta H < 0$  and  $\Delta S > 0$   
 (3)  $\Delta H < 0$  and  $\Delta S < 0$   
 (4)  $\Delta H < 0$  and  $\Delta S = 0$

22. Natural rubber has :

- (1) All trans-configuration  
 (2) Alternate cis- and trans-configuration  
 (3) Random cis- and trans-configuration  
 (4) All cis-configuration

23. In which of the following options the order of arrangement does not agree with the variation of property indicated against it ?

- (1)  $\text{B} < \text{C} < \text{N} < \text{O}$  (increasing first ionisation enthalpy)  
 (2)  $\text{I} < \text{Br} < \text{Cl} < \text{F}$  (increasing electron gain enthalpy)  
 (3)  $\text{Li} < \text{Na} < \text{K} < \text{Rb}$  (increasing metallic radius)  
 (4)  $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$  (increasing ionic size)

24. Which of the following reagents would distinguish cis-cyclopenta-1, 2-diol from the trans-isomer ?

- (1) Ozone  
 (2)  $\text{MnO}_2$   
 (3) Aluminium isopropoxide  
 (4) Acetone

25. The product obtained as a result of a reaction of nitrogen with  $\text{CaC}_2$  is :

- (1)  $\text{CaCN}$   
 (2)  $\text{CaCN}_3$   
 (3)  $\text{Ca}_2\text{CN}$   
 (4)  $\text{Ca}(\text{CN})_2$

26. Fog is a colloidal solution of :

- (1) Gas in liquid  
 (2) Solid in gas  
 (3) Gas in gas  
 (4) Liquid in gas

27. Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules ?

- (1)  $\text{Cl}_2 > \text{Br}_2 > \text{F}_2 > \text{I}_2$   
 (2)  $\text{Br}_2 > \text{I}_2 > \text{F}_2 > \text{Cl}_2$   
 (3)  $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$   
 (4)  $\text{I}_2 > \text{Br}_2 > \text{Cl}_2 > \text{F}_2$

28. Equal moles of hydrogen and oxygen gases are placed in a container with a pin-hole through which both can escape. What fraction of the oxygen escapes in the time required for one-half of the hydrogen to escape ?

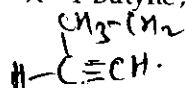
- (1)  $1/4$   
 (2)  $3/8$   
 (3)  $1/2$   
 (4)  $1/8$

$$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

$$\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$$

$$\frac{1}{8} \times \frac{1}{2} = \frac{1}{16}$$

29. Lithium has a bcc structure. Its density is  $530 \text{ kg m}^{-3}$  and its atomic mass is  $6.94 \text{ g mol}^{-1}$ . Calculate the edge length of a unit cell of Lithium metal. ( $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$ )
- 352 pm
  - 527 pm
  - 264 pm
  - 154 pm
30. Which of the following statements about the composition of the vapour over an ideal 1 : 1 molar mixture of benzene and toluene is correct? Assume that the temperature is constant at  $25^\circ\text{C}$ . (Given, Vapour Pressure Data at  $25^\circ\text{C}$ , benzene = 12.8 kPa, toluene = 3.85 kPa)
- The vapour will contain a higher percentage of toluene.
  - The vapour will contain equal amounts of benzene and toluene.
  - Not enough information is given to make a prediction.
  - The vapour will contain a higher percentage of benzene.
31. Which of the following has longest C-O bond length? (Free C-O bond length in CO is  $1.128 \text{ \AA}$ .)
- $[\text{Co}(\text{CO})_4]^{\ominus}$
  - $[\text{Fe}(\text{CO})_4]^{2-}$
  - $[\text{Mn}(\text{CO})_6]^+$
  - $\text{Ni}(\text{CO})_4$
32. Among the following, the correct order of acidity is :
- $\text{HClO} < \text{HClO}_2 < \text{HClO}_3 < \text{HClO}_4$
  - $\text{HClO}_2 < \text{HClO} < \text{HClO}_3 < \text{HClO}_4$
  - $\text{HClO}_4 < \text{HClO}_2 < \text{HClO} < \text{HClO}_3$
  - $\text{HClO}_3 < \text{HClO}_4 < \text{HClO}_2 < \text{HClO}$
33. In the reaction
- $$\text{H}-\text{C}\equiv\text{CH} \xrightarrow[\text{(2) } \text{CH}_3\text{CH}_2\text{Br}]{\text{(1) } \text{NaNH}_2/\text{liq. NH}_3} \text{X} \xrightarrow[\text{(2) } \text{CH}_3\text{CH}_2\text{Br}]{\text{(1) } \text{NaNH}_2/\text{liq. NH}_3} \text{Y}$$
- X and Y are :
- X = 2-Butyne; Y = 3-Hexyne
  - X = 2-Butyne; Y = 2-Hexyne
  - X = 1-Butyne; Y = 2-Hexyne
  - X = 1-Butyne; Y = 3-Hexyne
34. MY and  $\text{NY}_3$ , two nearly insoluble salts, have the same  $K_{sp}$  values of  $6.2 \times 10^{-13}$  at room temperature. Which statement would be true in regard to MY and  $\text{NY}_3$ ?
- The molar solubility of MY in water is less than that of  $\text{NY}_3$ .
  - The salts MY and  $\text{NY}_3$  are more soluble in 0.5 M KY than in pure water.
  - The addition of the salt of KY to solution of MY and  $\text{NY}_3$  will have no effect on their solubilities.
  - The molar solubilities of MY and  $\text{NY}_3$  in water are identical.
35. Consider the nitration of benzene using mixed conc.  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$ . If a large amount of  $\text{KHSO}_4$  is added to the mixture, the rate of nitration will be :
- slower
  - unchanged
  - doubled
  - faster
36. The product formed by the reaction of an aldehyde with a primary amine is :
- Ketone
  - Carboxylic acid
  - Aromatic acid
  - Schiff base
37. The pressure of  $\text{H}_2$  required to make the potential of  $\text{H}_2$ -electrode zero in pure water at 298 K is :
- $10^{-12} \text{ atm}$
  - $10^{-10} \text{ atm}$
  - $10^{-4} \text{ atm}$
  - $10^{-14} \text{ atm}$
38. The correct statement regarding RNA and DNA, respectively is :
- The sugar component in RNA is ribose and the sugar component in DNA is 2'-deoxyribose.
  - The sugar component in RNA is arabinose and the sugar component in DNA is ribose.
  - The sugar component in RNA is 2'-deoxyribose and the sugar component in DNA is arabinose.
  - The sugar component in RNA is arabinose and the sugar component in DNA is 2'-deoxyribose.
39. Which one given below is a non-reducing sugar?
- Lactose
  - Glucose
  - Sucrose
  - Maltose

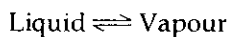


B

40. Which of the following statements about hydrogen is incorrect?

- (1) Hydrogen never acts as cation in ionic salts.
- (2) Hydronium ion,  $H_3O^+$  exists freely in solution.
- (3) Dihydrogen does not act as a reducing agent.
- (4) Hydrogen has three isotopes of which tritium is the most common.

41. Consider the following liquid - vapour equilibrium.



Which of the following relations is correct?

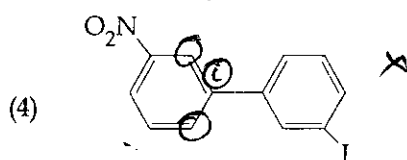
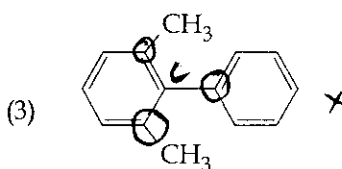
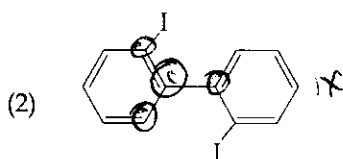
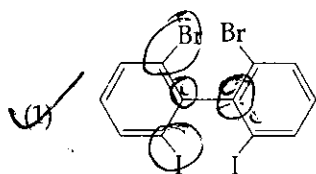
(1)  $\frac{d \ln P}{dT} = \frac{-\Delta H_v}{RT}$

(2)  $\frac{d \ln P}{dT^2} = \frac{-\Delta H_v}{T^2}$

(3)  $\frac{d \ln P}{dT} = \frac{\Delta H_v}{RT^2}$

(4)  $\frac{d \ln G}{dT^2} = \frac{\Delta H_v}{RT^2}$

42. Which of the following biphenyls is optically active?



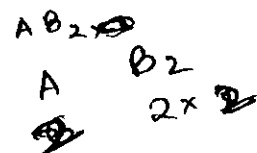
43. Which of the following statements is false?

- (1)  $Ca^{2+}$  ions are important in blood clotting.
- (2)  $Ca^{2+}$  ions are not important in maintaining the regular beating of the heart.
- (3)  $Mg^{2+}$  ions are important in the green parts of plants.
- (4)  $Mg^{2+}$  ions form a complex with ATP.

6

44. The ionic radii of  $A^+$  and  $B^-$  ions are  $0.98 \times 10^{-10}$  m and  $1.81 \times 10^{-10}$  m. The coordination number of each ion in  $\bar{A}B$  is:

- (1) 4
- (2) 8
- (3) 2
- (4) 6



45. The rate of a first-order reaction is  $0.04 \text{ mol l}^{-1} \text{ s}^{-1}$  at 10 seconds and  $0.03 \text{ mol l}^{-1} \text{ s}^{-1}$  at 20 seconds after initiation of the reaction. The half-life period of the reaction is:

- (1) 34.1 s
- (2) 44.1 s
- (3) 54.1 s
- (4) 24.1 s

46. The two polypeptides of human insulin are linked together by:

- (1) Phosphodiester bond
- (2) Covalent bond
- (3) Disulphide bridges
- (4) Hydrogen bonds

47. The coconut water from tender coconut represents:

- (1) Fleshy mesocarp
- (2) Free nuclear proembryo
- (3) Free nuclear endosperm
- (4) Endocarp

48. Which of the following is not a feature of the plasmids?

- (1) Circular structure
- (2) Transferable
- (3) Single-stranded
- (4) Independent replication

49. Which is the National Aquatic Animal of India?

- (1) River dolphin
- (2) Blue whale
- (3) Sea-horse
- (4) Gangetic shark

50. The *Avena* curvature is used for bioassay of:

- (1)  $GA_3$
- (2) IAA
- (3) Ethylene
- (4) ABA

51. Which of the following is the most important cause of animals and plants being driven to extinction ?

- (1) Alien species invasion
- (2) Habitat loss and fragmentation
- (3) Co - extinctions
- (4) Over - exploitation

52. Which of the following approaches does not give the defined action of contraceptive ?

(1)	Intra uterine devices	increase phagocytosis of sperms, suppress sperm motility and fertilizing capacity of sperms
(2)	Hormonal contraceptives	Prevent/retard entry of sperms, prevent ovulation and fertilization
(3)	Vasectomy	prevents spermatogenesis
(4)	Barrier methods	prevent fertilization

53. In a testcross involving  $F_1$  dihybrid flies, more parental-type offspring were produced than the recombinant-type offspring. This indicates :

- (1) Chromosomes failed to separate during meiosis.
- (2) The two genes are linked and present on the same chromosome.
- (3) Both of the characters are controlled by more than one gene.
- (4) The two genes are located on two different chromosomes.

54. A typical fat molecule is made up of :

- (1) One glycerol and three fatty acid molecules
- (2) One glycerol and one fatty acid molecule
- (3) Three glycerol and three fatty acid molecules
- (4) Three glycerol molecules and one fatty acid molecule

55. Match the terms in Column I with their description in Column II and choose the correct option :

Column I	Column II
(a) Dominance	(i) Many genes govern a single character
(b) Codominance	(ii) In a heterozygous organism only one allele expresses itself
(c) Pleiotropy	(iii) In a heterozygous organism both alleles express themselves fully
(d) Polygenic inheritance	(iv) A single gene influences many characters

Code:

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|--|-------|------|-------|
| (a)                                      | (b)   | (c)  | (d)   |
| <input checked="" type="checkbox"/> (ii) | (iii) | (iv) | (i)   |
| (2) (iv)                                 | (i)   | (ii) | (iii) |
| (3) (iv)                                 | (iii) | (i)  | (ii)  |
| (4) (ii)                                 | (i)   | (iv) | (iii) |

56. Which of the following statements is not correct ?

- (1) Insects that consume pollen or nectar without bringing about pollination are called pollen/nectar robbers.
- (2) Pollen germination and pollen tube growth are regulated by chemical components of pollen interacting with those of the pistil.
- (3) Some reptiles have also been reported as pollinators in some plant species.
- (4) Pollen grains of many species can germinate on the stigma of a flower, but only one pollen tube of the same species grows into the style.

57. Which of the following features is not present in *Periplaneta americana* ?

- (1) Indeterminate and radial cleavage during embryonic development
- (2) Exoskeleton composed of N-acetylglucosamine
- (3) Metamerically segmented body
- (4) Schizocoelom as body cavity

58. Water soluble pigments found in plant cell vacuoles are:

- (1) Chlorophylls
- (2) Carotenoids
- (3) Anthocyanins
- (4) Xanthophylls

59. A cell at telophase stage is observed by a student in a plant brought from the field. He tells his teacher that this cell is not like other cells at telophase stage. There is no formation of cell plate and thus the cell is containing more number of chromosomes as compared to other dividing cells. This would result in :
- (1) Polyploidy  
 (2) Somaclonal variation  
 (3) Polyteny  
 (4) Aneuploidy
60. A plant in your garden avoids photorespiratory losses, has improved water use efficiency, shows high rates of photosynthesis at high temperatures and has improved efficiency of nitrogen utilisation. In which of the following physiological groups would you assign this plant ?
- (1)  $C_4$   
 (2) CAM  
 (3) Nitrogen fixer  
 (4)  $C_3$
61. In higher vertebrates, the immune system can distinguish self-cells and non-self. If this property is lost due to genetic abnormality and it attacks self-cells, then it leads to :
- (1) Graft rejection  
 (2) Auto-immune disease  
 (3) Active immunity  
 (4) Allergic response
- Emerson's enhancement effect and Red drop have been instrumental in the discovery of :
- (1) Two photosystems operating simultaneously  
 (2) Photophosphorylation and cyclic electron transport  
 (3) Oxidative phosphorylation  
 (4) Photophosphorylation and non-cyclic electron transport
63. Select the correct statement :
- (1) *Salvinia*, *Ginkgo* and *Pinus* all are gymnosperms  
 (2) *Sequoia* is one of the tallest trees  
 (3) The leaves of gymnosperms are not well adapted to extremes of climate  
 (4) Gymnosperms are both homosporous and heterosporous
64. Which of the following is not a characteristic feature during mitosis in somatic cells ?
- (1) Disappearance of nucleolus  
 (2) Chromosome movement  
 (3) Synapsis  
 (4) Spindle fibres
65. Blood pressure in the pulmonary artery is :
- (1) more than that in the carotid.  
 (2) more than that in the pulmonary vein.  
 (3) less than that in the venae cavae.  
 (4) same as that in the aorta.
66. Which of the following structures is homologous to the wing of a bird ?
- (1) Wing of a Moth  
 (2) Hind limb of Rabbit  
 (3) Flipper of Whale  
 (4) Dorsal fin of a Shark
67. Seed formation without fertilization in flowering plants involves the process of :
- (1) Budding  
 (2) Somatic hybridization  
 (3) Apomixis  
 (4) Sporulation
68. Name the chronic respiratory disorder caused mainly by cigarette smoking :
- (1) Asthma  
 (2) Respiratory acidosis  
 (3) Respiratory alkalosis  
 (4) Emphysema
69. Spindle fibres attach on to :
- (1) Kinetochore of the chromosome  
 (2) Centromere of the chromosome  
 (3) Kinetosome of the chromosome  
 (4) Telomere of the chromosome
70. In context of Amniocentesis, which of the following statement is incorrect ?
- (1) It is used for prenatal sex determination.  
 (2) It can be used for detection of Down syndrome.  
 (3) It can be used for detection of Cleft palate.  
 (4) It is usually done when a woman is between 14 - 16 weeks pregnant.
71. Stems modified into flat green organs performing the functions of leaves are known as :
- (1) Phyllodes  
 (2) Phylloclades  
 (3) Scales  
 (4) Cladodes



72. In a chloroplast the highest number of protons are found in :
- (1) Lumen of thylakoids
  - (2) Inter membrane space
  - (3) Antennae complex
  - (4) Stroma
73. Nomenclature is governed by certain universal rules. Which one of the following is contrary to the rules of nomenclature ?
- (1) The first word in a biological name represents the genus name, and the second is a specific epithet
  - (2) The names are written in Latin and are italicised
  - (3) When written by hand, the names are to be underlined
  - (4) Biological names can be written in any language
74. In meiosis crossing over is initiated at :
- (1) Leptotene
  - (2) Zygotene
  - (3) Diplotene
  - (4) Pachytene
75. Antivenom injection contains preformed antibodies while polio drops that are administered into the body contain :
- (1) Harvested antibodies
  - (2) Gamma globulin
  - (3) Attenuated pathogens
  - (4) Activated pathogens
76. The taq polymerase enzyme is obtained from :
- (1) *Thiobacillus ferrooxidans*
  - (2) *Bacillus subtilis*
  - (3) *Pseudomonas putida*
  - (4) *Thermus aquaticus*
77. Which of the following most appropriately describes haemophilia ?
- (1) X-linked recessive gene disorder
  - (2) Chromosomal disorder
  - (3) Dominant gene disorder
  - (4) Recessive gene disorder
78. The standard petal of a papilionaceous corolla is also called :
- (1) Pappus
  - (2) Vexillum
  - (3) Corona
  - (4) Carina
79. Which part of the tobacco plant is infected by *Meloidogyne incognita* ?
- (1) Leaf
  - (2) Stem
  - (3) Root
  - (4) Flower
80. Which of the following statements is wrong for viroids ?
- (1) They are smaller than viruses
  - (2) They cause infections
  - (3) Their RNA is of high molecular weight
  - (4) They lack a protein coat
81. Which of the following statements is not true for cancer cells in relation to mutations ?
- (1) Mutations destroy telomerase inhibitor.
  - (2) Mutations inactivate the cell control.
  - (3) Mutations inhibit production of telomerase.
  - (4) Mutations in proto-oncogenes accelerate the cell cycle.
82. Which type of tissue correctly matches with its location ?
- | Tissue  | Location          |
|---|-------------------|
| (1) Areolar tissue                                    | Tendons           |
| (2) Transitional epithelium                           | Tip of nose       |
| (3) Cuboidal epithelium                               | Lining of stomach |
| <input checked="" type="checkbox"/> (4) Smooth muscle | Wall of intestine |
83. Which of the following pairs of hormones are not antagonistic (having opposite effects) to each other ?
- (1) Insulin - Glucagon
  - (2) Aldosterone - Atrial Natriuretic Factor
  - (3) Relaxin - Inhibin
  - (4) Parathormone - Calcitonin
84. Specialised epidermal cells surrounding the guard cells are called :
- (1) Subsidiary cells
  - (2) Bulliform cells
  - (3) Lenticels
  - (4) Complementary cells
85. Fertilization in humans is practically feasible only if :
- (1) the ovum and sperms are transported simultaneously to ampullary - isthmic junction of the fallopian tube.
  - (2) the ovum and sperms are transported simultaneously to ampullary - isthmic junction of the cervix.
  - (3) the sperms are transported into cervix within 48 hrs of release of ovum in uterus.
  - (4) the sperms are transported into vagina just after the release of ovum in fallopian tube.

86. Which one of the following is the starter codon ?
- (1) UGA
  - (2) UAA
  - (3) UAG
  - (4) AUG
87. A river with an inflow of domestic sewage rich in organic waste may result in :
- (1) Increased population of aquatic food web organisms.
  - (2) An increased production of fish due to biodegradable nutrients.
  - (3) Death of fish due to lack of oxygen.
  - (4) Drying of the river very soon due to algal bloom.
88. Following are the two statements regarding the origin of life :
- (a) The earliest organisms that appeared on the earth were non-green and presumably anaerobes.
  - (b) The first autotrophic organisms were the chemoautotrophs that never released oxygen.
- Of the above statements which one of the following options is correct ?
- (1) (b) is correct but (a) is false.
  - (2) Both (a) and (b) are correct.
  - (3) Both (a) and (b) are false.
  - (4) (a) is correct but (b) is false.
89. A system of rotating crops with legume or grass pasture to improve soil structure and fertility is called :
- (1) Contour farming
  - (2) Strip farming
  - (3) Shifting agriculture
  - (4) Ley farming
90. Gause's principle of competitive exclusion states that :
- (1) Competition for the same resources excludes species having different food preferences.
  - (2) No two species can occupy the same niche indefinitely for the same limiting resources.
  - (3) Larger organisms exclude smaller ones through competition.
  - (4) More abundant species will exclude the less abundant species through competition.

91. Which of the following characteristic features always holds true for the corresponding group of animals ?

(1)	Viviparous	Mammalia
(2)	Possess a mouth with an upper and a lower jaw	Chordata
(3)	3 - chambered heart with one incompletely divided ventricle	Reptilia
<input checked="" type="checkbox"/> (4)	Cartilaginous endoskeleton	Chondrichthyes

Changes in GnRH pulse frequency in females is controlled by circulating levels of :

- (1) estrogen and inhibin
- (2) progesterone only
- (3) progesterone and inhibin
- (4) estrogen and progesterone

93. Microtubules are the constituents of :

- (1) Spindle fibres, Centrioles and Cilia
- (2) Centrioles, Spindle fibres and Chromatin
- (3) Centrosome, Nucleosome and Centrioles
- (4) Cilia, Flagella and Peroxisomes

94. Mitochondria and chloroplast are :

- (a) semi-autonomous organelles.
- (b) formed by division of pre - existing organelles and they contain DNA but lack protein synthesizing machinery.

Which one of the following options is correct ?

- (1) (b) is true but (a) is false.
- (2) (a) is true but (b) is false.
- (3) Both (a) and (b) are false.
- (4) Both (a) and (b) are correct.

95. Photosensitive compound in human eye is made up of :

- (1) Opsin and Retinal
- (2) Opsin and Retinol
- (3) Transducin and Retinene
- (4) Guanosine and Retinol

96. Chrysophytes, Euglenoids, Dinoflagellates and Slime moulds are included in the kingdom :

- (1) Protista
- (2) Fungi
- (3) Animalia
- (4) Monera

- res  
up
97. The primitive prokaryotes responsible for the production of biogas from the dung of ruminant animals, include the :
- (1) Thermoacidophiles
  - (2) Methanogens
  - (3) Eubacteria
  - (4) Halophiles
- is
98. Identify the correct statement on 'inhibin' :
- (1) Is produced by granulose cells in ovary and inhibits the secretion of FSH.
  - (2) Is produced by granulose cells in ovary and inhibits the secretion of LH.
  - (3) Is produced by nurse cells in testes and inhibits the secretion of LH.
  - (4) Inhibits the secretion of LH, FSH and Prolactin.
- es  
in
99. It is much easier for a small animal to run uphill than for a large animal, because :
- (1) Smaller animals have a higher metabolic rate.
  - (2) Small animals have a lower  $O_2$  requirement.
  - (3) The efficiency of muscles in large animals is less than in the small animals.
  - (4) It is easier to carry a small body weight.
- le
100. A tall true breeding garden pea plant is crossed with a dwarf true breeding garden pea plant. When the  $F_1$  plants were selfed the resulting genotypes were in the ratio of :
- (1) 1 : 2 : 1 :: Tall heterozygous : Tall homozygous : Dwarf
  - (2) 3 : 1 :: Tall : Dwarf
  - (3) 3 : 1 :: Dwarf : Tall
  - (4) 1 : 2 : 1 :: Tall homozygous : Tall heterozygous : Dwarf
- d
101. Depletion of which gas in the atmosphere can lead to an increased incidence of skin cancers :
- (1) Ozone
  - (2) Ammonia
  - (3) Methane
  - (4) Nitrous oxide
102. Which one of the following is a characteristic feature of cropland ecosystem ?
- (1) Least genetic diversity
  - (2) Absence of weeds
  - (3) Ecological succession
  - (4) Absence of soil organisms
103. Tricarpellary, syncarpous gynoecium is found in flowers of :
- (1) Solanaceae
  - (2) Fabaceae
  - (3) Poaceae
  - (4) Liliaceae
104. In which of the following, all three are macronutrients ?
- (1) Iron, copper, molybdenum
  - (2) Molybdenum, magnesium, manganese
  - (3) Nitrogen, nickel, phosphorus
  - (4) Boron, zinc, manganese
105. Reduction in pH of blood will :
- (1) reduce the blood supply to the brain.
  - (2) decrease the affinity of hemoglobin with oxygen.
  - (3) release bicarbonate ions by the liver.
  - (4) reduce the rate of heart beat.
106. Lack of relaxation between successive stimuli in sustained muscle contraction is known as :
- (1) Fatigue
  - (2) Tetanus
  - (3) Tonus
  - (4) Spasm
107. Which one of the following statements is wrong ?
- (1) Golden algae are also called desmids.
  - (2) Eubacteria are also called false bacteria.
  - (3) Phycomycetes are also called algal fungi.
  - (4) Cyanobacteria are also called blue-green algae.
108. Which of the following is a restriction endonuclease ?
- (1) Protease
  - (2) DNase I
  - (3) RNase
  - (4) Hind II

109. Which of the following would appear as the pioneer organisms on bare rocks ?

- (1) Liverworts
- (2) Mosses
- (3) Green algae
- (4) Lichens

110. Water vapour comes out from the plant leaf through the stomatal opening. Through the same stomatal opening carbon dioxide diffuses into the plant during photosynthesis. Reason out the above statements using one of following options :

- (1) Both processes can happen together because the diffusion coefficient of water and  $\text{CO}_2$  is different.
- (2) The above processes happen only during night time.
- (3) One process occurs during day time, and the other at night.
- (4) Both processes cannot happen simultaneously.

111. Cotyledon of maize grain is called :

- (1) coleorhiza
- (2) coleoptile
- (3) scutellum
- (4) plumule

112. Which of the following guards the opening of hepatopancreatic duct into the duodenum ?

- (1) Ileocaecal valve
- (2) Pyloric sphincter
- (3) Sphincter of Oddi
- (4) Semilunar valve

113. In the stomach, gastric acid is secreted by the :

- (1) parietal cells
- (2) peptic cells
- (3) acidic cells
- (4) gastrin secreting cells

114. In mammals, which blood vessel would normally carry largest amount of urea ?

- (1) Dorsal Aorta
- (2) Hepatic Vein
- (3) Hepatic Portal Vein
- (4) Renal Vein

115. The term ecosystem was coined by :

- (1) A.G. Tansley
- (2) E. Haeckel
- (3) E. Warming
- (4) E.P. Odum

116. Which of the following is required as inducer(s) for the expression of Lac operon ?

- (1) galactose
- (2) lactose
- (3) lactose and galactose
- (4) glucose

117. Which of the following is wrongly matched in the given table ?

	Microbe	Product	Application
(1)	<i>Monascus purpureus</i>	Statins	lowering of blood cholesterol
(2)	<i>Streptococcus</i>	Streptokinase	removal of clot from blood vessel
<input checked="" type="checkbox"/> (3)	<i>Clostridium butylicum</i>	Lipase	removal of oil stains
<input checked="" type="checkbox"/> (4)	<i>Trichoderma polysporum</i>	Cyclosporin A	immunosuppressive drug

118. When does the growth rate of a population following the logistic model equal zero ? The logistic model is given as  $dN/dt = rN(1-N/K)$  :

- (1) when N nears the carrying capacity of the habitat.
- (2) when  $N/K$  equals zero.
- (3) when death rate is greater than birth rate.
- (4) when  $N/K$  is exactly one.

119. Which one of the following statements is not true ?

- (1) Exine of pollen grains is made up of sporopollenin
- (2) Pollen grains of many species cause severe allergies
- (3) Stored pollen in liquid nitrogen can be used in the crop breeding programmes
- (4) Tapetum helps in the dehiscence of anther

20. In bryophytes and pteridophytes, transport of male gametes requires :

- (1) Insects
- (2) Birds
- (3) Water
- (4) Wind

21. Which of the following is not a stem modification ?

- (1) Thorns of citrus
- (2) Tendrils of cucumber
- (3) Flattened structures of *Opuntia*
- (4) Pitcher of *Nepenthes*

22. Which one of the following cell organelles is enclosed by a single membrane ?

- (1) Chloroplasts
- (2) Lysosomes
- (3) Nuclei
- (4) Mitochondria

23. Analogous structures are a result of :

- (1) Convergent evolution
- (2) Shared ancestry
- (3) Stabilizing selection
- (4) Divergent evolution

24. Which one of the following statements is wrong ?

- (1) Cellulose is a polysaccharide.  $G \rightarrow AC$
- (2) Uracil is a pyrimidine.  $AG$
- (3) Glycine is a sulphur containing amino acid.
- (4) Sucrose is a disaccharide.

25. Proximal end of the filament of stamen is attached to the :

- (1) Connective
- (2) Placenta
- (3) Thalamus or petal
- (4) Anther

26. Which of the following is not required for any of the techniques of DNA fingerprinting available at present ?

- (1) Zinc finger analysis
- (2) Restriction enzymes
- (3) DNA - DNA hybridization
- (4) Polymerase chain reaction

$AG \rightarrow$  Purin  
 $CT/U \rightarrow$  Pyri

127. Which one of the following characteristics is not shared by birds and mammals ?

- (1) Breathing using lungs
- (2) Viviparity
- (3) Warm blooded nature
- (4) Ossified endoskeleton

128. Select the incorrect statement :

- (1) LH triggers ovulation in ovary.
- (2) LH and FSH decrease gradually during the follicular phase.
- (3) LH triggers secretion of androgens from the Leydig cells.
- (4) FSH stimulates the sertoli cells which help in spermiogenesis.

129. The amino acid Tryptophan is the precursor for the synthesis of :

- (1) Thyroxine and Triiodothyronine
- (2) Estrogen and Progesterone
- (3) Cortisol and Cortisone
- (4) Melatonin and Serotonin

130. Joint Forest Management Concept was introduced in India during :

- (1) 1970s
- (2) 1980s
- (3) 1990s
- (4) 1960s

131. One of the major components of cell wall of most fungi is :

- (1) Peptidoglycan
- (2) Cellulose
- (3) Hemicellulose
- (4) Chitin

132. A complex of ribosomes attached to a single strand of RNA is known as :

- (1) Polymer
- (2) Polypeptide
- (3) Okazaki fragment
- (4) Polysome

133. Which of the following features is not present in the Phylum - Arthropoda ?

- (1) Metameric segmentation
- (2) Parapodia
- (3) Jointed appendages
- (4) Chitinous exoskeleton

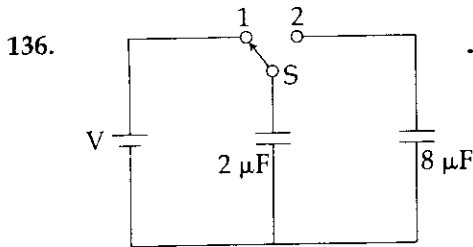
134. Asthma may be attributed to :

- (1) allergic reaction of the mast cells in the lungs
- (2) inflammation of the trachea
- (3) accumulation of fluid in the lungs
- (4) bacterial infection of the lungs

135. Pick out the correct statements :

- (a) Haemophilia is a sex-linked recessive disease.
- (b) Down's syndrome is due to aneuploidy.
- (c) Phenylketonuria is an autosomal recessive gene disorder.
- (d) Sickle cell anaemia is an X-linked recessive gene disorder.

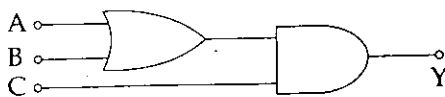
- (1) (b) and (d) are correct.
- (2) (a), (c) and (d) are correct.
- (3) (a), (b) and (c) are correct.
- (4) (a) and (d) are correct.



A capacitor of  $2 \mu\text{F}$  is charged as shown in the diagram. When the switch  $S$  is turned to position 2, the percentage of its stored energy dissipated is :

- (1) 20%
- (2) 75%
- (3) 80%
- (4) 0%

137. To get output 1 for the following circuit, the correct choice for the input is :



- (1)  $A = 1, B = 0, C = 0$
- (2)  $A = 1, B = 1, C = 0$
- (3)  $A = 1, B = 0, C = 1$
- (4)  $A = 0, B = 1, C = 0$

138. A potentiometer wire is 100 cm long and a constant potential difference is maintained across it. Two cells are connected in series first to support one another and then in opposite direction. The balance points are obtained at 50 cm and 10 cm from the positive end of the wire in the two cases. The ratio of emf's is :

- (1) 5 : 4
- (2) 3 : 4
- (3) 3 : 2
- (4) 5 : 1

$$\frac{90}{50} = \frac{10}{30}$$

$$2 = 2 \quad n = 9$$

$$n = 3$$

139. When a metallic surface is illuminated with radiation of wavelength  $\lambda$ , the stopping potential is  $V$ . If the same surface is illuminated with radiation of wavelength  $2\lambda$ , the stopping potential is  $\frac{V}{4}$ . The threshold wavelength for the metallic surface is :

- (1)  $5\lambda$
- (2)  $\frac{5}{2}\lambda$
- (3)  $3\lambda$
- (4)  $4\lambda$

140. Two non-mixing liquids of densities  $\rho$  and  $n\rho$  ( $n > 1$ ) are put in a container. The height of each liquid is  $h$ . A solid cylinder of length  $L$  and density  $d$  is put in this container. The cylinder floats with its axis vertical and length  $pL$  ( $p < 1$ ) in the denser liquid. The density  $d$  is equal to :

- (1)  $\{2 + (n + 1)p\}\rho$
- (2)  $\{2 + (n - 1)p\}\rho$
- (3)  $\{1 + (n - 1)p\}\rho$
- (4)  $\{1 + (n + 1)p\}\rho$

141. Out of the following options which one can be used to produce a propagating electromagnetic wave ?

- (1) A stationary charge
- (2) A chargeless particle
- (3) An accelerating charge
- (4) A charge moving at constant velocity

142. The charge flowing through a resistance R varies with time t as  $Q = at - bt^2$ , where a and b are positive constants. The total heat produced in R is :

- (1)  $\frac{a^3 R}{3b}$
- (2)  $\frac{a^3 R}{2b}$
- (3)  $\frac{a^3 R}{b}$
- (4)  $\frac{a^3 R}{6b}$

Handwritten notes for Q142:  
 $\frac{at^2}{2}$     $\frac{bt^3}{4}$   
 $\frac{Q^2}{2C}$

146. Given the value of Rydberg constant is  $10^7 \text{ m}^{-1}$ , the wave number of the last line of the Balmer series in hydrogen spectrum will be :

- (1)  $0.5 \times 10^7 \text{ m}^{-1}$
- (2)  $0.25 \times 10^7 \text{ m}^{-1}$
- (3)  $2.5 \times 10^7 \text{ m}^{-1}$
- (4)  $0.025 \times 10^4 \text{ m}^{-1}$

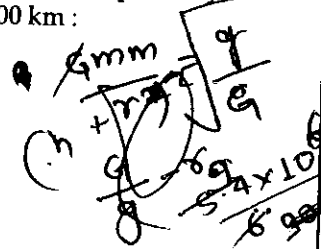
147. The ratio of escape velocity at earth ( $v_e$ ) to the escape velocity at a planet ( $v_p$ ) whose radius and mean density are twice as that of earth is :

- (1) 1 :  $2\sqrt{2}$
- (2) 1 : 4
- (3) 1 :  $\sqrt{2}$
- (4) 1 : 2

Handwritten note for Q147:  
 $v \propto \frac{v}{2 \times \sqrt{2}}$

143. At what height from the surface of earth the gravitation potential and the value of g are  $-5.4 \times 10^7 \text{ J kg}^{-2}$  and  $6.0 \text{ ms}^{-2}$  respectively? Take the radius of earth as 6400 km :

- (1) 1600 km
- (2) 1400 km
- (3) 2000 km
- (4) 2600 km



148. A long solenoid has 1000 turns. When a current of 4A flows through it, the magnetic flux linked with each turn of the solenoid is  $4 \times 10^{-3} \text{ Wb}$ . The self-inductance of the solenoid is :

- (1) 3 H
- (2) 2 H
- (3) 1 H
- (4) 4 H

Handwritten notes for Q148:  
 $N = 1000$   
 $I = 4$   
 $\Phi = 4000$   
 $BAI$

144. Coefficient of linear expansion of brass and steel rods are  $\alpha_1$  and  $\alpha_2$ . Lengths of brass and steel rods are  $l_1$  and  $l_2$  respectively. If  $(l_2 - l_1)$  is maintained same at all temperatures, which one of the following relations holds good ?

- (1)  $\alpha_1 l_2^2 = \alpha_2 l_1^2$
- (2)  $\alpha_1^2 l_2 = \alpha_2^2 l_1$
- (3)  $\alpha_1 l_1 = \alpha_2 l_2$
- (4)  $\alpha_1 l_2 = \alpha_2 l_1$

Handwritten note for Q144:  
 $\sqrt{\frac{g \times 10^6}{6400}} = \frac{3000}{34}$

149. A car is negotiating a curved road of radius R. The road is banked at an angle  $\theta$ . The coefficient of friction between the tyres of the car and the road is  $\mu_s$ . The maximum safe velocity on this road is :

- (1)  $\sqrt{gR \frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$
- (2)  $\sqrt{\frac{g}{R} \frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$
- (3)  $\sqrt{\frac{g}{R^2} \frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$
- (4)  $\sqrt{gR^2 \frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}}$

145. The intensity at the maximum in a Young's double slit experiment is  $I_0$ . Distance between two slits is  $d = 5\lambda$ , where  $\lambda$  is the wavelength of light used in the experiment. What will be the intensity in front of one of the slits on the screen placed at a distance  $D = 10d$  ?

- (1)  $\frac{I_0}{4}$
- (2)  $\frac{3}{4} I_0$
- (3)  $\frac{I_0}{2}$
- (4)  $I_0$

Handwritten notes for Q145:  
 $9 \times 10^6 = (\delta + h)^2$   
 $3 \times 10^3$   
 $\frac{9 \times 10^6}{(\delta + h)^2} = \frac{I_0}{4}$

150. The magnetic susceptibility is negative for :

- (1) paramagnetic material only
- (2) ferromagnetic material only
- (3) paramagnetic and ferromagnetic materials
- (4) diamagnetic material only

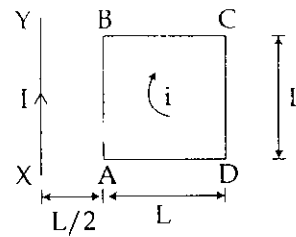
151. A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of  $15 \text{ ms}^{-1}$ . Then, the frequency of sound that the observer hears in the echo reflected from the cliff is:

(Take velocity of sound in air =  $330 \text{ ms}^{-1}$ )

- (1) 800 Hz  
 (2) 838 Hz  
 (3) 885 Hz  
 (4) 765 Hz
152. A body of mass 1 kg begins to move under the action of a time dependent force  $\vec{F} = (2t \hat{i} + 3t^2 \hat{j}) \text{ N}$ , where  $\hat{i}$  and  $\hat{j}$  are unit vectors along  $x$  and  $y$  axis. What power will be developed by the force at the time  $t$ ?
- (1)  $(2t^2 + 4t^4) \text{ W}$   
 (2)  $(2t^3 + 3t^4) \text{ W}$   
 (3)  $(2t^3 + 3t^5) \text{ W}$   
 (4)  $(2t^2 + 3t^3) \text{ W}$
153. From a disc of radius  $R$  and mass  $M$ , a circular hole of diameter  $R$ , whose rim passes through the centre is cut. What is the moment of inertia of the remaining part of the disc about a perpendicular axis, passing through the centre?
- (1)  $13 MR^2/32$   
 (2)  $11 MR^2/32$   
 (3)  $9 MR^2/32$   
 (4)  $15 MR^2/32$
154. In a diffraction pattern due to a single slit of width 'a', the first minimum is observed at an angle  $30^\circ$  when light of wavelength  $5000 \text{ \AA}$  is incident on the slit. The first secondary maximum is observed at an angle of:

- (1)  $\sin^{-1}\left(\frac{2}{3}\right)$   
 (2)  $\sin^{-1}\left(\frac{1}{2}\right)$   
 (3)  $\sin^{-1}\left(\frac{3}{4}\right)$   
 (4)  $\sin^{-1}\left(\frac{1}{4}\right)$

155. A square loop ABCD carrying a current  $i$ , is placed near and coplanar with a long straight conductor XY carrying a current  $I$ , the net force on the loop will be:



- (1)  $\frac{\mu_0 i I}{2\pi}$   
 (2)  $\frac{2\mu_0 i I L}{3\pi}$   
 (3)  $\frac{\mu_0 i I L}{2\pi}$   
 (4)  $\frac{2\mu_0 i I}{3\pi}$
156. A black body is at a temperature of 5760 K. The energy of radiation emitted by the body at wavelength 250 nm is  $U_1$ , at wavelength 500 nm is  $U_2$  and that at 1000 nm is  $U_3$ . Wien's constant  $b = 2.88 \times 10^6 \text{ nmK}$ . Which of the following is correct?
- (1)  $U_3 = 0$   
 (2)  $U_1 > U_2$   
 (3)  $U_2 > U_1$   
 (4)  $U_1 = 0$
157. An air column, closed at one end and open at the other, resonates with a tuning fork when the smallest length of the column is 50 cm. The next larger length of the column resonating with the same tuning fork is:
- (1) 100 cm  
 (2) 150 cm  
 (3) 200 cm  
 (4) 66.7 cm

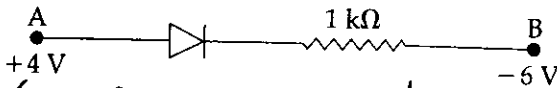


place  
ducto  
op wi

158. The molecules of a given mass of a gas have r.m.s. velocity of  $200 \text{ ms}^{-1}$  at  $27^\circ\text{C}$  and  $1.0 \times 10^5 \text{ Nm}^{-2}$  pressure. When the temperature and pressure of the gas are respectively,  $127^\circ\text{C}$  and  $0.05 \times 10^5 \text{ Nm}^{-2}$ , the r.m.s. velocity of its molecules in  $\text{ms}^{-1}$  is :

- (1)  $\frac{400}{\sqrt{3}}$
- (2)  $\frac{100\sqrt{2}}{3}$
- (3)  $\frac{100}{3}$
- (4)  $100\sqrt{2}$

159. Consider the junction diode as ideal. The value of current flowing through AB is :



- (1)  $10^{-2} \text{ A}$
- (2)  $10^{-1} \text{ A}$
- (3)  $10^{-3} \text{ A}$
- (4)  $0 \text{ A}$

$10 = V$   
 $R = 1000$   
 $\frac{10}{1000}$

160. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is :

- (1)  $90^\circ$
- (2)  $45^\circ$
- (3)  $180^\circ$
- (4)  $0^\circ$

$A \cdot B$   
 $A \cdot B \cos \theta = B \cos \theta - A \cos \theta$

161. A astronomical telescope has objective and eyepiece of focal lengths 40 cm and 4 cm respectively. To view an object 200 cm away from the objective, the lenses must be separated by a distance :

- (1) 46.0 cm
- (2) 50.0 cm
- (3) 54.0 cm
- (4) 37.3 cm

$10 = m$   
 $(1 - \frac{200}{40}) = \frac{1}{m}$

162. A npn transistor is connected in common emitter configuration in a given amplifier. A load resistance of  $800 \Omega$  is connected in the collector circuit and the voltage drop across it is 0.8 V. If the current amplification factor is 0.96 and the input resistance of the circuit is  $192 \Omega$ , the voltage gain and the power gain of the amplifier will respectively be :

- (1) 3.69, 3.84
- (2) 4, 4
- (3) 4, 3.69
- (4) 4, 3.84

163. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process until its volume is again reduced to half. Then :

- (1) Compressing the gas through adiabatic process will require more work to be done.
- (2) Compressing the gas isothermally or adiabatically will require the same amount of work.
- (3) Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas.
- (4) Compressing the gas isothermally will require more work to be done.

164. A long straight wire of radius  $a$  carries a steady current  $I$ . The current is uniformly distributed over its cross - section. The ratio of the magnetic fields  $B$  and  $B'$ , at radial distances  $\frac{a}{2}$  and  $2a$  respectively, from the axis of the wire is :

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

$\frac{B}{B'} = \frac{\frac{1}{2} I L}{2 I L} = \frac{1}{4}$

165. Match the corresponding entries of column 1 with column 2. [Where  $m$  is the magnification produced by the mirror]

Column 1	Column 2
(A) $m = -2 \rightarrow$	(a) Convex mirror <b>A</b>
(B) $m = -\frac{1}{2}$	(b) Concave mirror
(C) $m = +2$	(c) Real image <b>A</b>
(D) $m = +\frac{1}{2}$	(d) Virtual image
(1) $A \rightarrow a$ and $c$ ; $B \rightarrow a$ and $d$ ; $C \rightarrow a$ and $b$ ; $D \rightarrow c$ and $d$	<b>X</b>
(2) $A \rightarrow a$ and $d$ ; $B \rightarrow b$ and $c$ ; $C \rightarrow b$ and $d$ ; $D \rightarrow b$ and $c$	<b>X</b>
(3) $A \rightarrow c$ and $d$ ; $B \rightarrow b$ and $d$ ; $C \rightarrow b$ and $c$ ; $D \rightarrow a$ and $d$	<b>X</b>
(4) $A \rightarrow b$ and $c$ ; $B \rightarrow b$ and $c$ ; $C \rightarrow b$ and $d$ ; $D \rightarrow a$ and $d$	<b>X</b>

166. If the velocity of a particle is  $v = At + Bt^2$ , where  $A$  and  $B$  are constants, then the distance travelled by it between  $1s$  and  $2s$  is :
- (1)  $3A + 7B$
  - (2)  $\frac{3}{2}A + \frac{7}{3}B$
  - (3)  $\frac{A}{2} + \frac{B}{3}$
  - (4)  $\frac{3}{2}A + 4B$
167. A disk and a sphere of same radius but different masses roll off on two inclined planes of the same altitude and length. Which one of the two objects gets to the bottom of the plane first?
- (1) Sphere
  - (2) Both reach at the same time
  - (3) Depends on their masses
  - (4) Disk
168. Two identical charged spheres suspended from a common point by two massless strings of lengths  $l$ , are initially at a distance  $d$  ( $d < l$ ) apart because of their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity  $v$ . Then  $v$  varies as a function of the distance  $x$  between the spheres, as :
- (1)  $v \propto x$
  - (2)  $v \propto x^{-\frac{1}{2}}$
  - (3)  $v \propto x^{-1}$
  - (4)  $v \propto x^{\frac{1}{2}}$
169. A particle moves so that its position vector is given by  $\vec{r} = \cos \omega t \hat{x} + \sin \omega t \hat{y}$ . Where  $\omega$  is a constant.
- Which of the following is true ?
- (1) Velocity and acceleration both are parallel to  $\vec{r}$ .
  - (2) Velocity is perpendicular to  $\vec{r}$  and acceleration is directed towards the origin.
  - (3) Velocity is perpendicular to  $\vec{r}$  and acceleration is directed away from the origin.
  - (4) Velocity and acceleration both are perpendicular to  $\vec{r}$ .
170. A piece of ice falls from a height  $h$  so that it melts completely. Only one-quarter of the heat produced is absorbed by the ice and all energy of ice gets converted into heat during its fall. The value of  $h$  is : [Latent heat of ice is  $3.4 \times 10^5$  J/kg and  $g = 10$  N/kg]
- (1) 544 km
  - (2) 136 km
  - (3) 68 km
  - (4) 34 km
171. A uniform circular disc of radius 50 cm at rest is free to turn about an axis which is perpendicular to its plane and passes through its centre. It is subjected to a torque which produces a constant angular acceleration of  $2.0 \text{ rad s}^{-2}$ . Its net acceleration in  $\text{ms}^{-2}$  at the end of 2.0 s is approximately :
- (1) 7.0
  - (2) 6.0
  - (3) 3.0
  - (4) 8.0
172. What is the minimum velocity with which a body of mass  $m$  must enter a vertical loop of radius  $R$  so that it can complete the loop ?
- (1)  $\sqrt{2gR}$
  - (2)  $\sqrt{3gR}$
  - (3)  $\sqrt{5gR}$
  - (4)  $\sqrt{gR}$
173. A small signal voltage  $V(t) = V_0 \sin \omega t$  is applied across an ideal capacitor  $C$  :
- (1) Over a full cycle the capacitor  $C$  does not consume any energy from the voltage source.
  - (2) Current  $I(t)$  is in phase with voltage  $V(t)$ .
  - (3) Current  $I(t)$  leads voltage  $V(t)$  by  $180^\circ$ .
  - (4) Current  $I(t)$ , lags voltage  $V(t)$  by  $90^\circ$ .

174. A uniform rope of length  $L$  and mass  $m_1$  hangs vertically from a rigid support. A block of mass  $m_2$  is attached to the free end of the rope. A transverse pulse of wavelength  $\lambda_1$  is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is  $\lambda_2$ . The ratio  $\lambda_2/\lambda_1$  is :

(1)  $\sqrt{\frac{m_1 + m_2}{m_2}}$

(2)  $\sqrt{\frac{m_2}{m_1}}$

(3)  $\sqrt{\frac{m_1 + m_2}{m_1}}$

(4)  $\sqrt{\frac{m_1}{m_2}}$

175. An inductor 20 mH, a capacitor 50  $\mu$ F and a resistor 40  $\Omega$  are connected in series across a source of emf  $V = 10 \sin 340 t$ . The power loss in A.C. circuit is :

(1) 0.67 W

(2) 0.76 W

(3) 0.89 W

(4) 0.51 W

176. An electron of mass  $m$  and a photon have same energy  $E$ . The ratio of de-Broglie wavelengths associated with them is :

(1)  $\left(\frac{E}{2m}\right)^{\frac{1}{2}}$

(2)  $c(2mE)^{\frac{1}{2}}$

(3)  $\frac{1}{c} \left(\frac{2m}{E}\right)^{\frac{1}{2}}$

(4)  $\frac{1}{c} \left(\frac{E}{2m}\right)^{\frac{1}{2}}$

( $c$  being velocity of light)

177. When an  $\alpha$ -particle of mass ' $m$ ' moving with velocity ' $v$ ' bombards on a heavy nucleus of charge ' $Ze$ ', its distance of closest approach from the nucleus depends on  $m$  as :

(1)  $\frac{1}{\sqrt{m}}$

(2)  $\frac{1}{m^2}$

(3)  $m$

(4)  $\frac{1}{m}$

178. A refrigerator works between 4°C and 30°C. It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerated space constant. The power required is : (Take 1 cal = 4.2 Joules)

(1) 23.65 W

(2) 236.5 W

(3) 2365 W

(4) 2.365 W

179. A particle of mass 10 g moves along a circle of radius 6.4 cm with a constant tangential acceleration. What is the magnitude of this acceleration if the kinetic energy of the particle becomes equal to  $8 \times 10^{-4}$  J by the end of the second revolution after the beginning of the motion ?

(1) 0.15  $m/s^2$

(2) 0.18  $m/s^2$

(3) 0.2  $m/s^2$

(4) 0.1  $m/s^2$

180. The angle of incidence for a ray of light at a refracting surface of a prism is 45°. The angle of prism is 60°. If the ray suffers minimum deviation through the prism, the angle of minimum deviation and refractive index of the material of the prism respectively, are :

(1) 30°;  $\sqrt{2}$

(2) 45°;  $\sqrt{2}$

(3) 30°;  $\frac{1}{\sqrt{2}}$

(4) 45°;  $\frac{1}{\sqrt{2}}$

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