

DATE : 04/05/2014

Test Booklet Code



Aakash

Medical | IIT-JEE | Foundations

(Divisions of Aakash Educational Services Ltd.)

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Time : 3 hrs.

Answers & Solutions

Max. Marks : 720

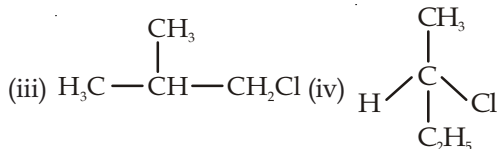
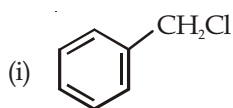
for

AIPMT-2014

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.
5. **On completion of the test, the candidate must handover the Answer Sheet to the invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.**
6. The CODE for this Booklet is **Q**. Make sure that the CODE printed on **Side-2** of the Answer Sheet is the same as that on this Booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.
7. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your roll no. anywhere else except in the specified space in the Test Booklet/ Answer Sheet.
8. Use of white fluid for correction is **NOT** permissible on the Answer Sheet.
9. Each candidate must show on demand his/her Admission Card to the Invigilator.
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 the 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.

1. Which of the following compounds will undergo racemisation when solution of KOH hydrolyses?



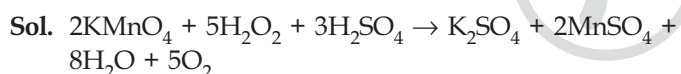
- (1) (ii) and (iv) (2) (iii) and (iv)
(3) (i) and (iv) (4) (i) and (ii)

Answer (No answer)

2. The reaction of aqueous KMnO_4 with H_2O_2 in acidic conditions gives :

- (1) Mn^{2+} and O_2 (2) Mn^{2+} and O_3
(3) Mn^{4+} and MnO_2 (4) Mn^{4+} and O_2

Answer (1)



3. Which one of the following is not a common component of Photochemical Smog?

- (1) Acrolein (2) Peroxyacetyl nitrate
(3) Chlorofluorocarbons (4) Ozone

Answer (3)

Sol. Fact.

4. Which of the following will be most stable diazonium salt RN_2^+X^- ?

- (1) $\text{C}_6\text{H}_5\text{N}_2^+\text{X}^-$ (2) $\text{CH}_3\text{CH}_2\text{N}_2^+\text{X}^-$
(3) $\text{C}_6\text{H}_5\text{CH}_2\text{N}_2^+\text{X}^-$ (4) $\text{CH}_3\text{N}_2^+\text{X}^-$

Answer (1)

Sol. Resonance stabilization

5. Which of the following hormones is produced under the condition of stress which stimulates glycogenolysis in the liver of human beings?

- (1) Insulin (2) Adrenaline
(3) Estradiol (4) Thyroxin

Answer (2)

Sol. Fact

6. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reactant is left in excess and how much?

(At. wt. Mg = 24; O = 16)

- (1) O_2 , 0.16 g (2) Mg, 0.44 g
(3) O_2 , 0.28 g (4) Mg, 0.16 g

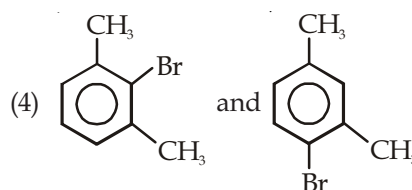
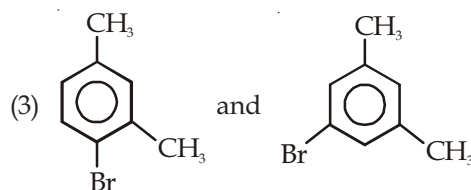
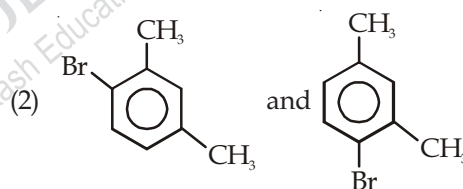
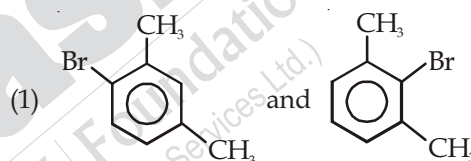
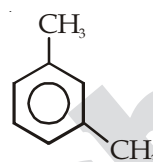
Answer (4)

Sol. 24 g Mg requires 16 g oxygen

\therefore 0.56 g oxygen requires 0.84 g Mg

\therefore Mg left = 0.16 g

7. What products are formed when the following compound is treated with Br_2 in the presence of FeBr_3 ?



Answer (2)

Sol. $-\text{CH}_3$ group is o, p - directing.

8. Which of the following organic compounds polymerizes to form the polyester Dacron?

- (1) Benzoic acid and ethanol
- (2) Terephthalic acid and ethylene glycol
- (3) Benzoic acid and para HO - (C₆H₄) - OH
- (4) Propylene and para HO - (C₆H₄) - OH

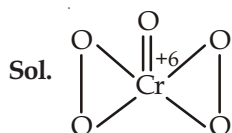
Answer (2)

Sol. Fact.

9. In acidic medium, H₂O₂ changes Cr₂O₇²⁻ to CrO₅ which has two (-O-O-) bonds. Oxidation state of Cr in CrO₅ is

- (1) +3
- (2) +6
- (3) -10
- (4) +5

Answer (2)



10. Which of the following orders of ionic radii is correctly represented?

- (1) Na⁺ > F⁻ > O²⁻
- (2) F⁻ > O²⁻ > Na⁺
- (3) Al³⁺ > Mg²⁺ > N³⁻
- (4) H⁻ > H⁺ > H

Answer (No answer)

Sol. All answer are incorrect.

11. Which of the following salts will give highest pH in water?

- (1) NaCl
- (2) Na₂CO₃
- (3) CuSO₄
- (4) KCl

Answer (2)

Sol. Salt of strong base and weak acid.

12. Which of the following will not be soluble in sodium hydrogen carbonate?

- (1) Benzoic acid
- (2) o-Nitrophenol
- (3) Benzenesulphonic acid
- (4) 2,4,6-trinitrophenol

Answer (2)

Sol. o-nitrophenol is weaker acid than HCO₃⁻.

13. For the reaction, X₂O₄(l) → 2XO₂(g)

$$\Delta U = 2.1 \text{ kcal}, \Delta S = 20 \text{ cal K}^{-1} \text{ at } 300 \text{ K}$$

Hence, ΔG is

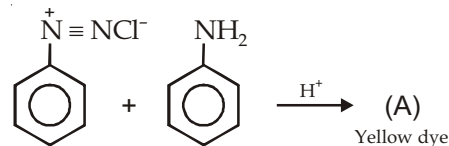
- (1) -2.7 kcal
- (2) 9.3 kcal
- (3) -9.3 kcal
- (4) 2.7 kcal

Answer (1)

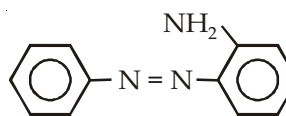
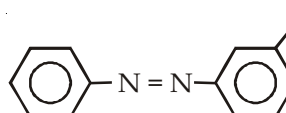
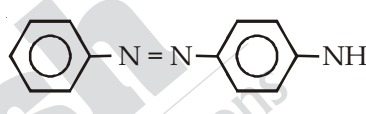
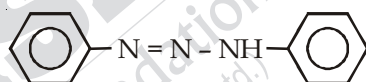
Sol. $\Delta H = \Delta U + \Delta ngRT = 3.300 \text{ kcal}$

$$\Delta G = \Delta H - T\Delta S = -2.700 \text{ kcal}$$

14. In the following reaction, the product (A)



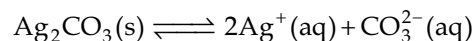
is

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

Answer (3)

Sol. Major product is formed by para attack.

15. Using the Gibbs energy change, $\Delta G^\circ = +63.3 \text{ kJ}$, for the following reaction,



the K_{sp} of Ag₂CO₃(s) in water at 25°C is

$$(R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1})$$

- (1) 8.0×10^{-12}
- (2) 2.9×10^{-3}
- (3) 7.9×10^{-2}
- (4) 3.2×10^{-26}

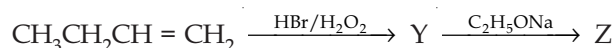
Answer (1)

Sol. $\Delta G^\circ = -2.303 RT \log K_{\text{sp}}$

$$63300 = -2.303 \times 8.314 \times 298 \log K_{\text{sp}}$$

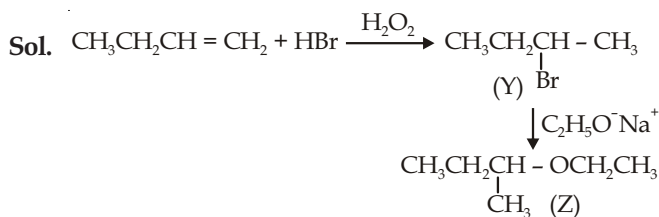
$$K_{\text{sp}} = 8 \times 10^{-12}$$

16. Identity Z in the sequence of reactions,



- (1) (CH₃)₂CH₂ - O - CH₂CH₃
- (2) CH₃(CH₂)₄ - O - CH₃
- (3) CH₃CH₂ - CH(CH₃) - O - CH₂CH₃
- (4) CH₃ - (CH₂)₃ - O - CH₂CH₃

Answer (3)



17. In the Kjeldahl's method for estimation of nitrogen present in a soil sample, ammonia evolved from 0.75 g of sample neutralized 10 mL of 1 M H_2SO_4 . The percentage of nitrogen in the soil is

- (1) 45.33 (2) 35.33
 (3) 43.33 (4) 37.33

Answer (4)

Sol. $\%N = \frac{1.4 \times N \times V}{w}$
 $= \frac{1.4 \times 10 \times 2}{0.75} = 37.33\%$

18. Which property of colloids is not dependent on the charge on colloidal particles?

- (1) Electrophoresis (2) Electro-osmosis
 (3) Tyndall effect (4) Coagulation

Answer (3)

Sol. Tyndall effect is an optical phenomenon.

19. For a given exothermic reaction, K_p and K'_p are the equilibrium constants at temperatures T_1 and T_2 , respectively. Assuming that heat of reaction is constant in temperature range between T_1 and T_2 , it is readily observed that

- (1) $K_p < K'_p$ (2) $K_p = K'_p$
 (3) $K_p = \frac{1}{K'_p}$ (4) $K_p > K'_p$

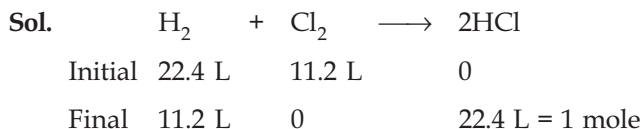
Answer (4)

Sol. Assuming $T_2 > T_1$.

20. When 22.4 litres of $\text{H}_2(\text{g})$ is mixed with 11.2 litres of $\text{Cl}_2(\text{g})$, each at STP, the moles of $\text{HCl}(\text{g})$ formed is equal to

- (1) 2 mol of $\text{HCl}(\text{g})$ (2) 0.5 mol of $\text{HCl}(\text{g})$
 (3) 1.5 mol of $\text{HCl}(\text{g})$ (4) 1 mol of $\text{HCl}(\text{g})$

Answer (4)




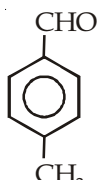
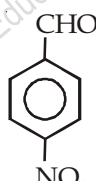

21. Which one of the following is an example of a thermosetting polymer?

- (1) $-(\text{CH}_2 - \underset{\text{Cl}}{\text{CH}})_n-$
 (2) $-(\underset{\text{H}}{\text{N}} - (\text{CH}_2)_6 - \underset{\text{H}}{\text{N}} - \overset{\text{O}}{\parallel} \text{C} - (\text{CH}_2)_4 - \overset{\text{O}}{\parallel} \text{C})_n-$
 (3) $(\text{C}_6\text{H}_3(\text{OH})_2 - \text{CH}_2)_n$
 (4) $-(\text{CH}_2 - \underset{\text{Cl}}{\text{C}} = \text{CH} - \text{CH}_2)_n-$

Answer (3)

Sol. Novolac is thermosetting polymer.

22. Which one is most reactive towards Nucleophilic addition reaction?

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

Answer (3)

Sol. Electron withdrawing group *i.e.*, $-\text{NO}_2$ favours nucleophilic attack.

23. Calculate the energy in joule corresponding to light of wavelength 45 nm : (Planck's constant $h = 6.63 \times 10^{-34}$ Js; speed of light $c = 3 \times 10^8$ ms $^{-1}$)

- (1) 6.67×10^{11} (2) 4.42×10^{-15}
 (3) 4.42×10^{-18} (4) 6.67×10^{15}

Answer (3)

Sol. $E = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{45 \times 10^{-9}}$
 $= 4.42 \times 10^{-18}$ J

24. Which of the following organic compounds has same hybridization as its combustion product $-(CO_2)$?

- (1) Ethyne (2) Ethene
(3) Ethanol (4) Ethane

Answer (1)

Sol. Product Reactant

$$O = C = O \quad H - C \equiv C - H$$

sp *sp* *sp*

25. Be^{2+} is isoelectronic with which of the following ions?

- (1) Li^+ (2) Na^+
(3) Mg^{2+} (4) H^+

Answer (1)

Sol. Both Be^{2+} and Li^{+1} have two electrons.

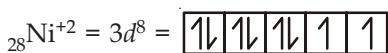
26. Magnetic moment 2.83 BM is given by which of the following ions?

(At. nos. Ti = 22, Cr = 24, Mn = 25, Ni = 28)

- (1) Ni^{2+} (2) Cr^{3+}
(3) Mn^{2+} (4) Ti^{3+}

Answer (1)

Sol. $\mu = 2.83$ BM, unpaired electrons = 2



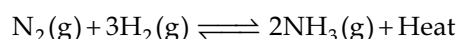
27. The weight of silver (at. wt. = 108) displaced by a quantity of electricity which displaces 5600 mL of O_2 at STP will be

- (1) 10.8 g (2) 54.0 g
(3) 108.0 g (4) 5.4 g

Answer (3)

Sol. $W_{O_2} = \frac{5600}{22400} \times 32 = 8 \text{ g} = 1 \text{ equivalent}$
 $= 1 \text{ equivalent of Ag}$
 $= 108 \text{ g}$

28. For the reversible reaction,



The equilibrium shifts in forward direction

- (1) By decreasing the pressure
(2) By decreasing the concentrations of $N_2(g)$ and $H_2(g)$
(3) By increasing pressure and decreasing temperature
(4) By increasing the concentration of $NH_3(g)$

Answer (3)

Sol. Le chatelier's principle.

29. The pair of compounds that can exist together is

- (1) $HgCl_2, SnCl_2$ (2) $FeCl_2, SnCl_2$
(3) $FeCl_3, KI$ (4) $FeCl_3, SnCl_2$

Answer (2)

Sol. Sn^{+2} can not reduce Fe^{+2} .

30. Which of the following complexes is used to be as an anticancer agent?

- (1) cis- $[PtCl_2(NH_3)_2]$ (2) cis- $K_2[PtCl_2Br_2]$
(3) Na_2CoCl_4 (4) mer- $[Co(NH_3)_3Cl_3]$

Answer (1)

Sol. Fact.

31. Among the following complexes the one which shows **Zero** crystal field stabilization energy (CFSE) is

- (1) $[Fe(H_2O)_6]^{3+}$ (2) $[Co(H_2O)_6]^{2+}$
(3) $[Co(H_2O)_6]^{3+}$ (4) $[Mn(H_2O)_6]^{3+}$

Answer (1)

Sol. $Fe^{+3} = d^5 = t_{2g}^3 e_g^2$, CFSE = 0.

32. If a is the length of the side of a cube, the distance between the body centered atom and one corner atom in the cube will be

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

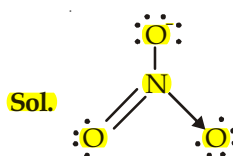
Answer (3)

Sol. Half of body diagonal, $\frac{\sqrt{3}a}{2}$.

33. Which one of the following species has plane triangular shape?

- (1) NO_3^- (2) NO_2^-
(3) CO_2 (4) N_3

Answer (1)



N is sp^2 hybrid and no lone pair.

34. Which of the following molecules has the maximum dipole moment?

- (1) CH₄ (2) NH₃
(3) NF₃ (4) CO₂

Answer (2)

Sol. Fact.

35. Acidity of diprotic acids in aqueous solutions increases in the order

- (1) H₂Se < H₂S < H₂Te (2) H₂Te < H₂S < H₂Se
(3) H₂Se < H₂Te < H₂S (4) H₂S < H₂Se < H₂Te

Answer (4)

Sol. Bond length increases from H₂S to H₂Te.

36. Reason of lanthanoid contraction is

- (1) Increasing nuclear charge
(2) Decreasing nuclear charge
(3) Decreasing screening effect
(4) Negligible screening effect of 'f' orbitals

Answer (4)

Sol. Fact.

37. Which of the following statements is correct for the spontaneous adsorption of a gas?

- (1) ΔS is negative and therefore, ΔH should be highly negative
(2) ΔS is positive and, therefore, ΔH should be negative
(3) ΔS is positive and, therefore, ΔH should also be highly positive
(4) ΔS is negative and, therefore, ΔH should be highly positive

Answer (1)

Sol. For adsorption ΔS = -ve, ΔH = -ve.

38. Artificial sweetener which is stable under cold conditions only is

- (1) Sucralose (2) Aspartame
(3) Alitame (4) Saccharine

Answer (2)

Sol. Aspartame decomposes at cooking temperature.

39. Equal masses of H₂, O₂ and methane have been taken in a container of volume V at temperature 27°C in identical conditions. The ratio of the volumes of gases H₂ : O₂ : methane would be

- (1) 16 : 8 : 1 (2) 16 : 1 : 2
(3) 8 : 1 : 2 (4) 8 : 16 : 1

Answer (2)

Sol. Ratio or moles (volume)

$$\Rightarrow \frac{W}{2} : \frac{W}{32} : \frac{W}{16}$$

$$\Rightarrow 16 : 1 : 2$$

40. (a) H₂O₂ + O₃ → H₂O + 2O₂

(b) H₂O₂ + Ag₂O → 2Ag + H₂O + O₂

Role of hydrogen peroxide in the above reactions is respectively

- (1) Reducing in (a) and oxidizing in (b)
(2) Reducing in (a) and (b)
(3) Oxidizing in (a) and (b)
(4) Oxidizing in (a) and reducing in (b)

Answer (4)

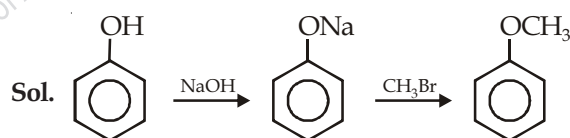
Sol. (a) H₂O₂ is reduced.

(b) Ag₂O is reduced.

41. Among the following sets of reactants which one produces anisole?

- (1) C₆H₅OH; NaOH; CH₃I
(2) C₆H₅OH; neutral FeCl₃
(3) C₆H₅-CH₃; CH₃COCl; AlCl₃
(4) CH₃CHO; RMgX

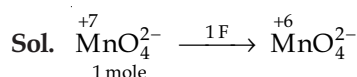
Answer (1)



42. When 0.1 mol MnO₄²⁻ is oxidised the quantity of electricity required to completely oxidise MnO₄²⁻ to MnO₄⁻ is

- (1) 2 × 96500 C (2) 9650 C
(3) 96.50 C (4) 96500 C

Answer (2)



∴ For 0.1 mole 0.1 F is required.

43. Of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression?

- (1) $C_6H_{12}O_6$ (2) $Al_2(SO_4)_3$
 (3) K_2SO_4 (4) KCl

Answer (2)

Sol. Van't Hoff factor of $Al_2(SO_4)_3$ is maximum *i.e.*, 5.

44. What is the maximum number of orbitals that can be identified with the following quantum numbers?

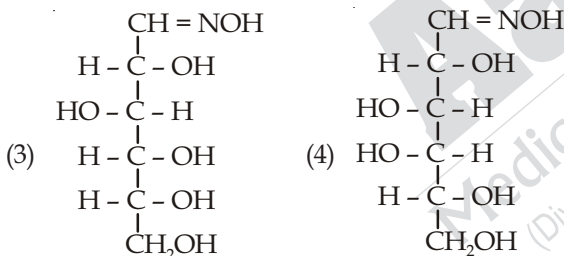
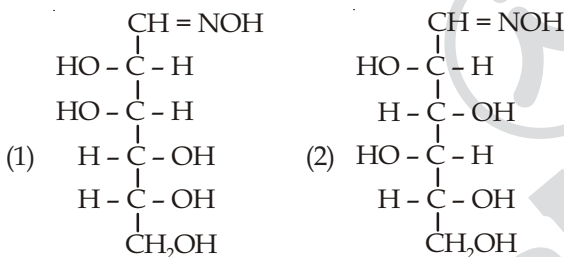
$$n = 3, l = 1, m_l = 0$$

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

Answer (4)

Sol. Orbital is $3p_z$.

45. D(+) glucose reacts with hydroxyl amine and yields an oxime. The structure of the oxime would be



Answer (3)

Sol. Glucoxime is formed.

46. Five kingdom system of classification suggested by R.H. Whittaker is not based on

- (1) Mode of reproduction
 (2) Mode of nutrition
 (3) Complexity of body organisation
 (4) Presence or absence of a well defined nucleus

Answer (4)

Sol. The main criteria of Whittaker's system are :- Cell type, Thallus organisation, Nutrition, Reproduction & phylogenetic relationship.

47. The main function of mammalian corpus luteum is to produce

- (1) Progesterone
 (2) Human chorionic gonadotropin
 (3) Relaxin only
 (4) Estrogen only

Answer (1)

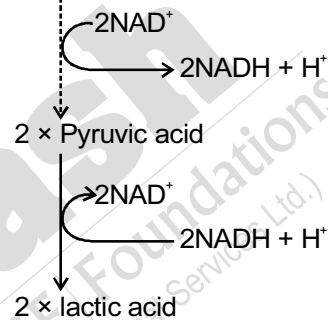
Sol. Corpus luteum secretes steroid hormones progesterone and estrogen.

48. In which one of the following processes CO_2 is not released?

- (1) Aerobic respiration in animals
 (2) Alcoholic fermentation
 (3) Lactate fermentation
 (4) Aerobic respiration in plants

Answer (3)

Sol. Glucose



49. Choose the correctly matched pair:

- (1) Moist surface of buccal cavity-Glandular epithelium
 (2) Tubular parts of nephrons-Cuboidal epithelium
 (3) Inner surface of bronchioles-Squamous epithelium
 (4) Inner lining of salivary ducts - Ciliated epithelium

Answer (2)

Sol. Moist surface of buccal cavity - Stratified non-keratinised squamous epithelium

Inner surface of bronchioles - Ciliated epithelium

Inner lining of salivary ducts - Cuboidal epithelium

50. Which of the following shows coiled RNA strand and capsomeres?

- (1) Tobacco mosaic virus
 (2) Measles virus
 (3) Retrovirus
 (4) Polio virus

Answer (1)

Sol. RNA is single stranded helically coiled with 6400 ribonucleotides.

51. Just as a person moving from Delhi to Shimla to escape the heat for the duration of hot summer, thousands of migratory birds from Siberia and other extremely cold northern regions move to

- (1) Meghalaya
- (2) Corbett National Park
- (3) Keolado National Park
- (4) Western Ghat

Answer (3)

Sol. Every winter the famous Keolado National Park (Bharatpur) in Rajasthan host thousands of migratory birds coming from Siberia and other extremely cold northern region.

52. You are given a fairly old piece of dicot stem and a dicot root. Which of the following anatomical structures will you use to distinguish between the two?

- (1) Secondary phloem
- (2) Protoxylem
- (3) Cortical cells
- (4) Secondary xylem

Answer (2)

Sol. In stems, the protoxylem lies towards the centre (pith) and the metaxylem lies towards the periphery of the organ. This type of primary xylem is called endarch. In root, the protoxylem lies towards periphery and metaxylem lies towards the centre, such arrangement is called exarch.

53. In 'S' phase of the cell cycle

- (1) Amount of DNA remains same in each cell
- (2) Chromosome number is increased
- (3) Amount of DNA is reduced to half in each cell
- (4) Amount of DNA doubles in each cell

Answer (4)

Sol. S or synthesis phase marks the period where DNA synthesis takes place. During this time the amount of DNA per cell doubles.

54. A species facing extremely high risk of extinction in the immediate future is called

- (1) Endemic
- (2) Critically Endangered
- (3) Extinct
- (4) Vulnerable

Answer (2)

Sol. A taxon facing extremely high risk of extinction in the immediate future is called critically endangered.

55. Fruit colour in squash is an example of

- (1) Dominant epistasis
- (2) Complementary genes
- (3) Inhibitory genes
- (4) Recessive epistasis

Answer (1)

Sol. Dominant epistasis is the phenomenon of masking or suppressing the expression of a gene by a dominant non-allelic gene.

eg, fruit colour in *Cucurbita pepo* (Summer squash)

56. Identify the hormone with its correct matching of source and function

- (1) Melatonin - pineal gland, regulates the normal rhythm of sleepwake cycle
- (2) Progesterone - corpus-luteum, stimulation of growth and activities of female secondary sex organs
- (3) Atrial natriuretic factor - ventricular wall increases the blood pressure
- (4) Oxytocin - posterior pituitary, growth and maintenance of mammary glands

Answer (1)

Sol. Atrial Natriuretic factor is secreted by atrial wall of heart. Oxytocin is synthesised by hypothalamous.

57. An example of edible underground stem is

- (1) Groundnut
- (2) Sweet potato
- (3) Potato
- (4) Carrot

Answer (3)

Sol. Sweet potato, Carrot – Edible root.

Potato – Edible underground stem.

58. Which of the following causes an increase in sodium reabsorption in the distal convoluted tubule?

- (1) Increase in antidiuretic hormone levels
- (2) Decrease in aldosterone levels
- (3) Decrease in antidiuretic hormone levels
- (4) Increase in aldosterone levels

Answer (4)

Sol. Aldosterone stimulates Na^+ and water reabsorption in DCT.

59. Which structures perform the function of mitochondria in bacteria?

- (1) Ribosomes
- (2) Cell wall
- (3) Mesosomes
- (4) Nucleoid

Answer (3)

Sol. Mesosomes help in respiration, secretion processes, to increase the surface area of the plasma membrane and enzymatic contact.

60. Select the option which is not correct with respect to enzyme action

- (1) Addition of lot of succinate does not reverse the inhibition of succinic dehydrogenase by malonate
- (2) A non-competitive inhibitor binds the enzyme at a site distinct from that which binds the substrate
- (3) Malonate is a competitive inhibitor of succinic dehydrogenase
- (4) Substrate binds with enzyme at its active site

Answer (1)

Sol. Inhibition of succinic dehydrogenase by malonate is an example of competitive inhibition. This is reversible reaction. On increasing the substrate (succinate) concentration the effect of inhibitor is removed and V_{max} remain same.

61. Which is the particular type of drug that is obtained from the plant whose one flowering branch is shown below?



- (1) Depressant
- (2) Stimulant
- (3) Pain-killer
- (4) Hallucinogen

Answer (4)

Sol. The plant illustrated in diagram is Datura which has hallucinogenic properties.

62. Fructose is absorbed into the blood through mucosa cells of intestine by the process called

- (1) Facilitated transport
- (2) Simple diffusion
- (3) Co-transport mechanism
- (4) Active transport

Answer (1)

Sol. Fructose is absorbed with the help of the carrier ions like Na^+ . This mechanism is called facilitated transport.

63. The solid linear cytoskeletal elements having a diameter of 6 nm and made up of a single type of monomer are known as

- (1) Microfilaments
- (2) Intermediate filaments
- (3) Lamins
- (4) Microtubules

Answer (1)

Sol. Microfilaments are ultramicroscopic long, narrow cylindrical solid rods or protein filaments (actin protein) of approx 8 nm in dm.

64. Which one of the following living organisms completely lacks a cell wall?

- (1) Sea - fan (*Gorgonia*)
- (2) *Saccharomyces*
- (3) Blue - green algae
- (4) Cyanobacteria

Answer (1)

Sol. *Gorgonia* (sea-fan) is an animal. All animal lack cell wall.

65. Tracheids differ from other tracheary elements in :

- (1) Being imperforate
- (2) Lacking nucleus
- (3) Being lignified
- (4) Having casparian strips

Answer (1)

Sol. Vessel is a long cylindrical tube like structure made of many cells, called vessel members, each with lignified walls and a large central cavity. Vessel members are interconnected through perforation in their common walls

66. Select the correct matching of the type of the joint with the example in human skeletal system :

Type of joint	Example
(1) Pivot joint	- between third and fourth cervical vertebrae
(2) Hinge joint	- between humerus and pectoral girdle
(3) Gliding joint	- between carpals
(4) Cartilaginous joint	- between frontal and parietal

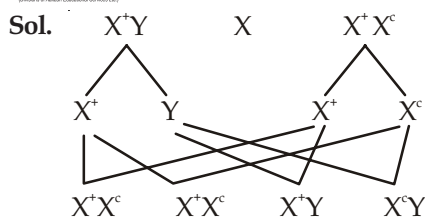
Answer (3)

Sol. Joint between carpals is gliding joint

67. A man whose father was colour blind marries a woman who had a colour blind mother and normal father. What percentage of male children of this couple will be colour blind?

- (1) 0%
- (2) 50%
- (3) 75%
- (4) 25%

Answer (2)



\therefore Colourblind male = 50%

68. A few normal seedlings of tomato were kept in a dark room. After a few days they were found to have become white-coloured like albinos. Which of the following terms will you use to describe them?

- (1) Embolised (2) Etiolated
(3) Defoliated (4) Mutated

Answer (2)

Sol. Etiolation is depigmentation is leaf when plant is placed in dark for more than 36 hrs.

69. Function of filiform apparatus is to :

- (1) Stimulate division of generative cell
(2) Produce nectar
(3) Guide the entry of pollen tube
(4) Recognize the suitable pollen at stigma

Answer (3)

Sol. Filiform apparatus, present in synergids, play an important role in guiding the pollen tube into the synergid.

70. Choose the correctly matched pair :

- (1) Adipose tissue - Dense connective tissue
(2) Areolar tissue - Loose connective tissue
(3) Cartilage - Loose connective tissue
(4) Tendon - Specialized connective tissue

Answer (2)

Sol. Areolar and adipose tissue are loose connective tissue while tendon is dense connective tissue. Cartilage is specialized connective tissue.

71. Forelimbs of cat, lizard used in walking; forelimbs of whale used in swimming and forelimbs of bats used in flying are an example of :

- (1) Adaptive radiation
(2) Homologous organs
(3) Convergent evolution
(4) Analogous organs

Answer (2)

Sol. Forelimbs of cat, lizard used in walking, forelimbs of whale used in swimming and forelimbs of bats used in flying are the examples of homologous. All are modified forelimbs, with the same types of bones, they have become different due to adaptation to habitat

72. Which one of the following is a non-reducing carbohydrate?

- (1) Sucrose (2) Lactose
(3) Ribose 5-phosphate (4) Maltose

Answer (1)

Sol. Lactose, Maltose, Ribose 5-phosphate all are reducing sugars.

73. At which stage of HIV infection does one usually show symptoms of AIDS?

- (1) When the infected retro virus enters host cells
(2) When HIV damages large numebr of helper T-Lymphocytes
(3) When the viral DNA is produced by reverse transcriptase
(4) Within 15 days of sexual contact with an infected person

Answer (2)

Sol. Symptoms of AIDS would appear in the late stage of HIV infection, when the virus attacks 'Helper-T-cells' and causes their depletion

74. What gases are produced in anaerobic sludge digesters?

- (1) Methane, hydrogen sulphide and CO₂
(2) Methane, hdyrogen sulphide and O₂
(3) Hydrogen sulphide and CO₂
(4) Methane and CO₂ only

Answer (1)

Sol. In anaerobic sludge digesters, bacteria produce a mixture of gases like CH₄, H₂S and CO₂

75. Anoxygenic photosynthesis is characteristic of

- (1) *Spirogyra*
(2) *Chlamydomonas*
(3) *Ulva*
(4) *Rhodospirillum*

Answer (4)

Sol. In *Rhodospirillum*, electron donor is organic compound during photosynthesis.

76. Match the following and select the **correct** option :

- | | |
|-----------------------|---------------------|
| (a) Earthworm | (i) Pioneer species |
| (b) Succession | (ii) Detritivore |
| (c) Ecosystem service | (iii) Natality |
| (d) Population growth | (iv) Pollination |

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

- | | | | |
|-----------|------|-------|-------|
| (1) (iv) | (i) | (iii) | (ii) |
| (2) (iii) | (ii) | (iv) | (i) |
| (3) (ii) | (i) | (iv) | (iii) |
| (4) (i) | (ii) | (iii) | (iv) |

Answer (3)

Sol. Detritivores, (eg. earthworm) break down detritus into smaller particles.

The species that invade a base area in succession is called pioneer species.

77. A location with luxuriant growth of lichens on the trees indicates that the

- (1) Trees are heavily infested
- (2) Location is highly polluted
- (3) Location is not polluted
- (4) Trees are very healthy

Answer (3)

Sol. Lichens are very good pollution indicators, they do not grow in polluted areas.

78. In vitro clonal propagation in plants is characterized by

- (1) Northern blotting
- (2) Electrophoresis and HPLC
- (3) Microscopy
- (4) PCR and RAPD

Answer (4)

Sol. Now a days PCR & RAPD technique are used for the characterisation of *in vitro* clonal propagation in plants.

Option (3) is also correct.

79. An alga which can be employed as food for human being is

- | | |
|-------------------------|----------------------|
| (1) <i>Chlorella</i> | (2) <i>Spirogyra</i> |
| (3) <i>Polysiphonia</i> | (4) <i>Ulothrix</i> |

Answer (1)

Sol. *Chlorella* is rich in proteins and are used as food supplements even by space travellers.

80. Which one of the following growth regulators is known as 'stress hormone'?

- | | |
|------------------------|---------------------|
| (1) Ethylene | (2) GA ₃ |
| (3) Indole acetic acid | (4) Abscisic acid |

Answer (4)

Sol. ABA stimulates the closure of stomata in the epidermis and increases the tolerance of plants to various kinds of stresses.

81. The enzyme recombinase is required at which stage of meiosis?

- | | |
|----------------|---------------|
| (1) Zygotene | (2) Diplotene |
| (3) Diakinesis | (4) Pachytene |

Answer (4)

Sol. Crossing over is an enzyme-mediated process and the enzyme involved is called recombinase.

82. Assisted reproductive technology, IVF involves transfer of

- (1) Zygote into the fallopian tube
- (2) Zygote into the uterus
- (3) Embryo with 16 blastomeres into the fallopian tube
- (4) Ovum into the fallopian tube

Answer (1)

Sol. In IVF, zygote or the embryo upto 8-celled stage is transferred into the fallopian tube

83. An example of *ex situ* conservation is

- | | |
|------------------|------------------------|
| (1) Seed Bank | (2) Wildlife Sanctuary |
| (3) Sacred Grove | (4) National Park |

Answer (1)

Sol. *In situ* conservation strategies - National park, biosphere reserve, sanctuaries, sacred groves.

84. The osmotic expansion of a cell kept in water is chiefly regulated by

- | | |
|---------------|------------------|
| (1) Vacuoles | (2) Plastids |
| (3) Ribosomes | (4) Mitochondria |

Answer (1)

Sol. Vacuoles

85. Which one of the following is wrong about *Chara*?

- (1) Globule and nucule present on the same plant
- (2) Upper antheridium and lower oogonium
- (3) Globule is male reproductive structure
- (4) Upper oogonium and lower round antheridium

Answer (2)

Sol. Nucule/oogonium/upper sex organ
Globule/antheridium/lower sex organ

86. The first human hormone produced by recombinant DNA technology is

- (1) Estrogen (2) Thyroxin
(3) Progesterone (4) Insulin

Answer (4)

Sol. The first hormone produced by recombinant DNA technology is insulin.

87. Which one of the following statements is **not correct**?

- (1) In retina the rods have the photopigment rhodopsin while cones have three different photopigments
(2) Retinal is a derivative of vitamin C
(3) Rhodopsin is the purplish red protein present in rods only
(4) Retinal is the light absorbing portion of visual photopigments

Answer (2)

Sol. Retinal pigment is an aldehyde of vitamin A.

88. Which one of the following statements is **correct**?

- (1) Mango is a parthenocarpic fruit
(2) A proteinaceous aleurone layer is present in maize grain
(3) A sterile pistil is called a staminode
(4) The seed in grasses is not endospermic

Answer (2)

Sol. Mango - seeded fruit

Sterile stamen - staminode

Seeds in grasses - endospermic

89. Pollen tablets are available in the market for

- (1) Breeding programmes
(2) Supplementing food
(3) *Ex situ* conservation
(4) In vitro fertilization

Answer (2)

Sol. Pollen grains are rich in nutrients and it has become a fashion in recent years to use pollen tablets as food supplements.

90. Select the correct option

	Direction of RNA synthesis	Direction of reading of the template DNA strand
(1)	3' - 5'	5' - 3'
(2)	5' - 3'	5' - 3'
(3)	3' - 5'	3' - 5'
(4)	5' - 3'	3' - 5'

Answer (4)

Sol. RNA Polymers catalyse polymerisation only in one direction, that is 5' → 3' and the strand that has the polarity 3' → 5' act as a template.

91. The organization which publishes the Red List of species is

- (1) IUCN (2) UNEP
(3) WWF (4) ICFRE

Answer (1)

Sol. The IUCN Red List of threatened species (also known as the IUCN Red List or Red Data List), founded in 1964, is the world's most comprehensive inventory of the global conservation status of biological species.

92. A human female with Turner's syndrome

- (1) Has one additional X chromosome
(2) Exhibits male characters
(3) Is able to produce children with normal husband
(4) Has 45 chromosomes with XO

Answer (4)

Sol. Turner's syndrome is caused due to the absence of one of the X chromosomes *i.e.* 45 with XO (or 44 + XO).

93. Match the following and select the **correct** answer

Column I	Column II
a. Centriole	(i) Infoldings in mitochondria
b. Chlorophyll	(ii) Thylakoids
c. Cristae	(iii) Nucleic acids
d. Ribozymes	(iv) Basal body cilia or flagella

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

Answer (4)

Sol. Ribozyme is catalytic RNA.

94. Approximately seventy percent of carbon-dioxide absorbed by the blood will be transported to the lungs

- (1) In the form of dissolved gas molecules
- (2) By binding to R.B.C.
- (3) As carbamino-haemoglobin
- (4) As bicarbonate ions

Answer (4)

Sol. Nearly 20 - 25 percent of CO₂ is transported by RBCs, whereas, 70 percent of it is carried as bicarbonates. About 7 percent of CO₂ is carried as dissolved state in plasma.

95. Which vector can clone only a small fragment of DNA?

- (1) Yeast artificial chromosome
- (2) Plasmid
- (3) Cosmid
- (4) Bacterial artificial chromosome

Answer (2)

Sol. Plasmid can clone only a small fragment of DNA about 10 kbp size

Cosmid - 45 kbp

YAC - 1 Mbp/ 1000 kbp - 2,500 kbp

BAC - 300 to 350 kbp

96. The zone of atmosphere in which the ozone layer is present is called

- (1) Mesosphere
- (2) Stratosphere
- (3) Troposphere
- (4) Ionosphere

Answer (2)

Sol. Good ozone is found in the upper part of the atmosphere called the stratosphere and it acts as a shield absorbing UV rays from the sun.

97. Which one of the following fungi contains hallucinogens?

- (1) *Amanita muscaria*
- (2) *Neurospora* sp.
- (3) *Ustilago* sp.
- (4) *Morchella esculenta*

Answer (1)

Sol. *Amanita muscaria* is noted for its hallucinogenic properties, with its main psychoactive constituent being the compound muscimol.

98. A scrubber in the exhaust of a chemical industrial plant removes

- (1) Particulate matter of the size 5 micrometer or above
- (2) Gases like ozone and methane
- (3) Particulate matter of the size 2.5 micrometer or less
- (4) Gases like sulphur dioxide

Answer (4)

Sol. A scrubber can remove gases like SO₂ in which the exhaust is passed through a spray of water or lime.

99. Select the Taxon mentioned that represents both marine and fresh water species

- (1) Ctenophora
- (2) Cephalochordata
- (3) Cnidaria
- (4) Echinoderms

Answer (3)

Sol. Members of ctenophora, cephalochordata and echinodermata are exclusively marine.

100. When the margins of sepals or petals overlap one another without any particular direction, the condition is termed as

- (1) Imbricate
- (2) Twisted
- (3) Valvate
- (4) Vexillary

Answer (1)

Sol. Imbricate aestivation - *Cassia*, gulmohur.

101. An aggregate fruit is one which develops from

- (1) Multicarpellary apocarpus gynoecium
- (2) Complete inflorescence
- (3) Multicarpellary superior ovary
- (4) Multicarpellary syncarpous gynoecium

Answer (1)

Sol. Aggregate fruits are developed from multicarpellary apocarpus gynoecium.

102. Commonly used vectors for human genome sequencing are

- (1) BAC and YAC
- (2) Expression Vectors
- (3) T/A Cloning Vectors
- (4) T-DNA

Answer (1)

Sol. Commonly used vectors for human genome sequencing are BAC (Bacterial artificial chromosome) and YAC (Yeast Artificial chromosome)

103. To obtain virus-free healthy plants from a diseased one by tissue culture technique, which part/parts of the diseased plant will be taken?

- (1) Palisade parenchyma
- (2) Both apical and axillary meristems
- (3) Epidermis only
- (4) Apical meristem only

Answer (2)

Sol. Apical and axillary meristems are free of virus.

104. Fight-or-flight reactions cause activation of

- (1) The kidney, leading to suppression of reninangiotensin-aldosterone pathway
- (2) The adrenal medulla, leading to increased secretion of epinephrine and norepinephrene
- (3) The pancreas leading to a reduction in the blood sugar levels
- (4) The parathyroid glands, leading to increased metabolic rate

Answer (2)

Sol. In fight or flight reactions, emergency hormones are secreted by adrenal medulla.

105. Stimulation of a muscle fiber by a motor neuron occurs at

- (1) The transverse tubules
- (2) The myofibril
- (3) The sacroplasmic reticulum
- (4) The neuromuscular junction

Answer (4)

Sol. Neuromuscular junction is the junction between motor neuron and muscle fibre.

106. *Planaria* possess high capacity of

- (1) Regeneration
- (2) Alternation of generation
- (3) Bioluminescence
- (4) Metamorphosis

Answer (1)

Sol. *Planaria*, is a flatworm which possess a high power of regeneration.

107. Placenta and pericarp are both edible portions in

- | | |
|------------|------------|
| (1) Banana | (2) Tomato |
| (3) Potato | (4) Apple |

Answer (2)

Sol. Tomato-edible part is pericarp and placenta.

108. Deficiency symptoms of nitrogen and potassium are visible first in

- | | |
|------------------|----------------------|
| (1) Young leaves | (2) Roots |
| (3) Buds | (4) Senescent leaves |

Answer (4)

Sol. N and K are mobile elements.

109. Geitonogamy involves

- (1) Fertilization of a flower by the pollen from the same flower
- (2) Fertilization of a flower by the pollen from a flower of another plant in the same population
- (3) Fertilisation of a flower by the pollen from a flower of another plant belonging to a distant population
- (4) Fertilisation of a flower by the pollen from another flower of the same plant

Answer (4)

Sol. Geitonogamy is transfer of pollen grains from the anther to the stigma of another flower of the same plant.

110. Viruses have

- (1) Prokaryotic nucleus
- (2) Single chromosome
- (3) Both DNA and RNA
- (4) DNA enclosed in a protein coat

Answer (4)

Sol. Nucleoprotein particles

111. How do parasympathetic neural signals affect the working of the heart?

- (1) Heart rate is increased without affecting the cardiac output
- (2) Both heart rate and cardiac output increase
- (3) Heart rate decreases but cardiac output increases
- (4) Reduce both heart rate and cardiac output

Answer (4)

Sol. Post-ganglionic fibers of parasympathetic nervous system secrete acetylcholine which decrease heart rate and cardiac output.

112. A marine cartilaginous fish that can produce electric current is

- | | |
|----------------------|--------------------|
| (1) <i>Torpedo</i> | (2) <i>Trygon</i> |
| (3) <i>Scoltodon</i> | (4) <i>Pristis</i> |

Answer (1)

Sol. *Torpedo*-Electric ray can produce electric current.

113. An analysis of chromosomal DNA using the southern hybridisation technique **does not use**

- (1) Blotting
- (2) Autoradiography
- (3) PCR
- (4) Electrophoresis

Answer (3)

Sol. PCR is only for amplification of DNA.

114. Archaeobacteria differ from eubacteria in

- (1) Mode of nutrition
- (2) Cell shape
- (3) Mode of reproduction
- (4) Cell membrane structure

Answer (4)

Sol. Cell membrane of archaeobacteria possesses branched chain lipids.

115. If 20 J of energy is trapped at producer level, then how much energy will be available to peacock as food in the following chain?

Plant → Mice → Snake → Peacock

- | | |
|--------------|------------|
| (1) 0.002 J | (2) 0.2 J |
| (3) 0.0002 J | (4) 0.02 J |

Answer (4)

Sol. Plant → 20 J

Mice → $20 \times 10\% = 2 \text{ J}$

Snake → $2 \times 10\% = 0.2 \text{ J}$

Peacock → $0.2 \times 10\% = 0.02 \text{ J}$

116. Which one of the following are analogous structures?

- (1) Gills of prawn and lungs of man
- (2) Thorns of *Bougainvillea* and tendrils of *Cucurbita*
- (3) Flippers of dolphin and legs of horse
- (4) Wings of bat and wings of pigeon

Answer (1)

Sol. Wings of bat are skin folds stretched mainly between elongated finger but the wings of birds are a feather covering all along the arm. They look similar because they have a common use for flying, but their origin are not common. This makes them analogous characteristics rather than homologous characteristics.

As per 10th class NCERT option (4) can also taken as correct option.

117. Dr. F. Went noted that if coleoptile tips were removed and placed on agar for one hour, the agar would produce a bending when placed on one side of freshly cut coleoptile stumps. Of what significance is this experiment?

- (1) It is the basis for quantitative determination of small amounts of growth-promoting substances
- (2) It supports the hypothesis that IAA is auxin
- (3) It demonstrated polar movement of auxins
- (4) It made possible the isolation and exact identification of auxin

Answer (4)

Sol. F.W. went isolated auxin from *Avena* coleoptile tip.

118. Non-albuminous seed is produced in

- (1) Castor
- (2) Wheat
- (3) Pea
- (4) Maize

Answer (3)

Sol. Seed of garden pea is ex-albuminous or non endospermic.

119. During which phase(s) of cell cycle, amount of DNA in a cell remains at 4C level if the initial amount is denoted as 2C?

- (1) G₁ and S
- (2) Only G₂
- (3) G₂ and M
- (4) G₀ and G₁

Answer (2)

Sol. In M-phase, both 4C and 2C of DNA are present in different stages.

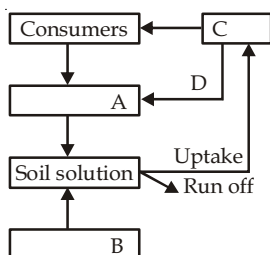
120. Transformation was discovered by

- (1) Hershey and Chase
- (2) Griffith
- (3) Watson and Crick
- (4) Meselson and Stahl

Answer (2)

Sol. In 1928, **Frederick Griffith** performed transformation experiment by using *Streptococcus pneumoniae*.

121. Given below is a simplified model of phosphorus cycling in a terrestrial ecosystem with four blanks (A-D). Identify the blanks.



Options :

	A	B	C	D
(1)	Litter fall	Producers	Rock minerals	Detritus
(2)	Detritus	Rock minerals	Producer	Litter fall
(3)	Producers	Litter fall	Rock minerals	Detritus
(4)	Rock minerals	Detritus	Litter fall	Producers

Answer (2)

Sol. A - Detritus

B - Rock minerals

C - Producer

D - Litter fall

122. In a population of 1000 individuals 360 belong to genotype AA, 480 to Aa and the remaining 160 to aa. Based on this data, the frequency of allele A in the population is

(1) 0.5 (2) 0.6

(3) 0.7 (4) 0.4

Answer (2)

Sol. According to Hardy Weinberg principle.

$$p^2 + 2pq + q^2 = 1; (p + q)^2 = 1$$

(AA) $p^2 = 360$ out of 1000 individual or $p^2 = 36$ out of 100

$q^2 = 160$ out of 1000 or $q^2 = 16$ out of 100

$$\text{so } q = \sqrt{.16} = .4. \text{ As } p + q = 1$$

so, p is 0.6.

123. Tubectomy is a method of sterilization in which

- (1) Ovaries are removed surgically
- (2) Small part of vas deferens is removed or tied up
- (3) Uterus is removed surgically
- (4) Small part of the fallopian tube is removed or tied up

Answer (4)

Sol. In tubectomy, small part of fallopian tube is removed or tied up.

124. Which of the following is responsible for peat formation?

- (1) *Riccia* (2) *Funaria*
- (3) *Sphagnum* (4) *Marchantia*

Answer (3)

Sol. Species of *Sphagnum*, a moss provides peat that have long been used as fuel.

125. Which one of the following shows isogamy with non-flagellated gametes?

- (1) *Ectocarpus* (2) *Ulothrix*
- (3) *Spirogyra* (4) *Sargassum*

Answer (3)

Sol. *Spirogyra* shows isogamy with non-lagellated gametes.

126. Which one of the following is **wrongly** matched?

- (1) Translation-Using information in m-RNA to make protein
- (2) Repressor protein-Binds to operator to stop enzyme synthesis
- (3) Operon-Structural genes, operator and promoter
- (4) Transcription-Writing information from DNA to t-RNA

Answer (3)

Sol. Operon consist of - regulator gene, promotor gene, operator gene and structural gens.

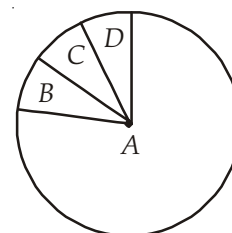
127. Which of the following is a hormone releasing Intra Uterine Device (IUD)?

- (1) LNG-20 (2) Cervical cap
- (3) Vault (4) Multiload 375

Answer (1)

Sol. LNG-20 is a hormone releasing intra-uterine device (IUD).

128. Given below is the representation of the extent of global diversity of *invertebrates*. What groups the four portions (A-D) represent respectively?



Options :

	A	B	C	D
(1)	Crustaceans	Insects	Molluscs	Other animal Groups
(2)	Molluscs	Other animal Groups	Crustaceans	Insects
(3)	Insects	Molluscs	Crustaceans	Other animal Groups
(4)	Insects	Crustaceans	Other animal Groups	Molluscs

Answer (3)

Sol. A - Insects

B - Molluscs

C - Crustaceans

D - Other animal groups

129. Male gametophyte with least number of cells is present in :

- (1) *Funaria* (2) *Lilium*
 (3) *Pinus* (4) *Pteris*

Answer (2)

Sol. Male gametophyte is highly reduced in angiosperm and is known as pollen grain. It is 2 or 3-celled.

130. The shared terminal duct of the reproductive and urinary system in the human male is

- (1) Ureter
 (2) Vas deferens
 (3) Vasa efferentia
 (4) Urethra

Answer (4)

Sol. In human male, urethra is urinogenital duct carry urine and sperm both.

131. Injury localized to the hypothalamus would most likely disrupt

- (1) Co-ordination during locomotion
 (2) Executive function, such as decision making
 (3) Regulation of body temperature
 (4) Short term memory

Answer (3)

Sol. Hypothalamus regulates body temperature.

132. Select the correct option describing gonadotropin activity in a normal pregnant female

- (1) High level of FSH and LH facilitate implantation of the embryo
 (2) High level of hCG stimulates the synthesis of estrogen and progesterone
 (3) High level of hCG stimulates the thickening of endometrium
 (4) High level of FSH and LH stimulates the thickening of endometrium

Answer (2)

Sol. In pregnant female, hCG maintains the corpus luteum which secretes estrogen and progesterone.

133. The initial step in the digestion of milk in humans is carried out by?

- (1) Trypsin (2) Rennin
 (3) Pepsin (4) Lipase

Answer (2)

Sol. The initial step in the digestion of milk in human is carried out by rennin.

134. The motile bacteria are able to move by

- (1) Flagella (2) Cilia
 (3) Pili (4) Fimbriae

Answer (1)

Sol. Motile bacteria have thin filamentous extensions from their cell wall called flagella.

135. Person with blood group AB is considered as universal recipient because he has

- (1) Both A and B antibodies in the plasma
 (2) No antigen on RBC and no antibody in the plasma
 (3) Both A and B antigens in the plasma but no antibodies
 (4) Both A and B antigens on RBC but no antibodies in the plasma

Answer (4)

Sol. Person with blood group AB has both A and B antigens on RBC but no antibodies in the plasma.

136. A conducting sphere of radius R is given a charge Q . The electric potential and the electric field at the centre of the sphere respectively are

- (1) $\frac{Q}{4\pi\epsilon_0 R}$ and zero (2) $\frac{Q}{4\pi\epsilon_0 R}$ and $\frac{Q}{4\pi\epsilon_0 R^2}$
 (3) Both are zero (4) Zero and $\frac{Q}{4\pi\epsilon_0 R^2}$

Answer (1)

Sol. Electric potential, $V = \frac{Q}{4\pi\epsilon_0 R}$

Electric field $E = 0$.

137. If n_1 , n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by

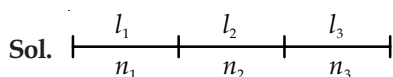
(1) $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{n_1}} + \frac{1}{\sqrt{n_2}} + \frac{1}{\sqrt{n_3}}$

(2) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

(3) $n = n_1 + n_2 + n_3$

(4) $\frac{1}{n} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

Answer (4)



$n_1 = \frac{1}{2l_1} \sqrt{\frac{T}{\mu}}$; $n_2 = \frac{1}{2l_2} \sqrt{\frac{T}{\mu}}$; $n_3 = \frac{1}{2l_3} \sqrt{\frac{T}{\mu}}$

$n = \frac{1}{2l} \sqrt{\frac{T}{\mu}}$ ($l = l_1 + l_2 + l_3$)

$\therefore \frac{1}{n} = \frac{2l}{\sqrt{\frac{T}{\mu}}} = \frac{2l_1}{\sqrt{\frac{T}{\mu}}} + \frac{2l_2}{\sqrt{\frac{T}{\mu}}} + \frac{2l_3}{\sqrt{\frac{T}{\mu}}} = \frac{1}{n_1} + \frac{1}{n_2} + \frac{1}{n_3}$

138. Copper of fixed volume V is drawn into wire of length l . When this wire is subjected to a constant force F , the extension produced in the wire is Δl . Which of the following graphs is a straight line?

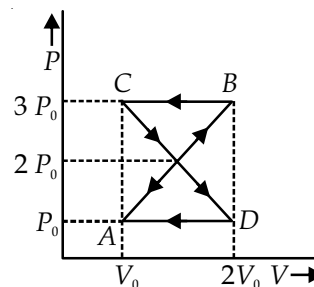
(1) Δl versus l^2 (2) Δl versus $\frac{1}{l^2}$

(3) Δl versus l (4) Δl versus $\frac{1}{l}$

Answer (1)

Sol. $V = Al$, $Y = \frac{Fl}{A\Delta l} \Rightarrow \Delta l = \frac{Fl}{AY} = \frac{Fl^2}{VY}$
 $\Rightarrow \Delta l \propto l^2$

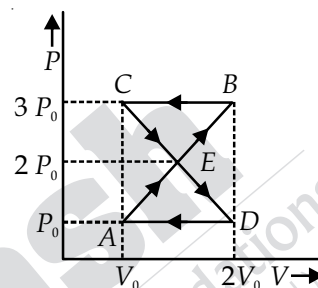
139. A thermodynamic system undergoes cyclic process ABCDA as shown in figure. The work done by the system in the cycle is



- (1) $2P_0 V_0$ (2) $\frac{P_0 V_0}{2}$
(3) Zero (4) $P_0 V_0$

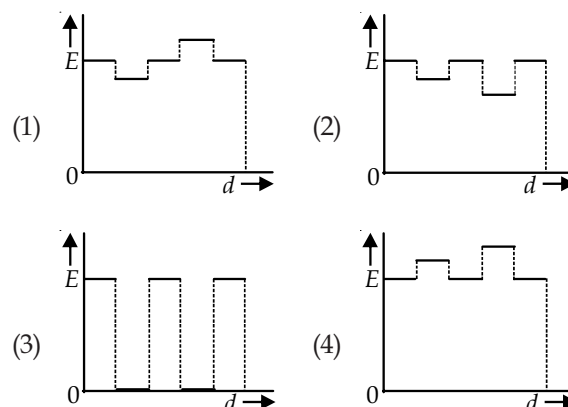
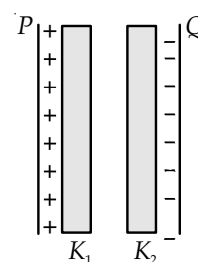
Answer (3)

Sol.



$W = \text{Area of } BCE + \text{Area of } ADE$
 $= -W_0 + W_0 = 0$

140. Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field E between the plates with distance d as measured from plate P is correctly shown by



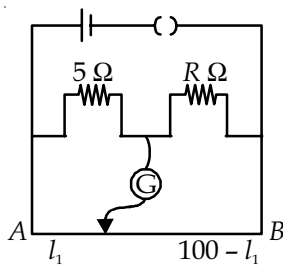
Answer (2)

Sol. Electric field inside parallel plate capacitor having

$$\text{charge } Q \text{ at place where dielectric is absent} = \frac{Q}{A\epsilon_0}$$

$$\text{where dielectric is present} = \frac{Q}{KA\epsilon_0}$$

141. The resistances in the two arms of the meter bridge are 5Ω and $R \Omega$, respectively. When the resistance R is shunted with an equal resistance, the new balance point is at $1.6 l_1$. The resistance R , is :



- (1) 15Ω
- (2) 20Ω
- (3) 25Ω
- (4) 10Ω

Answer (1)

Sol. Initially, $\frac{5}{l_1} = \frac{R}{100-l_1}$... (i)

Finally, $\frac{5}{1.6l_1} = \frac{R}{2(100-1.6l_1)}$... (ii)

$$\Rightarrow \frac{R}{1.6(100-l_1)} = \frac{R}{2(100-1.6l_1)}$$

$$\Rightarrow 160 - 1.6 l_1 = 200 - 3.2 l_1$$

$$\Rightarrow 1.6 l_1 = 40$$

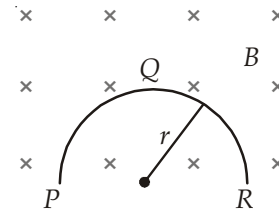
$$\Rightarrow l_1 = 25$$

From Equation (i),

$$\frac{5}{25} = \frac{R}{75}$$

$$\Rightarrow R = 15 \Omega.$$

142. A thin semicircular conducting ring (PQR) of radius r is falling with its plane vertical in a horizontal magnetic field B , as shown in figure. The potential difference developed across the ring when its speed is v , is



- (1) $Bv\pi r^2/2$ and P is at higher potential
- (2) πrBv and R is at higher potential
- (3) $2rBv$ and R is at higher potential
- (4) Zero

Answer (3)

Sol.

$$\epsilon = BL_{\text{eff}}v \quad (L_{\text{eff}} = \text{Diameter})$$

$$= B 2Rv$$

143. A particle is moving such that its position coordinates (x, y) are

- $(2\text{m}, 3\text{m})$ at time $t = 0$,
- $(6\text{m}, 7\text{m})$ at time $t = 2$ s and
- $(13\text{m}, 14\text{m})$ at time $t = 5$ s

Average velocity vector (\vec{V}_{av}) from $t = 0$ to $t = 5$ s is

- (1) $\frac{7}{3}(\hat{i} + \hat{j})$
- (2) $2(\hat{i} + \hat{j})$
- (3) $\frac{11}{5}(\hat{i} + \hat{j})$
- (4) $\frac{1}{5}(13\hat{i} + 14\hat{j})$

Answer (3)

Sol. $\vec{V}_{av} = \frac{(x_2 - x_1)\hat{i} + (y_2 - y_1)\hat{j}}{t_2 - t_1}$

$$= \frac{(13 - 2)\hat{i} + (14 - 3)\hat{j}}{5 - 0}$$

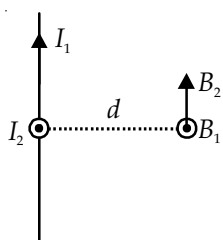
$$= \frac{11\hat{i} + 11\hat{j}}{5} = \frac{11}{5}(\hat{i} + \hat{j})$$

144. Two identical long conducting wires AOB and COD are placed at right angle to each other, with one above other such that O is their common point for the two. The wires carry I_1 and I_2 currents, respectively. Point P is lying at distance d from O along a direction perpendicular to the plane containing the wires. The magnetic field at the point P will be

- (1) $\frac{\mu_0}{2\pi d}(I_1 + I_2)$ (2) $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)$
 (3) $\frac{\mu_0}{2\pi d}(I_1^2 + I_2^2)^{1/2}$ (4) $\frac{\mu_0}{2\pi d}\left(\frac{I_1}{I_2}\right)$

Answer (3)

Sol.



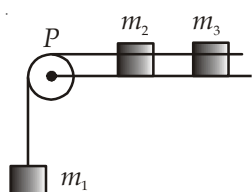
$$B = \sqrt{B_1^2 + B_2^2}$$

$$= \frac{\mu_0}{2\pi d}(I_1^2 + I_2^2)^{1/2}$$

145. A system consists of three masses m_1 , m_2 and m_3 connected by a string passing over a pulley P . The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction $= \mu$)

The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is

(Assume $m_1 = m_2 = m_3 = m$)

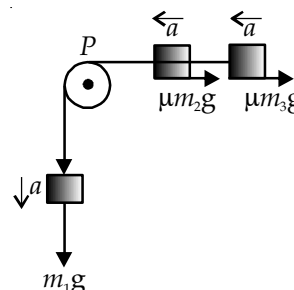


- (1) $\frac{2g\mu}{3}$ (2) $\frac{g(1-2\mu)}{3}$
 (3) $\frac{g(1-2\mu)}{2}$ (4) $\frac{g(1-g\mu)}{9}$

Answer (2)

Sol. $a = \frac{m_1g - \mu(m_2 + m_3)g}{m_1 + m_2 + m_3} = \frac{m[g - 2\mu g]}{3m}$

$$= \frac{g}{3}[1 - 2\mu]$$



146. In an ammeter 0.2% of main current passes through the galvanometer. If resistance of galvanometer is G , the resistance of ammeter will be

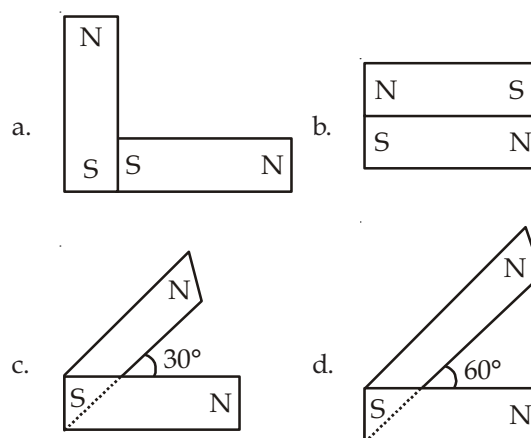
- (1) $\frac{499}{500}G$ (2) $\frac{1}{500}G$
 (3) $\frac{500}{499}G$ (4) $\frac{1}{499}G$

Answer (2)

Sol. $n = \frac{I}{I_g} = \frac{100}{0.2} = 500$

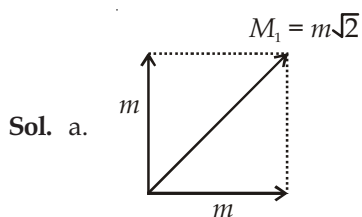
$$R_A = \frac{G}{n} = \frac{G}{500}$$

147. Following figures show the arrangement of bar magnets in different configurations. Each magnet has magnetic dipole moment \vec{m} . Which configuration has highest net magnetic dipole moment?

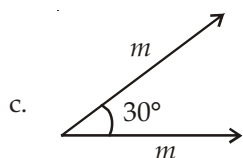


- (1) b (2) c
 (3) d (4) a

Answer (2)



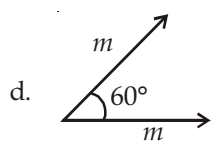
b. $\frac{m}{m} \Rightarrow M_2 = 0$



$$M_3 = m\sqrt{(1 + \cos 30^\circ)^2}$$

$$= m\sqrt{\left(1 + \frac{\sqrt{3}}{2}\right)^2}$$

$$= m\sqrt{2 + \sqrt{3}}$$



$$M_4 = 2m\cos 30^\circ$$

$$= m\sqrt{3}$$

148. If the focal length of objective lens is increased then magnifying power of

- (1) Microscope and telescope both will increase
- (2) Microscope and telescope both will decrease
- (3) Microscope will decrease but that of telescope will increase
- (4) Microscope will increase but that of telescope decrease

Answer (3)

Sol. MP of microscope = $\frac{L}{f_0} \left[1 + \frac{P}{f_e} \right]$

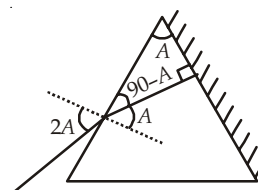
MP of telescope = $\frac{f_0}{f_e} \left[1 + \frac{f_e}{D} \right]$

149. The angle of a prism is A . One of its refracting surfaces is silvered. Light rays falling at an angle of incidence $2A$ on the first surface returns back through the same path after suffering reflection at the silvered surface. The refractive index μ , of the prism is

- (1) $2 \cos A$
- (2) $\frac{1}{2} \cos A$
- (3) $\tan A$
- (4) $2 \sin A$

Answer (1)

Sol. Normal incidence at silvered surface



$$\therefore \mu = \frac{\sin i}{\sin r} \text{ so, } \mu \frac{\sin 2A}{\sin A} = \frac{2 \sin A \cos A}{\sin A} = 2 \cos A$$

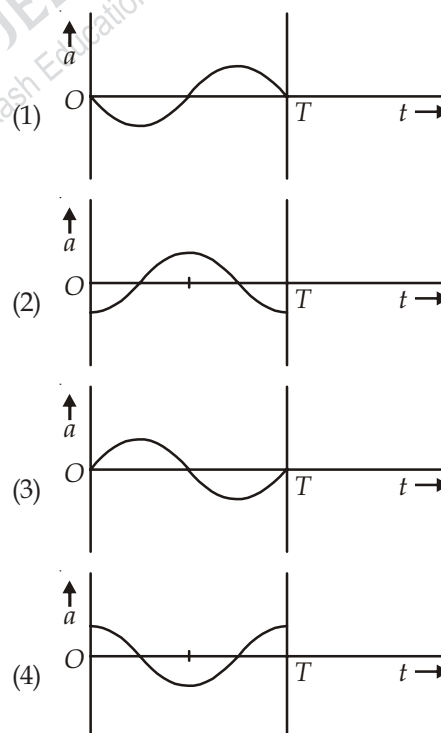
150. The oscillation of a body on a smooth horizontal surface is represented by the equation,

$$X = A \cos(\omega t)$$

where X = displacement at time t

ω = frequency of oscillation

Which one of the following graphs shows correctly the variation a with t ?

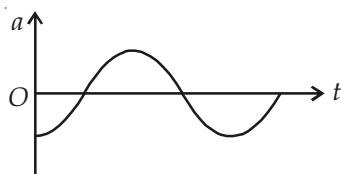


Here a = acceleration at time t

T = time period

Answer (2)

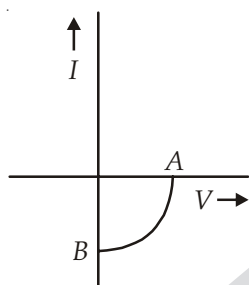
Sol. $x = A \cos \omega t$



$$v = \frac{dx}{dt} = -A\omega \sin \omega t$$

$$a = \frac{d^2x}{dt^2} = -A\omega^2 \cos \omega t$$

151. The given graph represents $V - I$ characteristic for a semiconductor device.



Which of the following statement is **correct**?

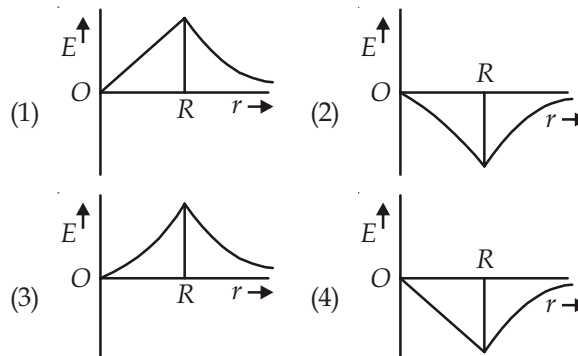
- (1) It is for a solar cell and points A and B represent open circuit voltage and current, respectively
- (2) It is for a photodiode and points A and B represent open circuit voltage and current, respectively
- (3) It is for a LED and points A and B represents open circuit voltage and short circuit current respectively
- (4) It is $V - I$ characteristic for solar cell where point A represents open circuit voltage and point B short circuit current

Answer (4)

Sol. Solar cell \rightarrow Open circuit $I = 0$, potential $V = \text{emf}$

\rightarrow Short circuit $I = I$, potential $V = 0$

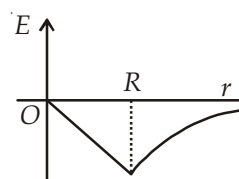
152. Dependence of intensity of gravitational field (E) of earth with distance (r) from centre of earth is correctly represented by



Answer (4)

Sol. $E_{\text{in}} = -\frac{GMr}{R^3}$

$$E_{\text{out}} = -\frac{GM}{r^2}$$



153. The number of possible natural oscillations of air column in a pipe closed at one end of length 85 cm whose frequencies lie below 1250 Hz are (velocity of sound = 340 ms^{-1})

- (1) 5
- (2) 7
- (3) 6
- (4) 4

Answer (3)

Sol. $l_c = 0.85 \text{ m}$

$$f_0 = \frac{v}{4l_c} = \frac{340 \text{ ms}^{-1}}{4 \times 0.85 \text{ m}} = 100 \text{ Hz}$$

$$f_n = (2n + 1)f_0 = f_0, 3f_0, 5f_0, 7f_0, 9f_0, 11f_0, 13f_0$$

$$= 100 \text{ Hz}, 300 \text{ Hz}, 500 \text{ Hz}, 700 \text{ Hz}, 900 \text{ Hz}, 1100 \text{ Hz}$$

154. Two cities are 150 km apart. Electric power is sent from one city to another city through copper wires. The fall of potential per km is 8 volt and the average resistance per km is 0.5Ω . The power loss in the wire is

- (1) 19.2 kW
- (2) 19.2 J
- (3) 12.2 kW
- (4) 19.2 W

Answer (1)

Sol. Resistance = $150 \times 0.5 = 75 \Omega$

$$I = \frac{\Delta V}{\Delta R} = \frac{8}{0.5} = 16 \text{ A}$$

$$P = I^2 R = (16)^2 \times 75 \text{ W} = 19200 = 19.2 \text{ kW}$$

155. A beam of light of $\lambda = 600$ nm from a distant source falls on a single slit 1 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. The distance between first dark fringes on either side of the central bright fringe is

- (1) 1.2 mm (2) 2.4 cm
 (3) 2.4 mm (4) 1.2 cm

Answer (3)

Sol. Distance between 1st order dark fringes = width of principal max

$$x = \frac{2\lambda D}{d} = \frac{2 \times 600 \times 10^{-9} \times 2}{10^{-3}}$$

$$= 2400 \times 10^{-6}$$

$$= 2.4 \times 10^{-3} \text{ m} = 2.4 \text{ mm}$$

156. If force (F), velocity (V) and time (T) are taken as fundamental units, then the dimensions of mass are

- (1) $[F V T^{-2}]$ (2) $[F V^{-1} T^{-1}]$
 (3) $[F V^{-1} T]$ (4) $[F V T^{-1}]$

Answer (3)

Sol. $F = [M V T^{-1}]$

$$\Rightarrow M = [F V^{-1} T]$$

157. The barrier potential of a p - n junction depends on :

- a. Type of semiconductor material
 b. Amount of doping
 c. Temperature

Which one of the following is correct?

- (1) b only (2) b and c only
 (3) a, b and c (4) a and b only

Answer (3)

Sol. It depends on all.

158. The binding energy per nucleon of ${}^7_3\text{Li}$ and ${}^4_2\text{He}$ nuclei are 5.60 MeV and 7.06 MeV, respectively. In the nuclear reaction ${}^7_3\text{Li} + {}^1_1\text{H} \rightarrow {}^4_2\text{He} + {}^4_2\text{He} + Q$, the value of energy Q released is

- (1) -2.4 MeV (2) 8.4 MeV
 (3) 17.3 MeV (4) 19.6 MeV

Answer (3)

Sol. $Q = 2(\text{BE of He}) - (\text{BE of Li})$

$$= 2 \times (4 \times 7.06) - (7 \times 5.60)$$

$$= 56.48 - 39.2 = 17.3 \text{ MeV}$$

159. If the kinetic energy of the particle is increased to 16 times its previous value, the percentage change in the de-Broglie wavelength of the particle is

- (1) 75 (2) 60
 (3) 50 (4) 25

Answer (1)

$$\text{Sol. } \lambda = \frac{h}{p} = \frac{h}{\sqrt{2mE}} \quad (\because p = \sqrt{2mE})$$

$$\lambda' = \frac{h}{\sqrt{2m(16E)}} = \frac{\lambda}{4} = 0.25\lambda$$

$$\% \text{ change} = -75\%$$

160. Light with an energy flux of $25 \times 10^4 \text{ Wm}^{-2}$ falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2 , the average force exerted on the surface is

- (1) $2.50 \times 10^{-6} \text{ N}$ (2) $1.20 \times 10^{-6} \text{ N}$
 (3) $3.0 \times 10^{-6} \text{ N}$ (4) $1.25 \times 10^{-6} \text{ N}$

Answer (1)

$$\text{Sol. } F_{\text{av}} = \frac{2IA}{c} = \frac{2 \times 25 \times 10^4 \times 15 \times 10^{-4}}{3 \times 10^8} \text{ N}$$

$$= 250 \times 10^{-8} \text{ N} = 2.5 \times 10^{-6} \text{ N}$$

161. In a region, the potential is represented by $V(x, y, z) = 6x - 8xy - 8y + 6yz$, where V is in volts and x, y, z are in metres. The electric force experienced by a charge of 2 coulomb situated at point (1, 1, 1) is

- (1) 30 N (2) 24 N
 (3) $4\sqrt{35} \text{ N}$ (4) $6\sqrt{5} \text{ N}$

Answer (3)

Sol. $V = 6x - 8xy - 8y + 6yz$

$$E_x = -\frac{\partial V}{\partial x} = -(6 - 8y) = 2$$

$$E_y = -\frac{\partial V}{\partial y} = -(-8x - 8 + 6z) = 10$$

$$E_z = -\frac{\partial V}{\partial z} = -6y = -6$$

$$E = \sqrt{E_x^2 + E_y^2 + E_z^2} = \sqrt{4 + 100 + 36} = \sqrt{140}$$


$$= 2\sqrt{35} \text{ N/C}$$

$$F = qE = 4\sqrt{35} \text{ N}$$

162. A speeding motorcyclist sees traffic jam ahead of him. He slows down to 36 km/hour. He finds that traffic has eased and a car moving ahead of him at 18 km/hour is honking at a frequency of 1392 Hz. If the speed of sound is 343 m/s, the frequency of the honk as heard by him will be

- (1) 1372 Hz (2) 1412 Hz
(3) 1454 Hz (4) 1332 Hz

Answer (2)

Sol. $v_0 = 36 \text{ km/h} = 10 \text{ m/s}$ $v_s = 18 \text{ km/h} = 5 \text{ m/s}$


$$f' = f \left[\frac{v + v_0}{v + v_s} \right] = 1392 \times \left(\frac{343 + 10}{343 + 5} \right) \text{ Hz}$$

$$= 1392 \times \frac{353}{348} \text{ Hz} = 1412 \text{ Hz}$$

163. The ratio of the accelerations for a solid sphere (mass m and radius R) rolling down an incline of angle ' θ ' without slipping and slipping down the incline without rolling is

- (1) 2 : 3 (2) 2 : 5
(3) 7 : 5 (4) 5 : 7

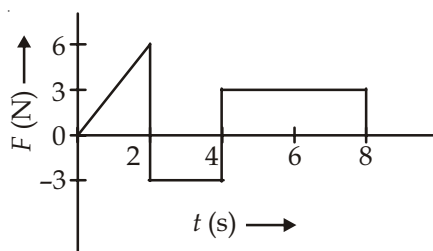
Answer (4)

Sol. $a_{\text{slipping}} = g \sin \theta$

$$a_{\text{rolling}} = \frac{g \sin \theta}{1 + \frac{K^2}{r^2}} = \frac{5}{7} g \sin \theta$$

$$\frac{a_{\text{rolling}}}{a_{\text{slipping}}} = \frac{5}{7}$$

164. The force F acting on a particle of mass m is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from zero to 8 s is



- (1) 20 Ns (2) 12 Ns
(3) 6 Ns (4) 24 Ns

Answer (2)

Sol. Change in momentum = Area below the F versus t graph in that interval

$$= \left(\frac{1}{2} \times 2 \times 6 \right) - (2 \times 3) + (4 \times 3)$$

$$= 6 - 6 + 12 = 12 \text{ Ns}$$

165. In the Young's double-slit experiment, the intensity of light at a point on the screen where the path difference is λ is K , (λ being the wavelength of light used). The intensity at a point where the path

difference is $\frac{\lambda}{4}$, will be

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

Answer (2)

Sol. Path difference λ means maxima $I_{\text{max}} = K$

$$I = K \cos^2 \frac{\phi}{2} = K \cos^2 \left[\frac{2\pi}{\lambda} \times \frac{\lambda}{4} \times \frac{1}{2} \right]$$


$$= K \cos^2 \frac{\pi}{4}$$

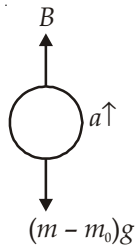
$$= \frac{K}{2}$$

166. A balloon with mass m is descending down with an acceleration a (where $a < g$). How much mass should be removed from it so that it starts moving up with an acceleration a ?

- (1) $\frac{2ma}{g-a}$ (2) $\frac{ma}{g+a}$
(3) $\frac{ma}{g-a}$ (4) $\frac{2ma}{g+a}$

Answer (4)

Sol.  $a \downarrow mg - B = ma \quad \dots(i)$



$$B - (m - m_0)g = (m - m_0)a \quad \dots(ii)$$

Equation (i) + equation (ii)

$$\Rightarrow mg - mg + m_0g = ma + ma - m_0a$$

$$\Rightarrow m_0 = \frac{2ma}{g+a}$$

167. A potentiometer circuit has been set up for finding the internal resistance of a given cell. The main battery, used across the potentiometer wire, has an emf of 2.0 V and a negligible internal resistance. The potentiometer wire itself is 4 m long. When the resistance, R , connected across the given cell, has values of

- (i) Infinity
(ii) 9.5 Ω ,

the 'balancing lengths', on the potentiometer wire are found to be 3 m and 2.85 m, respectively.

The value of internal resistance of the cell is

- (1) 0.95 Ω (2) 0.5 Ω
(3) 0.75 Ω (4) 0.25 Ω

Answer (2)

$$\text{Sol. } r = \left(\frac{l_1}{l_2} - 1 \right) R$$

$$= \left(\frac{3}{2.85} - 1 \right) 9.5 \Omega = \frac{0.15}{2.85} \times 9.5 \Omega$$

$$= 0.5 \Omega$$

168. A monoatomic gas at a pressure P , having a volume V expands isothermally to a volume $2V$ and then adiabatically to a volume $16V$. The final pressure of

the gas is (take $\gamma = \frac{5}{3}$)

- (1) 32 P (2) $\frac{P}{64}$
(3) 16 P (4) 64 P

Answer (2)

Sol. Step - 1 Isothermal Expansion

$$PV = P_2 2V \quad \Rightarrow \quad P_2 = \frac{P}{2}$$

Step - 2 Adiabatic Expansion

$$P_2 V_2^\gamma = P_3 V_3^\gamma$$

$$\Rightarrow \frac{P}{2} (2V)^\gamma = P_3 (16V)^\gamma$$

$$\Rightarrow P_3 = \frac{P}{2} \left(\frac{2V}{16V} \right)^\gamma = \frac{P}{2} \times \left(\frac{1}{8} \right)^\gamma = \frac{P}{64}$$

169. A certain number of spherical drops of a liquid of radius r coalesce to form a single drop of radius R and volume V . If ' T ' is the surface tension of the liquid, then

(1) Energy = $3VT \left(\frac{1}{r} + \frac{1}{R} \right)$ is absorbed

(2) Energy = $3VT \left(\frac{1}{r} - \frac{1}{R} \right)$ is released

(3) Energy is neither released nor absorbed

(4) Energy = $4VT \left(\frac{1}{r} - \frac{1}{R} \right)$ is released

Answer (2)

Sol. Energy released = $(A_f - A_i)T$

$$A_f = 4\pi R^2 = \frac{3}{3} 4\pi \frac{R^3}{R} = \frac{3V}{R}$$

$$A_i = n \times 4\pi r^2 = \frac{V}{\frac{4}{3}\pi r^3} 4\pi r^2 = \frac{3V}{r}$$

$$\Rightarrow \text{Energy released} = 3VT \left[\frac{1}{r} - \frac{1}{R} \right]$$

170. A body of mass ($4m$) is lying in x - y plane at rest. It suddenly explodes into three pieces. Two pieces each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is

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

Answer (1)

Sol. Initial momentum = $P_i = 0$

Final momentum $P_f = 0 = mv\hat{i} + mv\hat{j} + \vec{P}_3$

$\Rightarrow P_3 = mv\sqrt{2}$

Total KE = $\frac{P_3^2}{2 \times 2m} + \frac{1}{2}mv^2 + \frac{1}{2}mv^2$

$= \frac{2m^2v^2}{4m} + mv^2 = \frac{3mv^2}{2}$

171. Hydrogen atom in ground state is excited by a monochromatic radiation of $\lambda = 975 \text{ \AA}$. Number of spectral lines in the resulting spectrum emitted will be

- (1) 2 (2) 6
 (3) 10 (4) 3

Answer (2)

Sol. Energy incident = $\frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{975 \times 10^{-10} \times 1.6 \times 10^{-19}} \text{ eV}$
 $= 12.75 \text{ eV}$

The Hydrogen atom will be excited to $n = 4$

Number of spectral lines = $\frac{4(4-1)}{2} = 6$

172. A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass = $5.98 \times 10^{24} \text{ kg}$) have to be compressed to be a black hole?

- (1) 10^{-6} m (2) 10^{-2} m
 (3) 100 m (4) 10^{-9} m

Answer (2)

Sol. $V_e = \sqrt{\frac{2GM}{R}} = C$

$\Rightarrow R = \frac{2GM}{C^2} = \frac{2 \times 6.67 \times 10^{-11} \times 5.98 \times 10^{24}}{(3 \times 10^8)^2}$

$= \frac{2 \times 6.67 \times 5.98}{9} \times 10^{-3} \text{ m}$

$= 8.86 \times 10^{-3} \text{ m} \approx 10^{-2} \text{ m}$

173. A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} and angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms^{-2}) is (given $g = 9.8 \text{ ms}^{-2}$)

- (1) 5.9 (2) 16.3
 (3) 110.8 (4) 3.5

Answer (4)

Sol. $y = x \tan \theta - \frac{gx^2}{2u^2 \cos^2 \theta}$

For equal trajectories for same angle of projection

$\frac{g}{u^2} = \text{constant}$

$\Rightarrow \frac{9.8}{5^2} = \frac{g'}{3^2}$

$g' = \frac{9.8 \times 9}{25} = 3.528 \text{ m/s}^2 \approx 3.5 \text{ m/s}^2$

174. Certain quantity of water cools from 70°C to 60°C in the first 5 minutes and to 54°C in the next 5 minutes. The temperature of the surroundings is

- (1) 20°C (2) 42°C
 (3) 10°C (4) 45°C

Answer (4)

Sol. Newtons law of cooling $\frac{\theta_1 - \theta_2}{\Delta t} = K \left[\frac{\theta_1 + \theta_2}{2} - \theta_0 \right]$.

First $\Rightarrow \frac{70 - 60}{5} = K[65 - \theta_0]$

$\Rightarrow 2 = K[65 - \theta_0]$... (i)

Next $\Rightarrow \frac{60 - 54}{5} = K[57 - \theta_0]$... (ii)

Dividing (i) and (ii)

$\frac{5}{3} = \frac{65 - \theta_0}{57 - \theta_0}$

$\Rightarrow 285 - 5\theta_0 = 195 - 3\theta_0$

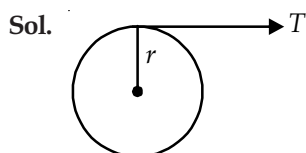
$\Rightarrow 2\theta_0 = 90$

$\theta_0 = 45^\circ$

175. A solid cylinder of mass 50 kg and radius 0.5 m is free to rotate about the horizontal axis. A massless string is wound round the cylinder with one end attached to it and other hanging freely. Tension in the string required to produce an angular acceleration of 2 revolutions s^{-2} is

- (1) 50 N (2) 78.5 N
(3) 157 N (4) 25 N

Answer (3)



$$Tr = I\alpha$$

$$T = \frac{I\alpha}{r} = \frac{mr^2}{2} \times \frac{\alpha}{r} = \frac{mr\alpha}{2}$$

$$= \frac{50 \times 0.5 \times 2 \times 2\pi}{2} \text{ N} = 157 \text{ N}$$

176. Steam at 100°C is passed into 20 g of water at 10°C . When water acquires a temperature of 80°C , the mass of water present will be:

[Take specific heat of water = $1 \text{ cal g}^{-1}\text{C}^{-1}$ and latent heat of steam = 540 cal g^{-1}]

- (1) 31.5 g (2) 42.5 g
(3) 22.5 g (4) 24 g

Answer (3)

Sol. Heat gain by water = Heat lost by steam

$$20 \times 1 \times (80 - 10) = m \times 540 + m \times 1 \times (100 - 80)$$

$$\Rightarrow 1400 = 560 m$$

$$\Rightarrow m = 2.5 \text{ g}$$

$$\text{Total mass of water} = 20 + 2.5 = 22.5 \text{ g}$$

177. A radio isotope X with a half life 1.4×10^9 years decays of Y which is stable. A sample of the rock from a cave was found to contain X and Y in the ratio 1 : 7. The age of the rock is

- (1) 3.92×10^9 years (2) 4.20×10^9 years
(3) 8.40×10^9 years (4) 1.96×10^9 years

Answer (2)

Sol. $X : Y = 1 : 7$

$$X : (X + Y) = 1 : 8 = 1 : 2^3$$

$$\Rightarrow 3 \text{ half life}$$

$$\therefore \Delta T = 3 \times 1.4 \times 10^9 \text{ yrs} = 4.2 \times 10^9 \text{ yrs.}$$

178. A transformer having efficiency of 90% is working on 200 V and 3 kW power supply. If the current in the secondary coil is 6A, the voltage across the secondary coil and the current in the primary coil respectively are

- (1) 450 V, 15 A (2) 450 V, 13.5 A
(3) 600 V, 15 A (4) 300 V, 15 A

Answer (1)

Sol. Power output = $3 \text{ kW} \times \frac{90}{100} = 2.7 \text{ kW}$

$$I_b = 6 \text{ A}$$

$$V_s = \frac{2.7 \text{ kW}}{6 \text{ A}} = 450 \text{ V}$$

$$I_p = \frac{3 \text{ kW}}{200 \text{ V}} = 15 \text{ A}$$

179. When the energy of the incident radiation is increased by 20%, the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5 eV to 0.8 eV. The work function of the metal is

- (1) 1.0 eV (2) 1.3 eV
(3) 1.5 eV (4) 0.65 eV

Answer (1)

Sol. $E = h\nu - \phi$

$$\Rightarrow 0.5 = h\nu - \phi \quad \dots(1)$$

$$\text{Again } 0.8 = 1.2 h\nu - \phi \quad \dots(2)$$

$$\text{From equation (1)} \times 1.2 \Rightarrow 0.6 = 1.2 h\nu - 1.2 \phi$$

$$\text{Equation (2)} \quad 0.8 = 1.2 h\nu - \phi$$

$$\begin{array}{r} - \quad - \quad + \\ -0.2 = -0.2 \phi \\ \phi = 1 \text{ eV} \end{array}$$

180. The mean free path of molecules of a gas, (radius r) is inversely proportional to

- (1) r^2 (2) r
(3) \sqrt{r} (4) r^3

Answer (1)

Sol. $\lambda = \frac{1}{\lambda d^2 n \sqrt{2}} = \frac{1}{4\pi r^2 n \sqrt{2}}$

$$\lambda \propto \frac{1}{r^2}$$

□ □ □