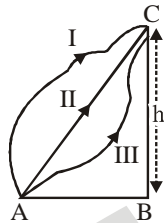## SAMPLE PAPER - 117

Time : 1 : 15 Hr.

Question : 60

PHYSICS

01. Consider a car moving on a straight road with a speed of 100 m s^{-1}. The distance at which the car can be stopped is [$\mu_k = 0.5$]
(1) 100 m (2) 1000 m (3) 800 m (4) 400 m

02. As shown in the diagram a particle is to be carried from point A to C via paths (I), (II) and (III) in gravitational field, then which of the following statements is correct :


(1) Work done is same for all the paths
(2) Work done is minimum for path (II)
(3) Work done is maximum for path (I)
(4) None of the above.

03. Under the action of force, a 2 kg mass moves such that its position as a function of time is given by $x = t^3/3$, where x is in meters and t in seconds. The work done by the force in first two seconds is:
(1) 1600 joules   (2) 160 joules
(3) 16 joules   (4) 1.6 joules.

04. A particle of mass 50 g is thrown vertically upwards with a speed of 5 m/s. Find work done by the force of gravity during the time the particle goes up.

(1) $\dfrac{5}{8}$ Joule   (2) $-\dfrac{5}{8}$ Joule

(3) $\dfrac{5}{4}$ Joule   (4) $-\dfrac{5}{4}$ Joule

05. An object of mass m is placed at a height R_e from surface of earth. Find the increase in potential energy of the object if the height of the object is increased to $3R_e$ from surface. (R_e: Radius of earth)

(1) $\dfrac{1}{3} mgR_e$ (2) $\dfrac{1}{6} mgR_e$

(3) $\dfrac{1}{2} mgR_e$ (4) $\dfrac{1}{4} mgR_e$

06. In a region, the intensity of an electric field is given by $E = 2\hat{i} + 3\hat{j} + \hat{k}$ in NC^{-1}. The electric flux through surface $S = 10\hat{i} - 3\hat{j} + 4\hat{k}$ m^2 in the region is
(1) $17 \text{ Nm}^2 C^{-1}$ (2) $33 \text{ Nm}^2 C^{-1}$
(3) $15 \text{ Nm}^2 C^{-1}$ (4) $25 \text{ Nm}^2 C^{-1}$

07. Consider the closed surface that surrounds part of the charge distribution shown in figure. Then the contribution to the electric flux linked with surface S is
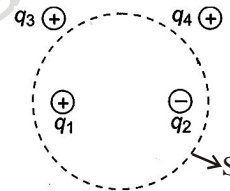

(1) q_1 and $-q_2$ only
(2) q_3 and $-q_2$ only
(3) q_1, $-q_2$, q_3 and q_4
(4) none of the above

08. The acceleration due to gravity on the earth's surface at the poles is g and angular velocity of the earth about the axis passing through the pole is ω. An object is weighed at the equator and at a height h above the poles by using a spring balance. If the weights are found to be same, then h is (h <<R, where R is the radius of the earth)

(1) $\dfrac{R^2\omega^2}{2g}$ (2) $\dfrac{R^2\omega^2}{g}$

(3) $\dfrac{R^2\omega^2}{8g}$ (4) $\dfrac{R^2\omega^2}{4g}$

09. Four identical particles of mass M are located at the corners of a square of side 'a'. What should be their speed if each of them revolves under the influence of other's gravitational field in a circular orbit circumscribing the square?
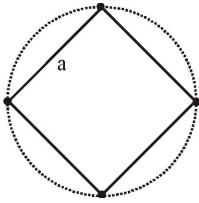

(1) $1.21\sqrt{\dfrac{GM}{a}}$

(2) $1.41\sqrt{\dfrac{GM}{a}}$

(3) $1.16\sqrt{\dfrac{GM}{a}}$

(4) $1.35\sqrt{\dfrac{GM}{a}}$

10. For a uniformly charged non conducting sphere with charge Q and radius 'R'. The distance from centre where electric field is same as at distance R/2 from centre.
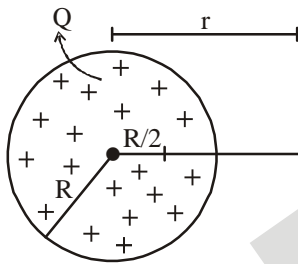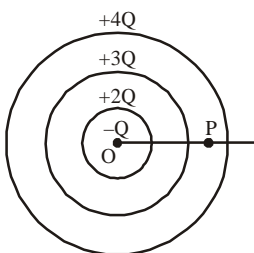

(1) $r = \sqrt{2}\,R$

(2) $r = \sqrt{3}\,R$

(3) $r = R$

(4) $r = \dfrac{R}{4}$

11. Three charged particles are placed on a straight line as shown in figure q_1 and q_2 are fixed, but q_3 can be moved. Under the action of the forces from q_1 and q_2 charge q_3 is in equilibrium. What is the relation between q_1 and q_2?
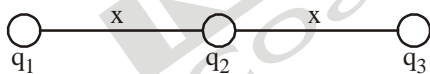
(1) $q_1 = 4q_2$

(2) $q_1 = -q_2$

(3) $q_1 = -4q_2$

(4) $q_1 = q_2$

12. For the system of three concentric conducting shells. Find electric field at point P. (take OP = r)

(1) $\dfrac{4KQ}{r^2}$ away from centre

(2) $\dfrac{4KQ}{r^2}$ towards the centre

(3) $\dfrac{3KQ}{r^2}$ away from centre

(4) $\dfrac{3KQ}{r^2}$ towards the centre

13. Magnification of a compound microscope is 30. Focal length of eyepiece is 5 cm and the image is formed at a distance of distinct vision of 25 cm. The magnification of the objective lens is
(1) 6 (2) 5
(3) 7.5 (4) 10

14. For compound microscope, focal length of objective and eyepiece are 1 cm and 2 cm, respectively and tube length in this case is 20 cm. Find the magnification of compound microscope when the final image is formed at infinity.
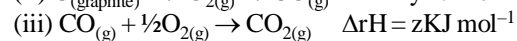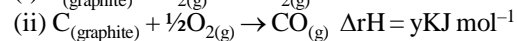(1) 25 (2) 250
(3) 15 (4) None of these

15. The interference pattern is obtained with two coherent light sources of intensity ratio n. In the interference pattern, the ratio $\dfrac{I_{max} - I_{min}}{I_{max} + I_{min}}$ will be

(1) $\dfrac{2\sqrt{n}}{(n+1)^2}$

(2) $\dfrac{\sqrt{n}}{n+1}$

(3) $\dfrac{2\sqrt{n}}{n+1}$

(4) $\dfrac{\sqrt{n}}{(n+1)^2}$

CHEMISTRY

16. On the basis of thermochemical equation (i) (ii) & (iii), find out which of the algebric relationship given in option (1) to (4) is correct
(i) $C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta rH = x\,KJ\,mol^{-1}$
(ii) $C_{(graphite)} + \tfrac{1}{2}O_{2(g)} \rightarrow CO_{(g)}$ $\Delta rH = y\,KJ\,mol^{-1}$
(iii) $CO_{(g)} + \tfrac{1}{2}O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta rH = z\,KJ\,mol^{-1}$
(1) $z = x + y$ (2) $x = y - z$
(3) $x = y + z$ (4) $y = 2z - x$

17. Study the orbital diagrams of two atoms 'X' and 'Y'. Which subshell will be more stable and why ?
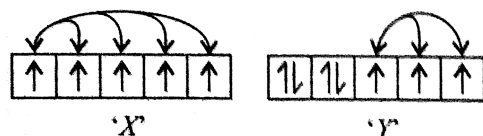
(1) X, exchange energy is maximum, so X is stable
(2) Y, exchange energy is maximum, so Y is stable
(3) X, exchange energy is minimum, so stability is maximum
(4) Y, exchange energy is minimum, so stability is maximum

18. Which of the following representations of i (van't Hoff factor) is not correct ?

(1) $i = \dfrac{\text{Observed colligative property}}{\text{Expected colligative property}}$

(2) $i = \dfrac{\text{Normal molecular mass}}{\text{Observed molecular mass}}$

(3) $i = \dfrac{\text{Number of molecules actually present}}{\text{Number of molecules expected to be present}}$

(4) $i = \dfrac{\text{Total number of particles taken before association/dissociation}}{\text{Number of particles after association/dissociation}}$

19. For a reaction $A_2 + B_2 \rightleftharpoons 2AB$ the figure shows the path of the reaction in absence and presence of a catalyst. What will be the energy of activation for forward (E_f) and backward (E_b) reaction in presence of a catalyst and ΔH for the reaction? The dotted curve is the path of reaction in presence of a catalyst
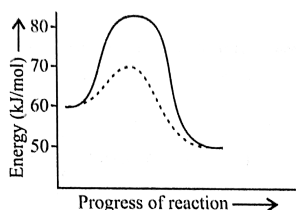
(1) $E_f = 60$ kJ/mol, $E_b = 70$ kJ/mol, $\Delta H = 20$ kJ/mol
(2) $E_f = 20$ kJ/mol, $E_b = 20$ kJ/mol, $\Delta H = 50$ kJ/mol
(3) $E_f = 70$ kJ/mol, $E_b = 20$ kJ/mol, $\Delta H = 10$ kJ/mol
(4) $E_f = 10$ kJ/mol, $E_b = 20$ kJ/mol, $\Delta H = -10$ kJ/mol

20. 10^{24} molecules of solute are dissolved in 10^{25} molecules of solvent, the mole fraction of solute in solution are:
(1) 0.09   (2) 0.08   (3) 0.07   (4) 0.05

21. The entalpy of vaporisation of a liquid is 30 kJ mol^{-1} and entropy of vaporisation is 75 J mol^{-1}. The boiling point of the liquid at 1 atm is:
(1) 250 K   (2) 400 K
(3) 450 K   (4) 600 K

22. Which is not an acid salt ?
(1) NaH_2PO_2 (2) NaH_2PO_3
(3) NaH_2PO_4 (4) None of these

23. The dissociation constant of HCN is 1.3×10^{-9}. The value of hydrolysis constant of KCN will be:
(1) 1.3×10^{-9} (2) 10^{-4}
(3) 7.7×10^{-5} (4) 0.77×10^{-5}

24. Which of the following chemical reactions depicts the oxidizing behaviour of H_2SO_4?

(1) $2HI + H_2SO_4 \longrightarrow I_2 + SO_2 + 2H_2O$
(2) $Ca(OH)_2 + H_2SO_4 \longrightarrow CaSO_4 + 2H_2O$
(3) $NaCl + H_2SO_4 \longrightarrow NaHSO_4$ HCl
(4) $2PCl_5 + H_2SO_4 \longrightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

25. Assuming each salt to be 90% dissociated which of the following will have highest osmotic pressure:
(1) decimolr $Al_2(SO_4)$
(2) Decimolar $BaCl_2$
(3) decimolar Na_2SO_4
(4) a solution obtained by mixing equal volumes of (2) and (3) and filtering.

26. The correct order of equivalent conductivity at infinite dilution of LiCl, NaCl and KCl is:
(1) LiCl > NaCl > KCl   (2) KCl > NaCl > LiCl
(3) NaCl > KCl > LiCl   (4) LiCl > KCl > NaCl

27. For the reaction, $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, the value of K_c at 800 °C is 0.1. When the equilibrium concentrations of both the reactants is 0.5 mol, what is the value of K_p at the same temperature
(1) 0.5   (2) 0.1
(3) 0.01   (4) 0.025

28. For a hypothetical reaction :
$4A(g) + 5B(g) \rightleftharpoons 4P(g) + 6Q(g)$
The equilibrium constant K_c has units:
(1) mol L^{-1} (2) mol^{-1} L
(3) $(\text{mol L}^{-1})^{-2}$ (4) unitless

29. Equilibrium constant for the reaction,
$2NO(g) + Cl_2(g) \rightleftharpoons 2NOCl(g)$,
is correctly given by the expression

(1) $K_c = \dfrac{[NOCl]^2}{[NO]^2[Cl_2]}$ (2) $K_c = \dfrac{[NOCl]}{[2NO][Cl_2]}$

(3) $K_c = \dfrac{[NO]^2 + [Cl_2]}{[NOCl]}$ (4) $K_c = \dfrac{[NO]^2 [Cl_2]}{[NOCl]^2}$

30. In the decomposition reaction $AB_5(g) \rightleftharpoons AB_3(g) + B_2(g)$, at equilibrium in a 10 litre closed vessel at 227 °C, 2 moles of AB_3, 5 moles of B_2 and 4 moles of AB_5 are present. The equilibrium constant K_C for the formation of $AB_5(g)$ is :
(1) 0.25   (2) 4.0   (3) 0.04   (4) 2.5

BOTANY

31. According to Chromosome Theory of Linkage of Morgan and Castle (1912).
(1) genes lie in a linear order in the chromosomes
(2) strength of linkage between two successive genes is inversely proportional to distance between two genes
(3) linked genes occur on the same chromosome
(4) all the above are correct

32. According to Chargaff's rule
(1) $A = C$ (2) $G = T$

(3) $A + G = T + C$ (4) $\dfrac{A + T}{C + G} = 1$

33. Mendel's work remain unrecognised for long time due to
I. communication was not easy.
II. concept of factors which did not blend was not accepted.
III. use of mathematics to explain biological problem was unacceptable.
IV he could not provide any physical proof for the existance of factors.
Choose the right combination.
(1) I and II   (2) II and III
(3) Ill and IV   (4) All of these

34. A typical example of cross pollination is:
(1) Viola   (2) Tomato
(3) Potato   (4) Papaya

35. The term 'totipotency' refers to the capacity of a:
(1) Cell to generate whole plant
(2) Bud to generate whole plant
(3) Seed to germinate
(4) Cell to enlarge in size

36. In given figure A and B represents:

(A)   (B)
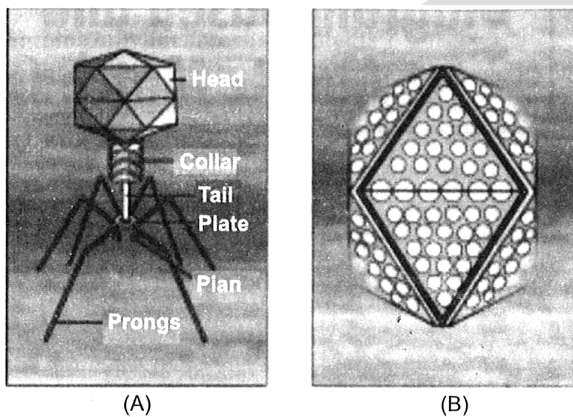
(1) (A)-Bacteriophage, (B)-Adenovirus which causes skin infections
(2) (A)-Bacteriophage, (B)-Adenovirus which causes respiratory infections
(3) (A)-Bacteriophage, (B)-Tobacco Mosaic Virus (TMV)
(4) (A)-Prion, (B)-Adenovirus which causes respiratory infections

37. Level of biological organization is present in what sequence?
(1) Organism → Populations → Communities → Biomes
(2) Communities → Populations → Biomes → Organism
(3) Populations → Organism → Communities → Biomes
(4) Organism → Biomes → Populations → Communities

38. Match the Column:

	Column-I		Column-II
A.	Standing state	1.	Exist in the atmosphere
B.	Gaseous cycles	2.	Amount of nutrients
C.	Standing crop	3.	Located in earth's crust
D.	Sedimentary cycles	4.	Living matter at different trophic level

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

39. Identify given diagram and choose correct option for labelled part of the structure:
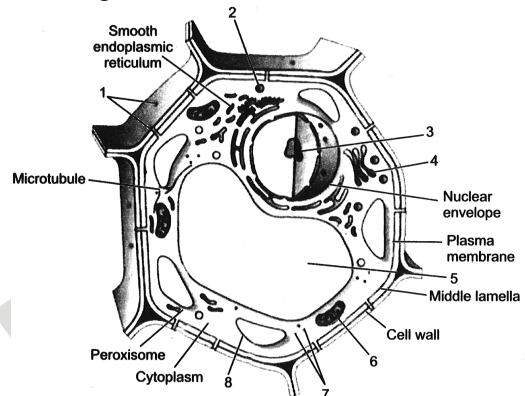
(1) Plant: 1–Plasmodesmata, 2–Ribosome, 3–Nucleolus, 6–Chloroplast
(2) Animal: 4–Golgi apparatus, 6–Mitochondria, 7–Lysosome
(3) Animal: 4–Golgi apparatus, 3–Nucleus, 2–Lysosome
(4) Plant: 2–Lysosome 4–Golgi apparatus, 7–Ribosome, 8–Chloroplast

40. Cells of root tip of onion have 14 chromosomes in each cell, how many chromosomes will the cell have at G1-phase, after S-phase, and after M-phase respectively?
(1) 7, 14, 14   (2) 14, 28, 28
(3) 14, 14, 14 (4) 7, 28, 14

41. Characters used to classify organism when no fossil evidence is supportive, is
(1) Numerical taxonomy   (2) Cytotaxonomy
(3) Chemotaxonomy   (4) All of these

42. Pteridophyte having microphylls is
(1) Ferns   (2) Psilotum
(3) Selaginella   (4) None of these

43. In haplontic life cycle, the zygote divides by
(1) Mitosis   (2) Meiosis
(3) Any of them   (4) Amitosis

44. Which of the following is true about guard cells?
(1) Outer wall is thin
(2) Inner wall (towards stomatal pore) is thick
(3) Bean-shaped in dicots and dumb-bell-shaped in grasses
(4) All the above

45. In reduction process of Calvin cycle requires how many ATP and NADPH for reduction of one molecule of CO_2?
   (1) 2 mole ATP and 3 mole NADPH
   (2) 2 mole ATP and 2 mole NADPH
   (3) 1 mole ATP and 2 mole NADPH
   (4) 3 mole ATP and 2 mole NADPH

ZOOLOGY

46. Saltatory conduction of nerve impulse takes place through:
   (1) Myelinated fibres   (2) Non-myelinated fibre
   (3) Gray fibres   (4) None of these

47. Choose incorrect statement with respect to insulin.
   (1) It stimulates conversion of glucose to glycogen
   (2) Insulin only acts on hepatocytes and enhance cellular glucose uptake and utilization
   (3) Deficiency of insulin can cause formation of harmful compounds known as ketone bodies
   (4) Insulin is a peptide hormone

48. After ovulation, Graafian follicle transforms into
   (1) Corpus cavernosa   (2) Corpus pellucida
   (3) Corpus luteum   (4) Corpus metrium

49. Which layer of blastocyst gets attached to the endometrium during implantation?
   (1) Trophoblast   (2) Blastomere
   (3) Inner cell mass   (4) Morula

50. The applications of Biotechnology include
   (A) Therapeutics
   (B) Diagnostics
   (C) GM crops for agriculture
   (D) Processed food
   (E) Bioremediation
   (F) Waste treatment
   (G) Energy production
   (1) A, B, C, E only   (2) C only
   (3) B, C, D, E only   (4) All of these

51. Which one of the following palindromic base sequences in DNA can be easily cut at the middle by some particular restriction enzyme?
   (1) 5′–CGTTCG–3′   (2) 5′–GATATG–3′
       3′–ATGGTA–5′   3′–CTACTA–5′
   (3) 5′–GAATTC–3′   (4) 5′–CACGTA-3′
       3′–CTTAAG–5′   3′–CTCAGT–5′

52. Function wise, just as there are nephridia in an earthworm, so are
   (1) parotid glands in toad
   (2) statocysts in prawn
   (3) flame cells in liver fluke
   (4) myotomes in fish

53. Which of the following secondary metabolites are used as drugs?
   (1) Abrin + Ricin
   (2) Vinblastine + Curcumin
   (3) Anthocyanin
   (4) Monoterpenes

54. The exchange of gases in the alveoli of the lungs takes place by
   (1) Simple diffusion   (2) Osmosis
   (3) Active transport   (4) Passive transport

55. Ammonia produced by metabolism is converted into __A__ in the liver of mammals and released into __B__ which is filtered and __C__ out by kidney.
   (1) A–Uric acid, B–Blood, C–Excreted
   (2) A–Urea, B–Blood, C–Excreted
   (3) A–Amino acid, B–Blood, C–Excreted
   (4) A–Sugar, B–Blood, C–Excreted

56. Which of the following is incorrect?
   (1) Bony fishes possess air bladders
   (2) A Bony fish possess operculum whereas an cartilagenous fish lacks them
   (3) Amphibians are oviparous and possess external fertilization
   (4) Amphibian skin is moist & scaly

57. Identify correctly the glands (A) and (B) alongwith the location and function:
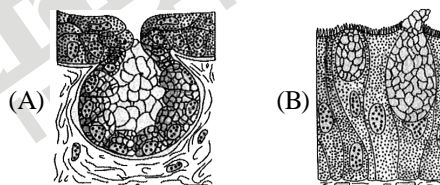
	Gland	Location	Function
(1)	A = Multicellular	Buccal cavity	Saliva secretion
(2)	A = Unicellular	Buccal cavity	Gastric juice
(3)	B = Multicellular	Alimentary canal	Mucous secretion
(4)	B = Unicellular	Skin	Sweat secretion

58. Read the following statements:
   (i) The lymphoid tissue of pharynx is called tonsils.
   (ii) Wharton's duct is one of the salivary duct.
   (iii) The hard surface of the teeth (enamel) helps in mastication of food.
   (iv) Chewing is important as it increases the surface area of food.
   (v) A bony flap called epiglottis prevents the entry of food into the glottis during swallowing.
   How many of the above statements are correct?
   (1) Four   (2) Three
   (3) Two   (4) Five

59. Which of the following is incorrect?
(1) Stool appears white-grey coloured in individuals with liver malfunction
(2) Indigestion may occur due to overeating
(3) The reflex action during vomiting is controlled by a centre in medulla
(4) Diarrhoea increases the absorption of food during digestion

60. Find out which of the following statements are true (T) false (F) and choose the correct option.
I. Neutrophils are the most abundant agranulocytes.
II. Basophils the least abundant white blood cells.
III. Neutrophils and monocytes are phagocytic cells.
IV. Basophils secrete histamine and serotonin but not heparin
(1) I–T; II–T; III–F; IV–F
(2) I–F; II–T; III–T; IV–F
(3) I–T; II–F; III–T; IV–F
(4) I–F; II–T; III–F; IV–T