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SAMPLE PAPER - 62

Time : 1 : 15 Hr. **Question : 60**

PHYSICS

01. Two particles of mass 1 kg and 3 kg have position vectors $-2\hat{i}+3\hat{j}+4\hat{k}$ and $+2\hat{i}+3\hat{j}-4\hat{k}$ respectively. The centre of mass has a position vector :

(1) $\hat{i}+3\hat{j}-2\hat{k}$ (2) $-\hat{i}-3\hat{j}-2\hat{k}$

(3) $-\hat{i}+3\hat{j}+2\hat{k}$ (4) $-\hat{i}+3\hat{j}-2\hat{k}$

02. The centre of mass of a system of two particles of masses m_1 and m_2 is at a distance d_1 from m_1 and at a distance d_2 from mass m_2 such that :

(1) $\dfrac{d_1}{d_2}=\dfrac{m_2}{m_1}$ (2) $\dfrac{d_1}{d_2}=\dfrac{m_1}{m_2}$

(3) $\dfrac{d_1}{d_2}=\dfrac{m_1}{m_1+m_2}$ (4) $\dfrac{d_1}{d_2}=\dfrac{m_2}{m_1+m_2}$

03. The velocity of the CM of a system changes from $\vec{v}_1 = 3\hat{i}$ m/s to $\vec{v}_2 = 4\hat{j}$ m/s during time $\Delta t = 2s$. If the mass of the system is m = 10 kg, the constant force acting on the system is :

(1) 25 N (2) 20 N (3) 50 N (4) 5 N

04. Two bodies of mass 1 kg and 3 kg have Acceleration $-\hat{i}+2\hat{j}-\hat{k}$ and $+3\hat{i}-2\hat{j}-\hat{k}$ respectively. The centre of mass of this system has Acceleration:

(1) $-\hat{i}+\hat{j}+\hat{k}$ (2) $-2\hat{i}+2\hat{k}$

(3) $-2\hat{i}-\hat{j}+\hat{k}$ (4) $2\hat{i}-\hat{j}-\hat{k}$

05. Two objects of masses 200 gm and 500 gm possess velocities $10\hat{i}$ m/s and $(3\hat{i}+5\hat{j})$ m/s respectively. The velocity of their centre of mass in m/s is :

(1) $5\hat{i}-25\hat{j}$ (2) $\dfrac{5}{7}\hat{i}+25\hat{j}$

(3) $5\hat{i}+\dfrac{25}{7}\hat{j}$ (4) $25\hat{i}-\dfrac{5}{7}\hat{j}$

06. A satellite of mass m is revolving close to surface of a planet of density d with time period T. The value of universal gravitational constant G on planet is given by

(1) $2d^2T\pi$ (2) $dt^2\pi$

(3) $\dfrac{1}{d^2T\pi}$ (4) $\dfrac{3\pi}{dT^2}$

07. Gravitational potential in a region is given by V= –(x+y+z) J/kg. Find the gravitational intensity at (2, 2, 2)

(1) $(\hat{i}+\hat{j}+\hat{k})\,N/kg$ (2) $2(\hat{i}+\hat{j}+\hat{k})\,N/kg$

(3) $3(\hat{i}+\hat{j}+\hat{k})\,N/kg$ (4) $4(\hat{i}+\hat{j}+\hat{k})\,N/kg$

08. A circular disc of radius R is removed from a bigger circular disc of radius 2R, such that the circumferences of the discs coincide. The centre of mass of the new disc is αR from the centre of the bigger disc. The value of α is

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

(3) $\dfrac{1}{2}$ (4) $\dfrac{1}{6}$

09. The moment of inertia of a uniform disc about an axis perpendicular to disc at the centre is $\dfrac{1}{2}MR^2$ (M = mass, R = radius of disc). If the disc is rolling on its edge without slipping on a straight line path, the ratio of rotational kinetic energy to translational one is:

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

10. If I_1 is the moment of inertia of a thin rod about an axis perpendicular to its length and passing through its centre of mass, and I_2 is the moment of inertia (about central axis) of the ring formed by bending the rod, then the ratio of I_1 to I_2 is

(1) $1:1$ (2) $\pi^2:3$ (3) $\pi:4$ (4) $3:5$

11. A particle performs uniform circular motion with an angular momentum L. If the frequency of particle's motion is doubled and its kinetic energy is halved it's angular momentum becomes

(1) $\dfrac{L}{2}$ (2) $\dfrac{L}{4}$ (3) $\dfrac{L}{6}$ (4) $\dfrac{L}{8}$

12. A body of mass m slides down an incline and reaches the bottom with a velocity v. If the same mass was in the form of a ring which rolls down this incline, the velocity of the ring at the bottom would have been

  (1) v   (2) $\sqrt{2}\,v$

  (3) $\dfrac{v}{\sqrt{2}}$ (4) $\left(\sqrt{\dfrac{2}{5}}\right)v$

13. A thin rod of length L and mass M is held vertically with one end on the floor and is allowed to fall. Find the velocity of the other end when it hits the floor, assuming that the end on the floor does not slip:

  (1) $\sqrt{\dfrac{3g}{L}}$ (2) $\sqrt{3gL}$ (3) $\sqrt{\dfrac{L}{3g}}$ (4) $\sqrt{\dfrac{g}{3L}}$

14. A body starting from rest is accelerated uniformly for 15 s. If x_1, x_2, x_3 are the distance travelled in 1st 5 s, next 5 s and last 5 s, then $x_1 : x_2 : x_3 =$

  (1) 1 : 2 : 3   (2) 1 : 1 : 1

  (3) 1 : 3 : 5   (4) 1 : 3 : 9

15. A car travels due east on a level road for 30 km. It then turns due north at an intersection and travels 40 km before stopping. The resultant displacement of the car is

  (1) 50 km, 53° north of east

  (2) 50 km, 53° east of north

  (3) 100 km, 37° north of east

  (4) 100 km, 37° east of north

CHEMISTRY

16. Within each pair of elements of F & Cl , S & Se, and Li & Na, respectively, the elements that release more energy upon an electron gain are:

  (1) F, Se and Na   (2) F, S and Li

  (3) Cl, S and Li   (4) Cl, Se and Na

17. The set of elements that differ in mutual relationship from those of the other sets is :

  (1) Li – Mg   (2) B – Si

  (3) Be – Al   (4) Li – Na

18. The percentage of s-character in hybridisation of C-atom in C_2H_2 is:

  (1) 22%   (2) 25%   (3) 33%   (4) 50%

19. $CH_3 - CH_2 - CHO$; $CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3$
         (A)   (B)

  Relation between (A) and (B) is

  (1) chain isomers   (2) positional isomers

  (3) functional isomers   (4) metamers

20. How many distinct terminal alkynes are possible for a compound having molecular formula C_5H_8?

  (1) 1   (2) 2

  (3) 3   (4) 4

21. 60 mL of $\dfrac{N}{5}$ H_2SO_4, 10 mL of $\dfrac{N}{2}$ HNO_3 and 30 mL of $\dfrac{N}{10}$ HCl are mixed together. The strength of the resulting mixture is

  (1) 0.10 N   (2) 0.2 N

  (3) 0.3 N   (4) 0.4 N

22. We have 100 mL of 0.1 M KCl solution. To make it 0.2 M

  (1) evaporate 50 mL water

  (2) evaporate 50 mL solution

  (3) add 0.1 mol KCl

  (4) add 0.01 mol KCl

23. 25 mL solution of barium hydroxide on titration with 0.1 molar solution of hydrochloric acid gave a titre value of 35 mL. The molarity of barium hydroxide is:

  (1) 0.28   (2) 0.35

  (3) 0.07   (4) 0.14

24. The volume of water that must be added to a mixture of 250 ml of 0.6 M HCl and 750 ml of 0.2 M HCl to obtain 0.25 solution of HCl is:

  (1) 750 ml   (2) 100 ml   (3) 200 ml   (4) 300 ml

25. A carbon compound containing carbon and oxygen has an approximate molar mass equal to 290. On analysis it is found to contain 50% by mass of each element. Therefore, the molecular formula of the compound is-

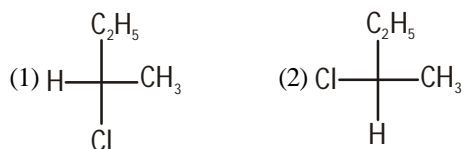 (1) $C_{12}O_9$ (2) C_4O_3 (3) C_3O_4 (4) C_9O_{12}

26. 20 mL of 0.1 M solution of compound Na_2CO_3. $NaHCO_3$. $2H_2O$ is titrated against 0.05 M HCl, x mL of HCl is used when phenolphthalein is used as an indicator and y mL of HCl is used when methyl orange is the indicator in two separate titrations. Hence (y – x) is:
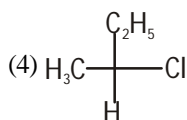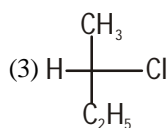
  (1) 40 mL   (2) 80 mL

  (3) 120 mL   (4) None of these

27. An aqueous solution of 6.3 g of oxalic acid dihydrate is made up to 250 mL. The volume of 0.1 NaOH required to completely neutralise 10 mL of this solution is
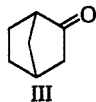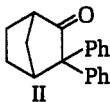
  (1) 40 mL   (2) 20 mL

  (3) 10 mL   (4) 4 mL

28. CH_3–CHCl–CH_2–CH_3 has a chiral centre which one of the following represents its R configuration:

  (1) H—(C with C_2H_5 top, CH_3 right, Cl bottom)
  (2) Cl—(C with C_2H_5 top, CH_3 right, H bottom)

(3)
$$\text{H} \underset{\text{C}_2\text{H}_5}{\overset{\text{CH}_3}{\vert}} \text{Cl}$$

(4)
$$\text{H}_3\text{C} \underset{\text{H}}{\overset{\text{C}_2\text{H}_5}{\vert}} \text{Cl}$$
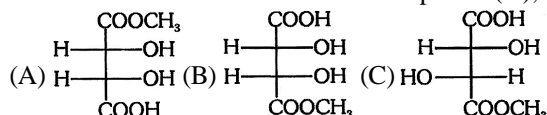
29. Which among the given molecules can exhibit tautomerism?

I   II   III

(1) III only   (2) Both I and III
(3) Both I and II   (4) Both II and III

30. The correct statement about the compound (A),

(1) (A) and (B) are identical
(2) (A) and (B) are diastereomers
(3) (A) and (C) are enantiomers
(4) (A) and (B) are enantiomers

BOTANY

31. Organelles important in spindle formation during nuclear division is
(1) Centriole (2) Golgi body
(3) Chloroplast   (4) Mitochondrial

32. Recognise the figure and find out the correct matching.
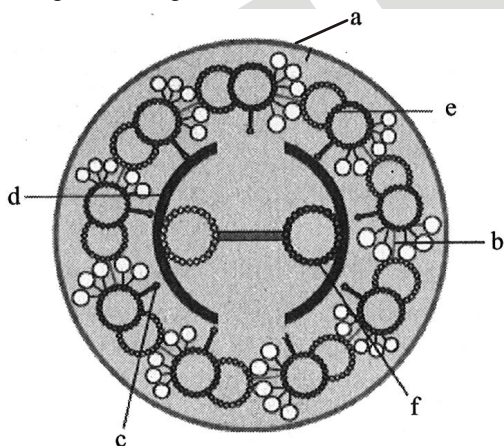
(1) d–plasma membrane, b–radial spoke, a–central sheath, c–interdoublet bridge, f–peripheral microtubule, e–central microtubule
(2) d–plasma membrane, c–radial spoke, a–central sheath, b–interdoublet bridge, e–peripheral microtubule, f–central microtubule
(3) a–plasma membrane, b–radial spoke, d–central sheath, c–interdoublet bridge, e–peripheral microtubule, f–central microtubule
(4) a–plasma membrane, c–radial spoke, d–central sheath, b–interdoublet bridge, e–peripheral microtubule, f–central microtubule

33. DNA occurs in
(1) Mitochondria, Plastids and Chromosomes
(2) Chromosomes, Mitochondria and Ribosomes
(3) Chromosomes, Mitochondria and Cell Membrane
(4) Chromosomes, Ribosomes and Cytoplasm

34. Small particles projecting from inner surfaces of cristae and inner mitochondrial membrane are
(1) Microsomes
(2) Oxysomes
(3) Myeloid bodies
(4) Informosomes

35. Mitochondria and chloroplast are
(a) semi-autonomous organelles.
(b) formed by division of pre-existing organelles and they contain DNA but lack protein synthesizing machinery.
Which one of the following options is correct:
(1) Both (a) and (b) are correct
(2) (b) is true but (a) is false
(3) (a) is true but (b) is false
(4) Both (a) and (b) are false

36. Fill in the blanks
1. Despite the absence of a heart or a circulatory system in plants, the flow of water upward through the xylem in plants can achieve fairly high rates up to ...a.... metres per hour.
2. Less than ...b.... percent of the water reaching the leaves is used in photosynthesis and plant growth.
3. Water loss from a leaf can be studied by using ...c...
4. Most researchers agree that water is mainly ...d... through the plant.
(1) a–10, b–5, c–potato osmometer, d–pushed
(2) a–5, b–10, c–cobalt chloride paper, d–pulled
(3) a–15, b–1, c–cobalt chloride paper, d–pulled
(4) a–10, b–1, c–cobalt chloride paper, d–pulled

37. Which one give the most valid and recent explanation for stomatal movements ?
(1) Starch hydrolysis
(2) Guard cell photosynthesis
(3) Transpiration
(4) Potassium influx and efflux

38. Osmosis is the special type of diffusion of water across a .... which depends on .... and .... respectively.
(1) Semi-permeable membrane, pressure gradient and concentration gradient.
(2) Selectively permeable membrane, pressure gradient and concentration gradient
(3) Selectively permeable membrane, apoplast and symplast
(4) Semi-permeable membrane, apoplast and symplast

39. Match column I with column II and choose the correct combination from the options given below.

	Column I		Column II
A	Water potential of pure water	1	Positive
B	Solute potential	2	Negative
C	Osmotic pressure	3	Zero
D	Osmotic potential	4	May be positive or negative

(1) A-3, B-2, C-1, D-4
(2) A-4, B-1, C-2, D-3
(3) A-4, B-2, C-3, D-1
(4) A-3, B-2, C-1, D-2

40. Which of the following element is present in plant tissues in excess of 10 mmole kg^{-1} of dry matter ?
(1) Magnesium   (2) Manganese
(3) Molybdenum   (4) Both 1 and 2

41. Match the column I and column II and select the correct combination.

	Column-I		Column-II
A.	Carbohydrate translocation	i.	Iron
B.	Component of vitamins (biotin and thiamine)	ii.	Phosphorus
C.	Synthesis of cell wall	iii.	Boron
D.	Component of cytochromes	iv.	Sulphur
E.	Phosphorylation reactions	v.	Calcium

(1) A-v, B-iv, C-ii, D-iii, E-i
(2) A-iii, B-iv, C-v, D-i, E-ii
(3) A-v, B-iv, C-ii, D-i, E-iii
(4) A-iii, B-i, C-v, D-iv, E-ii

42. Essential elements are often supplied to the crop plants through fertilizers. The components of fertilizers are
(1) Micro-nutrients (Cu, Zn, Fe, Mn etc.)
(2) Macro-nutrients (N, P, K, S etc.)
(3) Both 1 and 2
(4) Na, Se, Si, Co

43. In plants capillarity is aided by the
(1) Small diameter of tracheids
(2) large diameter of tracheids
(3) Small diameter of vessel elements
(4) Both 1 and 3

44. In human, the correct percentage of constituent of RBC's membrane is
(1) Protein 52% + lipid 40%
(2) 40% Protein + 50% lipid
(3) Protein 50% + lipid 50%
(4) Protein 90% + cellulose 5%

45. Whow proposed "cell lineage theory" by stating that "Omnis cellula e cellula"?
(1) Karl Nageli
(2) Rudolf virchow
(3) Schwann
(4) Anton Von Leuwenhoek

ZOOLOGY

46. Which of the following is not true?
(1) pCO_2 of deoxygenated blood is 95 mmHg.
(2) pCO_2 of alveolar air is 40 mmHg.
(3) pO_2 alveolar air is 104 mmHg.
(4) pO_2 of oxygenated blood is 95 mmHg.

47. The solubility of CO_2 is _____ times higher than that of O_2
(1) 10–15   (2) 20–25   (3) 30–35   (4) 210

48. Each molecule of haemoglobin can carry at the maximum of _____ molecules of O_2.
(1) 1   (2) 2   (3) 3   (4) 4

49. When partial pressure of CO_2 (pCO_2) rises, the oxygen dissociation curve of haemoglobin at 37°C will
(1) Shift towards right   (2) Shift towards left
(3) Become irregular   (4) Remain unchanged

50. Oxygen dissociation curve is
(1) Parabola   (2) Sigmoid
(3) Hyperbola   (4) Straight line

51. Which system jointly coordinates and regulates the physiological functions in the body?
(1) Nervous system   (2) Endocrine system
(3) Both (1) and (2)   (4) None of these

52. Adenohypophysis consists of
(1) Pars distalis   (2) Pars intermedia
(3) Pars nervosa   (4) Both (1) and (2)

53. Which of the following hormones of anterior pituitary together called gonadotrophins?
(1) LH and ACTH   (2) FSH and LH
(3) TSH and PRL   (4) MSH and LH

54. 24 hour diurnal rhythms of our body is maintained by
(1) Melatonin   (2) Glucagon
(3) Thymosin   (4) Oxytocin

55. The enlargement of thyroid gland is called
(1) Hypothyroidism
(2) Hyperthyroidism
(3) Goitre
(4) Isthmus

56. Which of the following hormones affect Ca^{2+} ion metabolism?
(1) TCT (Thyrocalcitonin)
(2) Parathyroid hormone (PTH)
(3) Both (1) and (2)
(4) Cortisol

57. In our body, the main mineralo corticoid is
(1) Adrenaline   (2) Aldosterone
(3) ADH   (4) Cortisol

58. Cockroach is
(1) Ammonotelic   (2) Ureotelic
(3) Uricotelic   (4) None of these

59. Where food is stored in cockroach?
(1) Pharynx   (2) Oesophagus
(3) Crop   (4) Gizzard

60. Pair of testes in cockroach lies in
(1) 2–4 abdominal segment
(2) 4–6 abdominal segment
(3) 4–7 abdominal segment
(4) 6–8 abdominal segment.