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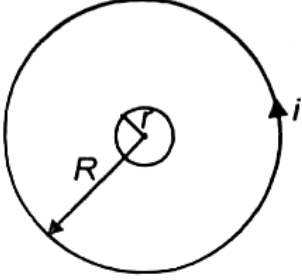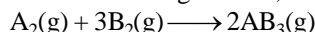
SAMPLE PAPER - 16

PHYSICS

01. A thin rectangular magnet suspended freely has a period of oscillation equal to T. Now, it is broken into two equal halves (each having half of the original length) and one piece is made to oscillate freely in the same field. If its period of oscillation is T′. The ratio of T′/T is

(1) $\dfrac{1}{2\sqrt{2}}$ 　　　　(2) 1/2

(3) 2 　　　　(4) 1/4

02. A uniform string is clamped at its two ends. Its mass per length is given by 20 g/metre, the transverse displacement wave of the string is given by $y = 5 \sin\left(\dfrac{2\pi}{3}x\right)\cos(20\pi t)$ m, then tension in the string is

(1) 9 N 　(2) 9.9 N 　(3) 1.8 N 　(4) 18 N

03. Water boils in an electric kettle in 15 minutes after switching on. If the length of the heating wire is decreased to 2/3 of its initial value, then the same amount of water will boil with the same supply voltage in

(1) 15 minutes 　　　　(2) 12 minutes

(3) 10 minutes 　　　　(4) 8 minutes

04. The dimension of $\dfrac{e^2}{4\pi\varepsilon_0 hc}$, where e, ε_0, h and c are electric charge, electric permittivity, Planck's constant and velocity of light in vacuum respectively

(1) $[M^0L^0T^0]$ (2) $[ML^0T^0]$

(3) $[M^0LT^0]$ 　　　　(4) $[M^0L^0T]$

05. A ball falls from a height of 5 m and strikes a lift which is moving in the upward direction with a velocity of 1 ms⁻¹, then the velocity with which the ball rebounds after collision will be

(1) 11 ms⁻¹ downwards

(2) 12 ms⁻¹ upwards

(3) 13 ms⁻¹ upwards

(4) 12 ms⁻¹ downwards

06. In a photoelectric experiment, the wavelength of the light incident on a metal is changed from 300 nm to 400 nm. The decrease in the stopping potential is close to :

$\left(\dfrac{hc}{e} = 1240\,nm-V\right)$

(1) 0.5 V 　　　　(2) 1.0 V

(3) 2.0 V 　　　　(4) 1.5 V

07. In a plane electromagnetic wave, the electric field oscillates sinusoidally at a frequency of 2.5×10^{10} Hz and amplitude 480 V m⁻¹. The amplitude of the oscillating magnetic field will be

(1) 1.52×10^{-8} Wb m⁻² 　(2) 1.52×10^{-7} Wb m⁻²

(3) 1.6×10^{-6} Wb m⁻² 　(4) 1.6×10^{-7} Wb m⁻²

08. What is the maximum energy required to launch a satellite of mass m from earth's surface in a circular orbit at an altitude of 2R (R = radius of the earth)

(1) $\dfrac{2}{3}$ mgR 　(2) mgR 　(3) $\dfrac{5}{6}$ mgR 　(4) $\dfrac{1}{3}$ mgR

09. Figure shows two concentric coplanar loops of radii R and r (R >>r). A current i varying with time t as i = 3t +5 is passed through the outer loop. The emf induced in the smaller loop of radius r is

(1) $\dfrac{\mu_0\pi r^2}{R}$ 　　　　(2) $\dfrac{3}{2}\dfrac{\mu_0\pi r^2}{R}$

(3) $\dfrac{1}{2}\dfrac{\mu_0\pi r^2}{R}$ 　　　　(4) Zero

10. The rays of the sun are focused on a piece of ice through a lens of diameter 5 cm, as a result of which 10 g ice melts in 10 minutes. The amount of heat received from the sun per unit area per minute is

(1) 4 cal cm⁻² min⁻¹ 　　(2) 40 cal cm⁻² min⁻¹

(3) 4 J cm⁻² min⁻¹ 　　(4) 400 cal cm⁻² min⁻¹

11. In a closed vessel, 5 moles of $A_2(g)$ and 7 moles of $B_2(g)$ are reacted in the following manner,
$$A_2(g) + 3B_2(g) \longrightarrow 2AB_3(g)$$
What is the total number of moles of gases present in the container at the end of the reaction?
(1) 22/3   (2) 7/3   (3) 14/3   (4) 8/3

12. For the following equilibrium
$$2Fe(s) + 3H_2O(g) \rightleftharpoons Fe_2O_3(s) + 3H_2(g)$$
$K_C = 27$. Hence, ratio of molar concentration of $H_2(g)$ and $H_2O(g)$ is
(1) 3   (2) 1
(3) 9   (4) 27
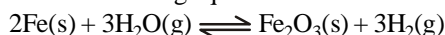
13. Which of the following statements comparing solutions with pure solvent is not correct?
(1) A solution containing a non-volatile solute has a lower vapour pressure than pure solvent
(2) A solution containing a non-volatile solute has a lower boiling point than pure solvent
(3) A solution containing a non-volatile solute has a lower freezing point than pure solvent
(4) A solution will have a greater mass than an equal volume of pure solvent if the solute has a molar mass greater than the solvent

14. For the second period elements the correct increasing order of first ionisation enthalpy is:
(1) $Li < Be < B < C < N < O < F < Ne$
(2) $Li < B < Be < C < O < N < F < Ne$
(3) $Li < B < Be < C < N < O < F < Ne$
(4) $Li < Be < B < C < O < N < F < Ne$

15. For the following reactions:
(1) $CH_3CH_2CH_2Br + KOH \rightarrow CH_3CH = CH_2 + KBr + H_2O$

(2)

(3)
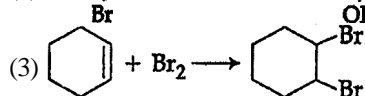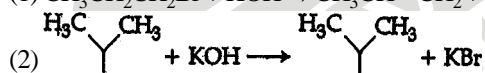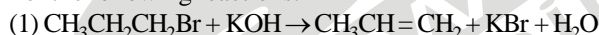
Which of the following statements is correct?
(1) (1) is substitution, (2) and (3) are addition reactions
(2) (1) and (2) are elimination reactions and (3) is addition reaction.
(3) (1) is elimination, (2) is substitution and (3) is addition reaction
(4) (1) is elimination, (2) and (3) are substitution reaction

16. Among the following, the reaction that proceeds through an electrophilic substitution is :

(1)

(2)

(3)

(4)
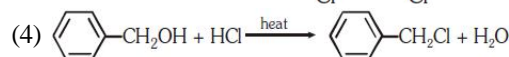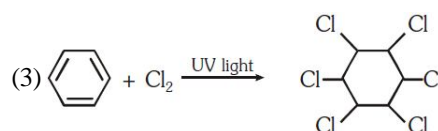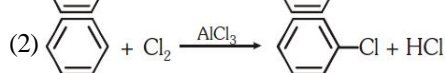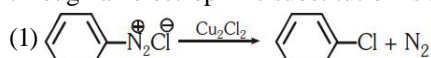
17. Match the following:
(A) Pure nitrogen   (i) Chlorine
(B) Haber process   (ii) Sulphuric acid
(C) Contact process   (iii) Ammonia
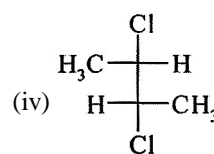(D) Deacon's process   (iv) Sodium azide or Barium azide
Which of the following is the correct option?
(1) [A] (iii)   [B] (iv)   [C] (ii)   [D] (i)
(2) [A] (iv)   [B] (iii)   [C] (ii)   [D] (i)
(3) [A] (i)   [B] (ii)   [C] (iii)   [D] (iv)
(4) [A] (ii)   [B] (iv)   [C] (i)   [D] (iii)

18. If excluded volume is taken zero, compressibility factor Z is
(1) $\left(1 - \dfrac{a}{RTV}\right)$ (2) $\left(1 + \dfrac{pb}{RT}\right)$
(3) $\dfrac{pV}{RT}$ (4) $\dfrac{RT}{pV}$

19. Which of the following pair is diastereomers ?
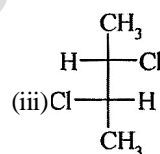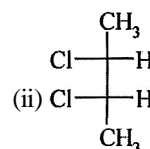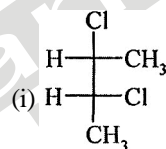
(1) i, ii   (2) i, iii
(3) i, iv   (4) iii, iv

20. Among the following which one does not act as an intermediate in Hofmann rearrangement
(1) RNCO
(2) $RC\overset{..}{O}\overset{..}{N}$
(3) RCONHBr
(4) RNC

21. In bryophytes and pteridophytes, transport of male gametes requires
(1) Wind   (2) Insects
(3) Birds   (4) Water

22. In stems, the protoxylem lies towards the .... and the metaxylem lies towards the .... of the organ.
    (1) centre; periphery
    (2) periphery; centre
    (3) periphery; periphery
    (4) centre; centre

23. Which statements about photosynthesis are correct?
    (a) First CO_2 acceptor in C_4 cycle is PGA
    (b) In C_3 plants, first stable product of photosynthesis is RuBP
    (c) Cyclic photophosphorylation results in formation of ATP
    (d) Oxygen liberated during photosynthesis comes from water
    (1) a and b alone are correct
    (2) a and c alone are correct
    (3) c and d alone are correct
    (4) b and c alone are correct

24. Match the following columns.

	Column–I		Column–II
A.	Monohybrid cross	1.	T and t
B.	Test cross	2.	TT
C.	Alleles	3.	Tt × Tt
D.	Homozygous tall	4.	t t
		5.	Tt × tt

    (1) A–3; B–5; C–4; D–2   (2) A–5; B–3; C–2; D–4
    (3) A–3; B–5; C–1; D–2   (4) A–3; B–1; C–5; D–2

25. Bud is the modification of
    (1) Root   (2) Shoot
    (3) Leaf   (4) Flower

26. Which one of the following is exotic species?
    (1) Parthenium   (2) Lantana
    (3) Eichhornia   (4) All of these

27. Mycorrhiza helps in
    (1) Nutrition uptake   (2) Food manufacturing
    (3) Disease resistance   (4) Disease prevention

28. Root-like, leaf-like and stem-like structures are present in
    (1) Bryophytes   (2) Pteridophytes
    (3) Gymnosperms   (4) Both (1) and (2)

29. Match the Column–I with Column–II, and choose the correct combination from the options given below.

	Column–I		Column–II
A.	NADH production	1.	$CO_2 + H_2O$
B.	Product of aerobic respiration	2.	ATP
C.	Oxidative phosphoryiation	3.	Glycolysis
D.	Fermentation	4.	Alcohol and lactic acid

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

30. Arrange the following events of meiosis in correct sequence:
    I. Crossing over
    II. Synapsis
    III. Terminalisation of chiasmata
    IV. Complete disappearance of nucleolus
    (1) II, III, IV, I   (2) II, I, IV, III
    (3) II, I, III, IV   (4) I, II, III, IV

ZOOLOGY

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

(1)	Viviparous	Mammalia
(2)	Possess a mouth with an upper and a lower jaw	Chordata
(3)	Three-chambered heart with one incompletely divided ventricle.	Reptilia
(4)	Cartilaginous endoskeleton	Chondrichthyes

32. Fill in the blanks in the below table.

Blood Group	Antigens on RBCs	Antibody in Plasma	Donor Groups
A	A	Anti-B	A, O
B	B	II	B, O
AB	AB	NIL	A, B, ABO, O
O	I	III	IV

    (1) I–Nil; II–Nil; III–Nil; IV–O
    (2) I–Nil; II–Nil; III–Anti-A; IV–AB
    (3) I–Nil; II–Anti-B; III–Anit-B; IV–O
    (4) I–Nil; II–Anti-A; III– Anti-A and B; IV–O

33. Match the following hormones with the respective disease:

(A)	Insulin	(i)	Addison's disease
(B)	Thyroxin	(ii)	Diabetes insipidus
(C)	Corticoids	(iii)	Dwarfism
(D)	Growth Hormone	(iv)	Goitre
		(v)	Diabetes mellitus

    (1) (A)–(ii); (B)–(iv); (C)–(iii); (D)–(i)
    (2) (A)–(v); (B)–(iv); (C)–(i); (D)–(iii)
    (3) (A)–(ii); (B)–(iv); (C)–(i); (D)–(iii)
    (4) (A)–(v); (B)–(i); (C)–(ii); (D)–(iii)

34. Cancers of internal organs can be detected by
    (1) Radiography   (2) CT
    (3) MRI   (4) All of these

35. The chitinous exoskeleton of arthropods is formed by the polymerization of
    (1) D–glucosamine
    (2) N–acetyl glucosamine
    (3) Lipoglycans
    (4) Keratin sulphate and chondroitin sulphate

36. Which of the following hormones can play a significant role in osteoporosis?
    (1) Aldosterone and prolactin
    (2) Estrogen and parathyroid hormone
    (3) Progesterone and aldosterone
    (4) Parathyroid hormone and prolactin

37. Homozygous purelines in cattle can be obtained by:
    (1) mating of unrelated individuals of same breed
    (2) mating of individuals of different breed
    (3) mating of individuals of different species
    (4) mating of related individuals of same breed

38. Which statements is wrong ?
    (1) After death artery become empty
    (2) At rest stage the cardiac output is maximum
    (3) Heart, and liver receive both oxygenated and deoxygenated blood.
    (4) Hepatic portal vein carry deoxygenated blood from gut to liver

39. 30 cycle of PCR amplified DNA approximately is how many times
    (1) 1 billion times
    (2) 1 million times
    (3) 100 times
    (4) 1000 times

40. Glottis is an opening in the floor of
    (1) Mouth
    (2) Trachea
    (3) Pharynx
    (4) Diaphragm