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SAMPLE PAPER - 97

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

PHYSICS

01. In a parallel plate capacitor, the capacity decreases, if
    (1) area of the plate is decreased
    (2) distance between the plates increases
    (3) dielectric constant decrease
    (4) All of the above

02. As shown in the figure, a very thin sheet of aluminium in placed in between the plates of the condenser. Then the capacity

    Aluminium strip
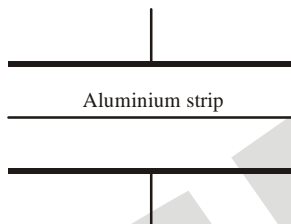
    (1) will increase
    (2) will decrease
    (3) remains unchanged
    (4) may increase or decrease

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


    (1)   (2)

    (3)   (4)
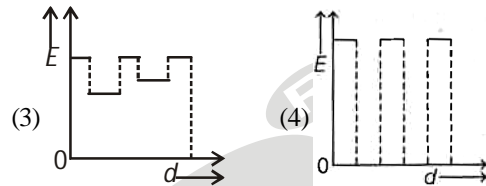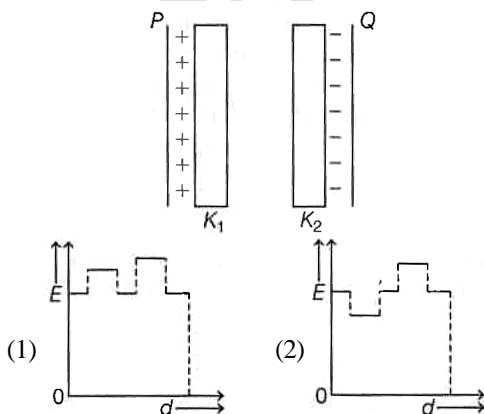
04. The capacity of a parallel plate condenser is $10\mu F$, when the distance between its plates is 8 cm. If the distance between the plates is reduced to 4 cm, then the capacity of this parallel plate condenser will be
    (1) $5\,\mu F$ (2) $10\,\mu F$ (3) $20\,\mu F$ (4) $40\,\mu F$

05. A parallel plate capacitor has a uniform electric field E in the space between the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is

    (1) $\dfrac{1}{2}\varepsilon_0 E^2$ (2) $\dfrac{E^2 Ad}{\varepsilon_0}$

    (3) $\dfrac{1}{2}\varepsilon_0 E^2 Ad$ (4) $\varepsilon_0 E A d$

06. Consider two concentric spherical metal shells of radii r_1 and r_2 ($r_2 > r_1$). If the outer shell has a charge q and the inner one is grounded, the charge on the inner shell is

    (1) $\dfrac{-r_2}{r_1} q$ (2) zero   (3) $\dfrac{-r_1}{r_2} q$ (4) $-q$

07. A capacitor having capacitance l μF with air, is filled with two dielectrics as shown below. How many times capacitance will increase?

    $K_1 = 8$ $K_2 = 4$
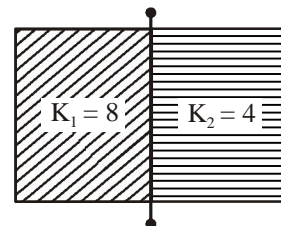
    (1) 12   (2) 6
    (3) 8/3   (4) 3

08. Which one of the following graphs represents correctly the variation of the gravitational field (F) with the distance (r) from the centre of a spherical shell of mass M and radius a


(1)   (2)   (3)   (4)
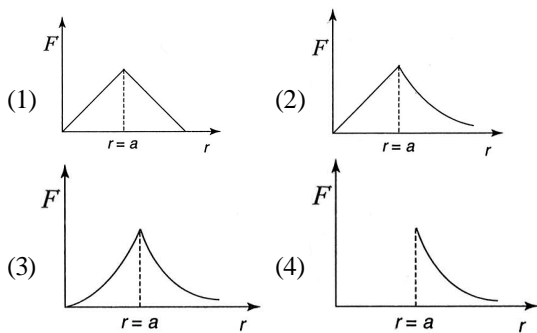
09. The moon's radius is 1/4 that of the earth and its mass is 1/80 times that of the earth. If g represents the acceleration due to gravity on the surface of the earth, that on the surface of the moon is
(1) g/4   (2) g/5   (3) g/6   (4) g/8

10. For a shell of mass M and radius R correct plot for gravitational potential (V) at a distance r from its centre will be

(1)   (2)   (3)   (4)
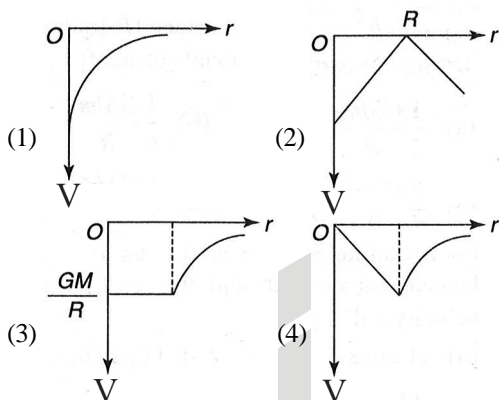
11. A stone is released from the top of a tower. It covers 24.5 m distance in the last second of its journey. What is the height of the tower ?
(1) 98 m   (2) 73.5 m
(3) 58.5 m   (4) 44.1 m.

12. Figure shows x–t graph of a particle. Find the time t such that the average velocity of the particle during the period 0 to t is zero.
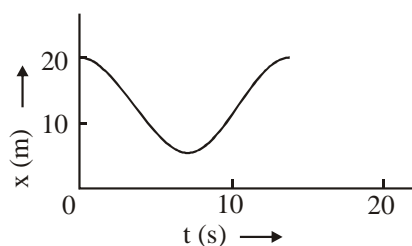
(1) 6 s   (2) 8 s
(3) 10 s   (4) 12 s

13. A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to $v(x) = \beta x^{-2n}$ where β and n are constants and x is the position of the particle. The acceleration of the particle as a function of x is given by
(1) $-2n\beta^2 x^{-2n-1}$ (2) $-2n\beta^2 x^{-4n-1}$
(3) $-2n\beta^2 x^{-2n+1}$ (4) $-2n\beta^2 e^{-4n+1}$

14. The motion of a particle along a straight line is described by equation: $x = 8 + 12t - t^3$ where x is in metre and t in second. The retardation of the particle when its velocity becomes zero is
(1) 12 ms^{-2} (2) 24 ms^{-2} (3) zero   (4) 6 ms^{-2}

15. A truck travelling due north at 20 m/s turns west and travels at the same speed. What is the change in its velocity :
(1) 40 m/s north-west
(2) $20\sqrt{2}$ m/s north-west
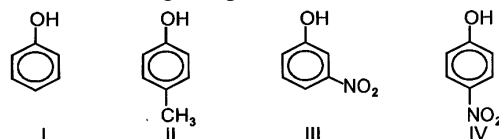(3) 40 m/s south-west
(4) $20\sqrt{2}$ m/s south-west

CHEMISTRY

16. The correct arrangement of the following substituent in the order of increase –I is.
(1) — F < — NMe₂ < — OMe
(2) — F < — OMe < — NMe₂
(3) — NMe₂ < — OMe < — F
(4) — NMe₂ < — F < — OMe

17. Name the group which is ortho para directing even ring deactivating group
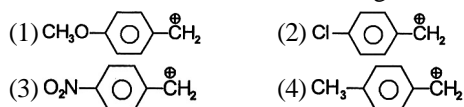(1) CH_3 (2) X (halo)   (3) NO_2 (4) SO_3H

18. In the following compounds,

The order of reactivity for electrophilic substitution is
(1) III > IV > I > II   (2) I > IV > III > II
(3) II > I > III > IV   (4) IV > III > I > II

19. Hyperconjugation phenomenon is possible in:

(1) $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH = CH_2$ (2) $CH_2 = CH_2$

(3) $C_6H_5 - CH = CH_2$ (4) $CH_3 - CH_2 - CH = CH_2$

20. The most stable carbocation amongst the following is:

(1) $CH_3O-\langle O \rangle-\overset{\oplus}{C}H_2$

(2) $Cl-\langle O \rangle-\overset{\oplus}{C}H_2$

(3) $O_2N-\langle O \rangle-\overset{\oplus}{C}H_2$
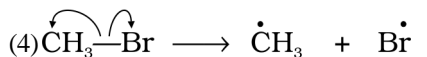
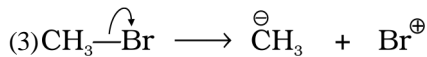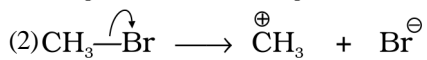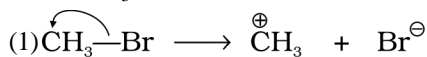(4) $CH_3-\langle O \rangle-\overset{\oplus}{C}H_2$

21. Electrophilic addition reactions proceed in two steps. The first step involves the addition of an electrophile. Name the type of intermediate formed in the first step of the following addition reaction.

$$H_3C—HC = CH_2 + H^+ \longrightarrow ?$$

(1) $2°$ Carbanion   (2) $1°$ Carbocation
(3) $2°$ Carbocation   (4) $1°$ Carbanion

22. Covalent bond can undergo fission in two different ways. The correct representation involving a heterolytic fission of $CH_3—Br$ is

(1) $\overset{\frown}{C}H_3—Br \longrightarrow \overset{\oplus}{C}H_3 + Br^{\ominus}$

(2) $CH_3\overset{\frown}{—}Br \longrightarrow \overset{\oplus}{C}H_3 + Br^{\ominus}$

(3) $CH_3\overset{\frown}{—}Br \longrightarrow \overset{\ominus}{C}H_3 + Br^{\oplus}$

(4) $\overset{\frown}{C}H_3\overset{\frown}{—}Br \longrightarrow \overset{\cdot}{C}H_3 + \overset{\cdot}{B}r$

23. The addition of HCl to an alkene proceeds in two steps. The first step is the attack of H^+ ion to $\rangle C = C \langle$ portion which can be shown as

(1) $H^+ \rangle C = C \langle$

(2) $H^+ \rangle C = C \langle$
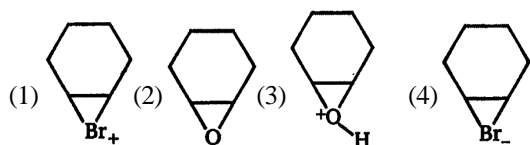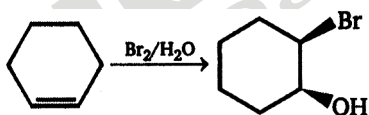
(3) $H^+ \rangle C = C \langle$
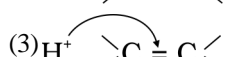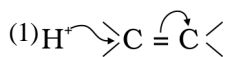
(4) All of these are possible

24. An organic compound containing C, H and N have the percentage 40, 13.33 and 46.67 respectively. Its empirical formula maybe:
(1) C_2H_7N (2) $C_2H_7N_2$ (3) CH_4N (4) CH_5N

25. Which of the following species is an intermediate in the reaction shown below?

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

26. When certain amount of an organic compound is dissolved in acetone, its boiling point increase by $0.34°C$. If K_b for acetone is $17.0°C\,kg\,mol^{-1}$, then find the molality of the solution
(1) 0.1 molal   (2) 0.2 molal
(3) 0.01 molal   (4) 0.02 molal

27. Which statement best explains the meaning of the phrases "like dissolves like"?
(1) A solute will easily dissolve a solute of similar mass
(2) A solvent and solute with similar intermolecular forces will readily form a solution
(3) The only true solutions are formed when water dissolves a non-polar solute
(4) The only true solutions are formed when water dissolves a polar solute

28. Persons are medically considered to have lead poisoning if they have a concentration of greater than 10 μg of lead per decilitre of blood. Concentration in parts per billion is
(1) 1000   (2) 100   (3) 10   (4) 1

29. The molecular weight of a gas is 45. Its density at STP is
(1) 22.4   (2) 11.2   (3) 5.7   (4) 2.0

30. A compound (80 g) on analysis gave C = 24 g, H = 4 g, O = 32 g. Its empirical formula is
(1) $C_2H_2O_2$ (2) C_2H_2O (3) CH_2O_2 (4) CH_2O

BOTANY

31. Mark the correct statements.
(1) In the 24 hour average duration of cell cycle of a human cell, cell division proper lasts for only about an hour
(2) Interphase lasts more than 95% of the duration of cell cycle
(3) DNA content gets half at S phase of interphase
(4) G_2 phase is also called post mitotic phase
(1) (1) and (2)   (2) (2) and (3)
(3) (1), (2) and (4)   (4) (3) and (4)

32. G_0 phase is characterised by
(1) DNA duplication   (2) active metabolism
(3) S phase   (4) M phase

33. If the initial amount of DNA is 8 C, then after S phase the amount of DNA would be
(1) 4C   (2) 8C   (3) 64C   (4) 16C

34. A bacterial cell divides every minute. It was found that it filled the Petri-plate in half-an-hour. In how much time was the plate filled one-fourth?
(1) 7.5 minutes   (2) 15 minutes
(3) 28 minutes   (4) 29 minutes

35. Cells having 20 bivalents undergoes meiosis I. Calculate the number of chromatids in each nuclei after meiosis I.
(1) 20   (2) 40   (3) 10   (4) 80

36. If the number of bivalents is 8 in metaphase I, what shall be the number of chromosomes in daughter cells after meiosis I and meiosis II, respectively.
(1) 8 and 4   (2) 4 and 4
(3) 8 and 8   (4) 16 and 8

37. Synaptonemal complex forms in
(1) zygotene (2) pachytene
(3) diplotene (4) diakinesis

38. Match Column-I with Column-II and select the correct option.

	Column-I		Column-II
(i)	Zygotene	(a)	Terminalisation of chiasmata
(ii)	Diplotene	(b)	Synapsis
(iii)	Metaphase I	(c)	Crossing over
(iv)	Diakinesis	(d)	Dissolution of synaptonemal complex
(v)	Pachytene	(e)	Best stage for the study of chiasmata
		(f)	Nuclear membrane and nucleolus diappear
		(g)	Tetrads are arranged on equatorial line

(1) (i)–(b); (ii)–(e); (d) (iii)–(g); (iv)–(a); (f); (v)–(c)
(2) (i)–(b); (ii)–(c); (iii)–(g); (iv)–(a); (d); (f); (v)–(e)
(3) (i)–(b); (ii)–(g); (iii)–(c); (iv)–(a); (d); (e); (v)–(f)
(4) (i)–(b); (ii)–(a); (iii)–(d); (iv)–(e); (c); (v)–(f)

39. Organelle important in spindle formation during nuclear division is
(1) Centriole (2) Golgi body
(3) Chloroplast (4) Mitochondrion

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

41. Raw materials required for light reactions are
(1) ADP and H_2O
(2) ADP, H_2O and NADP
(3) ADP and $NADPH_2$
(4) ATP and NADP

42. Law of limiting factor is
(1) Law of maximum
(2) Law of minimum
(3) Law of optimum
(4) All of the above

43. Fill in the blanks:
1. Light saturation occurs at .....a..... per cent of full sunlight.
2. There is a .....b..... relationship between incident light and CO_2 fixation rates at low light intensities.
3. C_3 plants show saturation at about ...c... µl L^{-1} while C_4 corresponds to saturation at about ...d... µl L^{-1}
(1) a–2–5%, b—sigmoid, c–350, d–460
(2) a–50%, b—linear, c–460, d—350
(3) a–10%, b—sigmoid, c–360, d–450
(4) a–10%, b—linear, c–450, d–360

44. RuBisCO is enzyme for
(1) Regeneration of RuBP
(2) Photolysis of water
(3) CO_2 fixation
(4) All of the above

45. How much oxygen is formed from 264 g of CO_2 and 216 g of H_2O?
(1) 48 g (2) 480 g
(3) 180 g (4) 192 g

ZOOLOGY

46. Read the statements (i-iv) and choose the correct option:
(i) Increase in melanised moths after industrialisation in Great Britain is a proof of Natural selection.
(ii) More individuals acquiring mean character value cause disruption.
(iii) Change in allelic frequency leads to hardy-Weinberg equilibrium.
(iv) Genetic drift changes allelic frequency in future generations.
(1) (ii) is correct
(2) (iv) is correct
(3) (i) and (iv) are correct
(4) (i) and (iii) are correct

47. Mark the A, B, C and D in the following figure
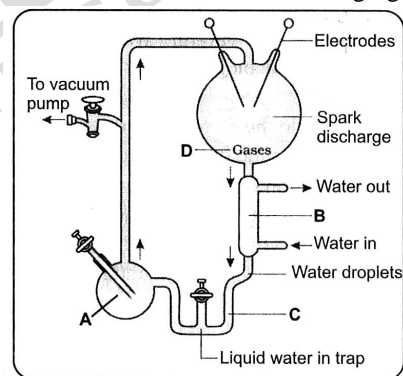
(1) A–Water containing organic compound; B–Condenser; C–Boiling water; D–CH_4, H_2, H_2O and NH_3 gases
(2) A–Boiling water; B–Condenser; C–Water containing organic compounds; D–CH_4, NH_3, H_2O and H_2 gases
(3) A–Condenser; B–Boiling water; C–Water containing organic compound; D–CH_4, NH_3, H_2O and H_2 gases
(4) A–Condenser; B–Water containing organic compound; C–CH_4, NH_3, H_2O and H_2 gases; D–Boiling water

48. The fitness, according to Darwin, refers ultimately and only to :
(1) Reproductive fitness
(2) Fit to search the food easily
(3) Protect itself from predator
(4) Fit to produce large quantity of enzyme for digestion

49. Read the following statements :
(A) Louis Pasteur with careful experimentation demonstrated biogenesis by pre-sterilized swan neck flask.
(B) Oparin-Haldane stated that the first form of life could have come from pre-existing chemicals.
(C) The condition on earth were-high temp. volcanic Storm, reducing atmosphere contain CH_4, NH_3, O_2 etc.
(D) Sugar, N_2-Bases, pigment and fat were formed in electric discharge experiment.
Choose the option with all the correct statement ?
(1) A, B, C, D   (2) A, B, C
(3) A, B, D   (4) A, C, D

50. How many statements are correct ?
(i) The universe is very old almost 20 billion years old.
(ii) Earth is formed about 4.5 billion years back.
(iii) There was no atmosphere on early earth.
(iv) Life appeared 500 million years after the formation of earth.
(v) Life came out of decaying and rotting matter like straw, mud etc. This was the theory of spontaneous generation.
(1) Three   (2) Five   (3) Four   (4) Two

51. When selection acts to eliminate both extremes from array of phenotypes, the frequency of intermediate type, which is already more is increased. This is called as :
(1) Disruptive selection
(2) Balancing selection
(3) Stabilising selection
(4) Non-directional section

52. Which of the following is correct sequence of events in the origin of new species according to Darwinism ?
(1) Natural selection, variation and their inheritance, survival of fittest, struggle for existence, high rate of reproduction
(2) High rate of reproduction, variations, and their inheritance, struggle for existence and survival of fittest
(3) High rate of reproduction, struggle for existence, variations and survival of fittest and their inheritance natural selection
(4) Survival of the fittest, variations and their inheritance, struggle for existence, high rate of reproduction

53. Flying squirrel and flying phalanger represent the phenomenon of :
(1) Divergent evolution   (2) Convergent evolution
(3) Adaptive radiation   (4) Divergent radiation

54. In 1953 S.L. Miller created primitive earth conditions in the laboratory and gave experimental evidence for origin of first form of life from preexisting non-living organic molecules. The primitive earth conditions created include:
(1) low temperature, volcanic storms, atmosphere rich in oxygen
(2) low temperature, volcanic storms, reducing atmosphere
(3) high temperature, volcanic storms, non-reducing atmosphere
(4) high temperature, volcanic storms, reducing atmosphere containing CH_4, NH_3 etc.

55. The first human-like being the hominid which probably did not eat meat having cranial capacity 650-800 cc was:
(1) Homo habilis   (2) Homo sapiens
(3) Australopithecus   (4) Dryopithecus

56. The sequence recognized by restriction endonucleases
(1) ORI
(2) Recognition sequence
(3) Palindrome sequence
(4) Both (2) and (3)

57. Select the incorrect matching.
(1) Chelone – Turtle
(2) Testudo – Tortoise
(3) Chameleon – Tree lizard
(4) Calotes – Wall lizard

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

59. The process by which PTH increases blood Ca^{2+} level except
(1) Acts on bones and stimulates the process of bone reabsorption/dissolution/demineralizations
(2) Reabsorption of Ca^{2+} by the renal tubules
(3) Increases Ca^{2+} absorption from the digested food
(4) Increases osteoblastic activity

60. Which of the following acts as secondary messenger?
(1) Ca^{2+} (2) IP_3 (3) cAMP   (4) All