S.C.R.A. → 2011

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

T.B.C. : P–FPEN–L–CUF

Test Booklet Series

Serial No. 157913

A

TEST BOOKLET

PHYSICAL SCIENCES

Paper—II

Time Allowed : Two Hours

Maximum Marks : 200

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES ***NOT*** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet***. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**

    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.

    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.

    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.

    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. A particle moves rectilinearly with retardation α whose magnitude is dependent of velocity as $\alpha = b\sqrt{v}$ where 'b' is a positive constant. The initial velocity of the particle is v_o. How long will the particle move before coming to rest ?

(a) $\frac{\sqrt{v_o}}{b}$

(b) $\frac{2\sqrt{v_o}}{b}$

(c) $\frac{3\sqrt{v_o}}{b}$

(d) $\frac{v_o}{b}$

2. A model of solar system is scaled down in the ratio 'k' but of materials of same mean density and actual materials of the planets and the sun. What happens to orbital periods of revolution of the planetary models ?

(a) The orbital period of revolution does not change

(b) The orbital period of revolution increases by a factor 'k'

(c) The orbital period of revolution decreases by a factor 'k'

(d) Data insufficient to draw the conclusion

3. A pulse of the form $y = ae^{-bx^2}$ is formed on a rope. Which one of the following functions represents the pulse travelling at 10 m/s in the negative x-direction ?

(a) $y = ae^{-b(x-10t)^2}$

(b) $y = e^{(-bx^2+10t)}$

(c) $y = ae^{-b(x+10t)^2}$

(d) $y = e^{(-bx^2-10t)}$

4. The ultimate limit of resolution of an optical microscope is set by :

(a) aberrations

(b) length of microscope tube

(c) design of objective lens

(d) diffraction of light

5. 8 g of oxygen and 7 g of nitrogen are mixed in a container. What is the value of 'n' in the expression PV = nRT of this mixture ?

(a) 1/4

(b) 1/2

(c) 2

(d) 15

6. The ear piece of a telephone is made of material having :

(a) large hysteresis and high permeability

(b) low hysteresis and large retentivity

(c) high permeability and low eddy current only

(d) low hysteresis, low eddy current and high permeability

7. A wire of length L is placed parallel to the lines of force in a uniform magnetic field B. If I is the current in the wire, then it will experience :

(a) a force in the direction of magnetic field

(b) a force in the direction opposite to the direction of magnetic field

(c) a force in the direction perpendicular to the direction of magnetic field

(d) no force

(Contd.)

8. A ball suspended by a thread swings in a vertical plane so that acceleration values at the extreme and lowest positions are equal. The thread deflection angle at the extreme position is :

(a) $\cos^{-1}\left(\frac{3}{4}\right)$

(b) $\cos^{-1}\left(\frac{2}{3}\right)$

(c) 60°

(d) 30°

9. When two plates of different metals are placed in an electrolyte, the developed emf between them depends on :

(a) the type of electrolyte

(b) distance between the plates

(c) position of the two metals in the electrochemical series

(d) All of the above

10. A vessel contains oil of density 0.8 g/cc over mercury of density 13.6 g/cc. A homogeneous sphere floats with half of its volume immersed in mercury and the other half in oil. What is the density of the material of the sphere ?

(a) 2.5 g/cc

(b) 3.3 g/cc

(c) 6.6 g/cc

(d) 7.2 g/cc

11. A point moves along x-axis according to the law $x = a\sin^2\left(\omega t - \frac{\pi}{4}\right)$. The amplitude and time period of oscillation of the point are respectively :

(a) $a, \frac{\pi}{2\omega}$

(b) $\frac{a}{2}, \frac{\pi}{\omega}$

(c) $\frac{a}{2}, \frac{\pi}{2\omega}$

(d) $a, \frac{\pi}{\omega}$

12. An electric charge 10^{-3} μC is placed at the origin (0, 0) on the x-y plane. The points A and B are situated at points $(\sqrt{2}, \sqrt{2})$ and (2, 0) respectively. What is the potential difference between the points A and B ?

(a) 9 V

(b) 4.5 V

(c) 2 V

(d) 0

13. Consider n moles of an ideal gas at temperature T kelvin. If it expands isothermally from volume V_1 to volume V_2, the heat added to the gas is :

(a) $nRT\ln\left(\frac{V_1}{V_2}\right)$

(b) $nRT\ln\left(\frac{V_2}{V_1}\right)$

(c) $nRT\left(\frac{V_2}{V_1}\right)$

(d) None of the above

(Contd.)

14. On a long straight road at night a man watches the light from the head lamps of an approaching car. At a certain point he is able to estimate the distance of the car from his position. He can do this by knowing which of the following ?

1. the separation of the car head lamps
2. the resolving power of his eye
3. the wavelength of light
4. the speed of the car

Select the correct answer using the code given below :

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

15. A piece of magnet having length L and pole strength m is magnetized by subjecting it to a uniform magnetic field. The piece is then transversely cut into three pieces. Then the intensity of magnetization will :

(a) be one-third that of original piece
(b) be three times that of original piece
(c) remain same
(d) be one-ninth of original piece

16. Two α-particles, each of 13.2 MeV energy are produced when a $_3Li^6$ nucleus is bombarded with a 4.4 MeV deuteron. What is the Q-value of the reaction ?

(a) 22 MeV
(b) 30.8 MeV
(c) 22 J
(d) 30.8 J

17. A current is flowing in a circular coil of radius r and the magnetic field at the centre is B_0. At what distance from the centre on the axis of the coil is the magnetic field $B_0/27$?

(a) $\sqrt{3}\,r$
(b) $2\sqrt{2}\,r$
(c) $\sqrt{2}\,r$
(d) $2r$

Note : For the next *02 (two)* questions that follow :

An ideal ammeter and a voltmeter are connected in series to a battery of emf ε. When certain resistance is connected in parallel with the voltmeter, the reading of the latter decreases η times whereas the reading of the ammeter increases same number of times.

18. If G is the resistance of the voltmeter and r is the internal resistance of the battery, then which one of the following is correct ?

(a) $G = \eta r$
(b) $G = 2\eta r$
(c) $G = 4\eta r$
(d) None of the above

19. What is the reading of voltmeter after connection of resistance ?

(a) $\dfrac{\varepsilon(\eta-1)}{\eta+1}$

(b) $\dfrac{\varepsilon(\eta+1)}{\eta}$

(c) $\dfrac{\varepsilon(\eta+1)}{\eta-1}$

(d) None of the above

(Contd.)

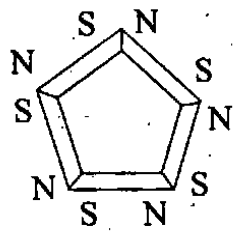
20. Consider a missile shot up from the surface of earth in the vertically upward direction with velocity v equal to escape velocity. Taking the earth to be a spherically symmetric object with radius R, at what distance from the centre of the earth will the speed of the missile be v/2 ?

(a) 3R/2

(b) 2R

(c) 3R

(d) 4R

21. 

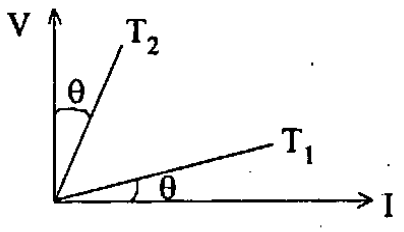
Five pieces of identical bar magnets each having magnetic moment M are placed in the form of a pentagon as shown above in the figure. What will be the resultant magnetic moment ?

(a) 5 M

(b) M/5

(c) $\sqrt{5}$ M

(d) 0

22. 

V(Voltage)-I(Current) for a conductor at temperatures T_1 and T_2 is as shown in the figure above. $T_2 - T_1$ is proportional to :

(a) sin 2θ

(b) cos 2θ

(c) tan 2θ

(d) cot 2θ

23. Resistivity of a potentiometer wire is ρ and the area of cross-section of the wire is A. If I is the current flowing through the wire, what is the potential gradient of the wire ?

(a) $\frac{I\rho}{A}$

(b) $\frac{I}{\rho A}$

(c) $\frac{IA}{\rho}$

(d) $\frac{I\rho}{2A}$

24. A body of mass m falling vertically downward with speed u is given an upward impulse I = FΔt > mu. With g being local gravitational acceleration, the maximum height h it will reach from the location of the impulse source is :

(a) $h = \frac{1}{g}\left(\frac{I}{m} - u\right)$

(b) $h = \frac{1}{2g}\left(\frac{I}{m} - u\right)^2$

(c) $h = \frac{1}{g}\left(\frac{I}{m} - u\right)^2$

(d) $h = \frac{1}{2g}\left(\frac{I}{m} - u\right)$

25. Which one of the following is true for the angle θ between magnetic field lines on the surface of ferromagnetic material and normal to the surface of the ferromagnetic material ?

(a) $\theta = 0°$

(b) $0° \leq \theta \leq 45°$

(c) $45° < \theta < 90°$

(d) $\theta = 90°$

(Contd.)

26. In a standing wave, the different particles vibrate with :

(a) same amplitude

(b) random amplitude

(c) variable amplitude independent of their location

(d) amplitude that depends on the location of the particle

27. A charge q is distributed with constant linear density around a circle of radius 'b' with centre at the origin in the xy-plane. What is the electric field at the point (0, 0, z) in cartesian coordinates ?

(a) $E_z = \frac{q}{4\pi\varepsilon_0} \frac{z}{z^2 + b^2}$

(b) $E_z = \frac{q}{4\pi\varepsilon_0} \frac{b}{(z^2 + b^2)^{\frac{3}{2}}}$

(c) $E_z = \frac{q}{4\pi\varepsilon_0} \frac{1}{z^2 + b^2}$

(d) $E_z = \frac{q}{4\pi\varepsilon_0} \frac{z}{(z^2 + b^2)^{\frac{3}{2}}}$

28. A copper wire of length 1000 m and cross-sectional area 1 mm^2 carries a current 4.5 A. Assume that each copper atom contributes one conduction electron. What is the speed of propagation of electric field along the conductor which causes the drift motion ?

[density of copper is 9.0×10^3 kg m^{-3} and atomic mass is 63.5]

(a) 3.0×10^{-3} m/s

(b) 3.0×10^{-4} m/s

(c) 3.0×10^{8} m/s

(d) 3.0×10^{10} m/s

29. A rigid insulated box is divided into two parts with a partition. One part is occupied by 1 gram mole of an ideal gas at temperature T_1 and the other by 2 gram moles of the same ideal gas at temperature T_2. When the partition is removed, what is the final equilibrium temperature T of the mixture ?

(a) $T = \frac{T_1 + T_2}{2}$

(b) $T = \frac{T_1 + 2T_2}{3}$

(c) $T = \frac{2T_1 + T_2}{3}$

(d) $T = \frac{T_1 + 4T_2}{5}$

30. A camera fitted at the bottom of an aircraft is to take photographs of the terrain vertically below for map making purposes. If the camera lens has a focal length of 15 cm and the scale of the terrain photographs is to be 1 : 50,000, then what is the best flying altitude of the aircraft ?

(a) 30 km

(b) 25 km

(c) 15 km

(d) 7.5 km

31. A 12 V battery connected to a 6 Ω, 10 H coil through a switch drives a constant current in the circuit. The switch is suddenly opened. Assuming it takes 1 ms to open the circuit, the average emf induced across the coil is :

(a) 20000 V

(b) 10000 V

(c) 5000 V

(d) 20 V

(Contd.)

32. To increase the magnification of telescope :
(a) the objective and eye piece should be of short focal length
(b) the objective and eye piece should be of large focal length
(c) the objective should be of large focal length and eye piece should be of short focal length
(d) the objective should be of short focal length and eye piece should be of large focal length

33. Consider a simple pendulum of mass m suspended by a thin string. The mass m is subjected to an external horizontal force F. In equilibrium, the string makes an angle θ with the vertical. With g being the local gravitational acceleration, the force F is equal to :
(a) mg sin θ cos θ
(b) mg cos θ
(c) mg sin θ
(d) mg tan θ

34. An ideal gas with specific heat ratio ($\gamma = 5/3$) is originally of pressure P_0 and volume V_0. If it expands adiabatically to final volume V_1, what is the work done (W) by the gas in this process ?

(a) $W=\frac{3P_0V_0}{2}\left[1-\left(\frac{V_0}{V_1}\right)^{\frac{1}{2}}\right]$

(b) $W=\frac{2P_0V_0}{3}\left[1-\left(\frac{V_0}{V_1}\right)^{\frac{1}{2}}\right]$

(c) $W=\frac{2P_0V_0}{3}\left[1-\left(\frac{V_0}{V_1}\right)^{\frac{2}{3}}\right]$

(d) $W=\frac{3P_0V_0}{2}\left[1-\left(\frac{V_0}{V_1}\right)^{\frac{2}{3}}\right]$

35. What is the number of neutrons in 7 g of $_6C^{14}$?
(a) $8 \times 6.02 \times 10^{23}$
(b) $7 \times 6.02 \times 10^{23}$
(c) $6 \times 6.02 \times 10^{23}$
(d) $4 \times 6.02 \times 10^{23}$

36. A block of glass having thickness 2 m is immersed 18 m deep in water. A ray of light is normally incident on the block after passing through the water. The time taken by the ray to cross the glass block from the moment of incidence on the water surface is :
[Refractive index of glass is 3/2 and that of water is 4/3]
(a) 9×10^{-8} s
(b) 8×10^{-8} s
(c) 2×10^{-8} s
(d) 10^{-8} s

37. The longest wavelength of Lyman series of hydrogen atom and the longest wavelength of Balmer series of the same spectrum bears the ratio :
(a) 27 : 5
(b) 5 : 27
(c) 4 : 1
(d) 1 : 4

(Contd.)

Note : For the next *02 (two)* questions that follow :

A cyclist rides along the circumference of a circular horizontal plane of radius R, the coefficient of friction being dependent only on the distance r from the centre of plane as $\mu = \mu_0\left(1-\frac{r}{R}\right)$ where μ_0 is a constant.

38. What is the radius of the circle with the centre at the point along which the cyclist can ride with maximum velocity ?
    (a) R
    (b) R/2
    (c) R/3
    (d) R/4

39. What is the maximum velocity (with reference to above question) ?
    (a) $\frac{\mu_0 Rg}{4}$
    (b) $\frac{\mu_0 Rg}{2}$
    (c) $\sqrt{\frac{\mu_0 Rg}{4}}$
    (d) None of the above

40. A particle moving with simple harmonic motion has an amplitude A. Its distance from the centre where the velocity is half of the maximum value will be :
    (a) $\pm\frac{A}{\sqrt{2}}$
    (b) $\pm\frac{A}{\sqrt{3}}$
    (c) $\pm\frac{\sqrt{3}A}{2}$
    (d) $\pm\frac{A}{2}$

41. A plane mirror is placed vertically 15 cm away from the image (I) formed by a concave mirror of focal length 20 cm when a pencil (O) is placed at a distance of 30 cm from the latter. The position of the image (I') from the concave mirror formed by the plane mirror is :
    (a) 30 cm
    (b) 60 cm
    (c) 75 cm
    (d) 90 cm

42. A near-sighted man can clearly see up to a distance of 1.5 m. What is the power of the lens of the spectacles necessary for the remedy of the defect ?
    (a) + 0.67 D
    (b) – 0.67 D
    (c) + 1.5 D
    (d) – 1.5 D

43. Two radioactive nuclei have half lives 15 minutes and 20 minutes respectively. Initially they have equal number of nuclei. What is the ratio of their remaining nuclei after 1 hour ?
    (a) 1 : 2
    (b) 2 : 1
    (c) 3 : 4
    (d) 4 : 3

(Contd.)

44. Consider the following statements :

1. The focal length of a lens is dependent on the wavelength of light.
2. The refractive index of the material of the lens is not same for all wavelengths of light.

Which one of the following is correct in respect of the above statements ?

(a) Both the statements are true and statement-2 is the correct explanation of statement-1

(b) Both the statements are true but statement-2 is not the correct explanation of statement-1

(c) Statement-1 is true, but statement-2 is false

(d) Statement-1 is false, but statement-2 is true

45. The sum of the individual masses of a $_3Li^7$ nucleus is 0.042 u more than the actual mass of the $_3Li^7$ nucleus. What is the binding energy per nucleon of the nucleus ?

[1u = ≡ 931 MeV]

(a) 13.034 MeV

(b) –13.034 MeV

(c) 5.586 MeV

(d) –5.586 MeV

46. Consider the following in respect of nuclear forces :

1. Nuclear forces are charge independent.
2. Nuclear forces are always attractive.

Which of the statements given above is/ are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

47. What is the ratio of the kinetic energy of an electron to the kinetic energy of a proton subjected to same potential difference ?

(a) 1 : 1836

(b) 1836 : 1

(c) 1 : 1

(d) 1 : 2

48. The linear momentum of the electron revolving in the second Bohr's orbit of radius r of hydrogen atom is :

(a) $\frac{h}{2\pi r}$

(b) $\frac{h}{2\pi}$

(c) $\frac{h}{\pi r}$

(d) $\frac{h}{\pi}$

49. Consider the following statements :

1. The penetrating power of α-particle is less than that of β particle.
2. Penetrating power of a particle is inversely proportional to its mass.

Which one of the following is correct in respect of the above statements ?

(a) Both the statements are true and statement-2 is the correct explanation of statement-1

(b) Both the statements are true but statement-2 is not the correct explanation of statement-1

(c) Statement-1 is true, but statement-2 is false

(d) Statement-1 is false, but statement-2 is true

(Contd.)

50. Earth's magnetic field has no vertical component :
(a) at the geographical north pole
(b) on magnetic equator
(c) on both the magnetic poles
(d) at the 45° latitude

51. For mobile charge carriers of mass m, the mobility is :
(a) independent of m
(b) directly proportional to m^2
(c) inversely proportional to m
(d) directly proportional to m

52. Which one of the following is correct ?
(a) Heat and work are intrinsic properties of a system
(b) Neither heat nor work is intrinsic property of a system
(c) Heat is an intrinsic property while work is not
(d) Work is an intrinsic property while heat is not

53. The internal resistance of a dry cell is :
(a) equal to that of electrolytic cell
(b) smaller than that of electrolytic cell
(c) higher than that of electrolytic cell
(d) zero

54. A body is acted upon a force which varies inversely as the distance x covered, The work done on the body is proportional to :
(a) x^2
(b) x
(c) $\sqrt{x}$
(d) $\log_e x$

55. There is a string of length L with ends fixed at x = 0 and x = L. Let c be the velocity of propagation of waves. For the standing waves $y = A \sin\left(\frac{\omega x}{c}\right)$, the resonant angular frequencies are :

(a) $\omega = \left(n + \frac{1}{2}\right)\frac{\pi L}{c}$

(b) $\omega = \left(n + \frac{1}{2}\right)\frac{\pi c}{L}$

(c) $\omega = \frac{n\pi L}{c}$

(d) $\omega = \frac{n\pi c}{L}$

where n is an integer.

56. Consider an ice cube of volume V m^3 and density 0.9 g/cm^3 floating in water. What is the minimum vertical downward force (in Newton) needed to be applied to immerse the cube completely ?
(a) Vg
(b) 10 Vg
(c) 100 Vg
(d) 0.1 Vg

57. What is the ratio of the radii of the nuclei of $_{13}Al^{27}$ and $_{52}Te^{125}$?
(a) 3 : 5
(b) 1 : 4
(c) 27 : 125
(d) 5 : 3

(Contd.)

Note : For the next *02 (two)* questions that follow :

There are two equal charges Q each, kept fixed at (0, 0, c) and (0, 0, −c).

58. For another particle with charge q, moving along x-axis, at what position x_0 is the magnitude of total force on q maximum ?

(a) $x_0 = \pm \frac{c}{\sqrt{2}}$

(b) $x_0 = \pm \sqrt{2}\, c$

(c) $x_0 = \pm c$

(d) $x_0 = \pm \frac{c}{2}$

59. What is the magnitude of the maximum force (with reference to above question) ? [All units are expressed in C G S (electrostatic) units]

(a) $\frac{4Qq}{3\sqrt{3}c^2}$

(b) $\frac{2Qq}{3\sqrt{3}c^2}$

(c) $\frac{4Qq}{\sqrt{3}c^2}$

(d) None of the above

60. Three equal resistances R each are connected to form a triangle ABC, one in each side. If an electric potential V is applied between points A and B, what is the current flowing out at B ?

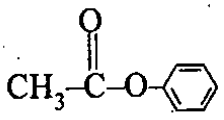
(a) 2V/R

(b) 2V/(3R)

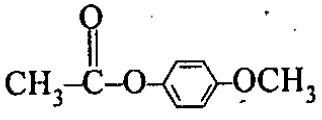
(c) 3V/(2R)

(d) V/R

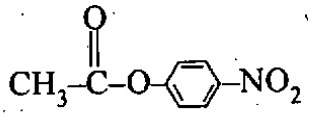
61. Consider the following compounds :



I



II



III

What is the correct order of reactivity of the above compounds towards alkaline hydrolysis ?

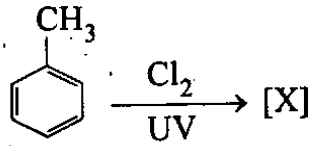
(a) II < I < III

(b) I < II < III

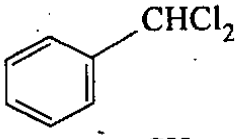
(c) III < I < II

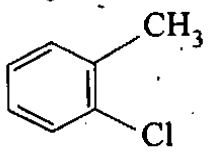
(d) II < III < I

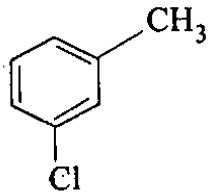
62. Consider the following reaction :

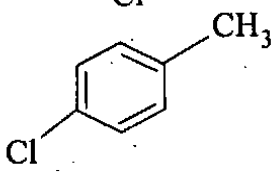


What is the major product [X] of the reaction ?

(a) 

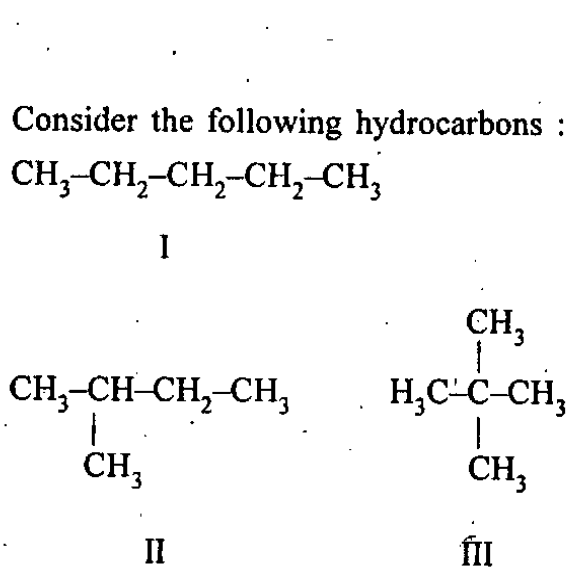
(b) 

(c) 

(d) 

(Contd.)

63. Consider the following hydrocarbons :



What is the correct order of the boiling points of above compounds ?

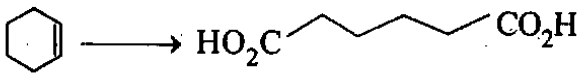
(a) III > II > I

(b) I > II > III

(c) II > III > I

(d) II > I > III

64. Consider the following reaction :



The conversion can be affected by :

(a) $KMnO_4$–H_2SO_4

(b) OsO_4

(c) $KMnO_4$

(d) $KMnO_4$–NaOH

65. Consider the following statements in respect of aromatic compounds :

1. It must be planar.
2. It must have uninterrupted cyclic cloud of π electrons above and below the plane of the molecule.
3. The π cloud must contain odd number of pair of π electrons.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

66. Consider the following compounds :

1. Benzene
2. Bromobenzene
3. Benzaldehyde
4. Naphthalene

What is the correct order of reactivity of the above compounds in electrophilic nitration reaction ?

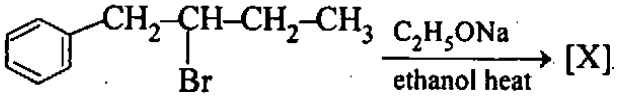
(a) 1 > 2 > 3 > 4

(b) 1 > 4 > 2 > 3

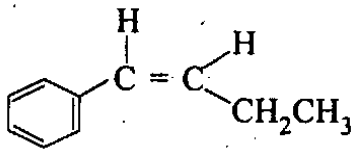
(c) 4 > 1 > 2 > 3

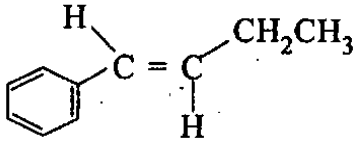
(d) 4 > 1 > 3 > 2

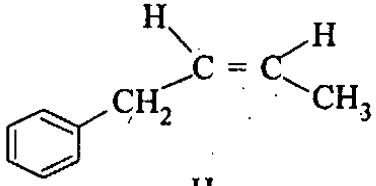
67. Consider the following reaction :

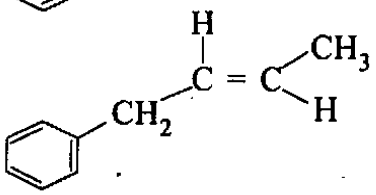


What is the major product [X] of the following reaction ?

(a) 

(b) 

(c) 

(d) 

(Contd.)

68. In which of the following reactions, chloroform is ***not*** involved as the reactant or the product ?

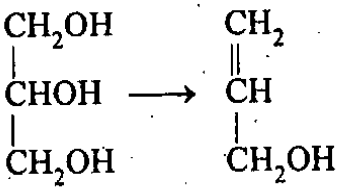
(a) Carbylamine test for amines

(b) Riemer-Tiemann reaction

(c) Reaction of acetophenone with bleaching powder

(d) Reaction of diethylketone with bleaching powder

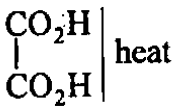
69. Consider the following conversion :



The conversion can be affected using :

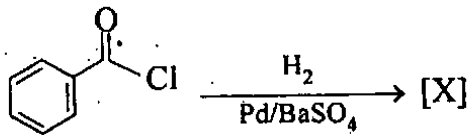
(a) P_2O_5/heat

(b) Conc. H_2SO_4/heat

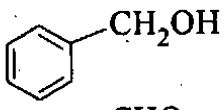
(c)  heat

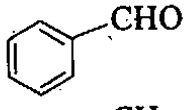
(d) CH_3CO_2H/heat

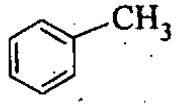
70. Consider the following reaction :



What is the major product [X] in the reaction ?

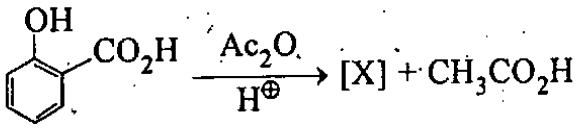
(a) 

(b) 

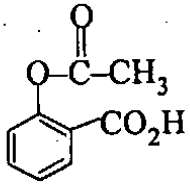
(c) 

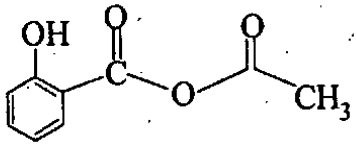
(d) 

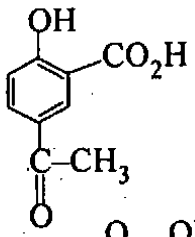
71. Consider the following reaction :

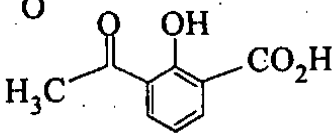


What is the major product [X] of the reaction ?

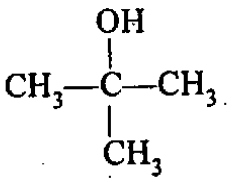
(a) 

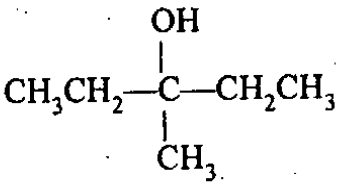
(b) 

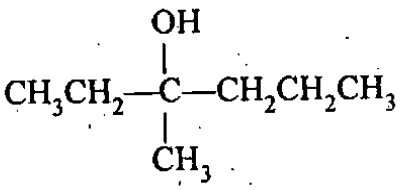
(c) 

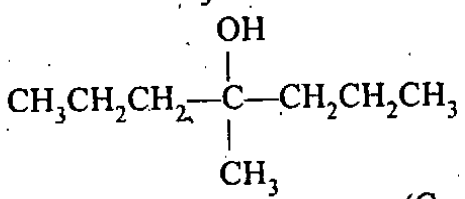
(d) 

72. Which one of the following tertiary alcohol can ***not*** be prepared from the reaction of an ester with excess Grignard reagent ?

(a) 

(b) 

(c) 

(d) 

(Contd.)

73. Which one of the following is correct for cellulose ?

(a) It is a branched chain polymer of β-D-glucose

(b) It is a linear chain polymer of β-D-glucose

(c) It is a linear chain polymer of α-D-glucose

(d) It is a branched chain polymer of α-D-glucose

74. Which one of the following is an essential amino acid ?

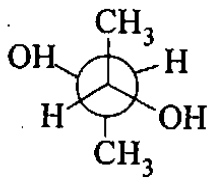
(a) Glycine

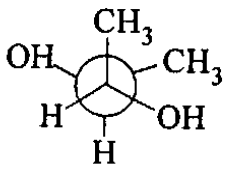
(b) Serine

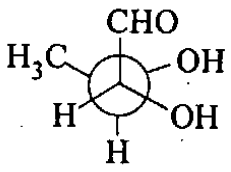
(c) Alanine

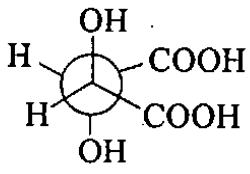
(d) Phenylalanine

75. Which one of the following Newman projections represents a meso compound ?

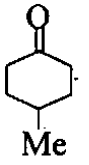
(a) 

(b) 

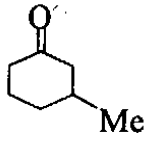
(c) 

(d) 

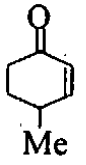
76. Which of the following compounds exhibit optical activity ?



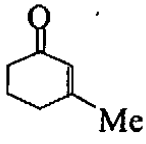
I



II



III



IV

Select the correct answer using the code given below :

(a) I and II

(b) I and IV

(c) II and III

(d) III and IV

77. When propylene reacts with hydrogen bromide in presence of peroxide, the product formed is :

(a) n-propyl alcohol

(b) propylene peroxide

(c) n-propyl bromide

(d) isopropyl bromide

78. Consider the following statements :

1. p-nitrostyrene easily undergoes nucleophilic addition reaction with diethylamine but styrene can not.
2. The terminal methylene group in p-nitrostyrene carries a negative charge and behaves as a nucleophile.

Which one of the following is correct in respect of the above two statements ?

(a) Both the statements are true and statement-2 is the correct explanation of statement-1

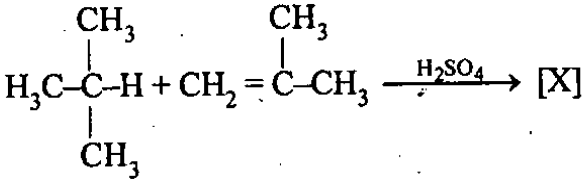
(b) Both the statements are true but statement-2 is ***not*** the correct explanation of statement-1

(c) Statement-1 is true but statement-2 is false

(d) Statement-1 is false but statement-2 is true

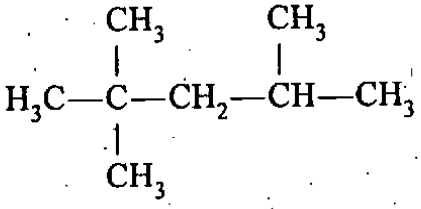
(Contd.)

79. Consider the following reaction :

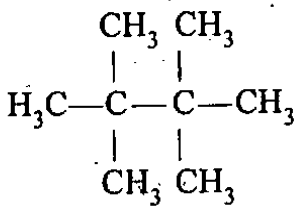


What is the major product [X] of the reaction ?

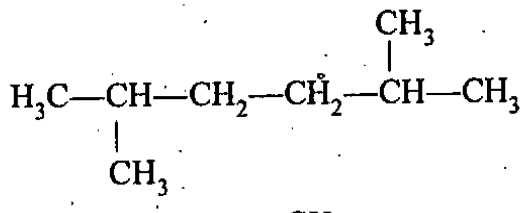
(a)



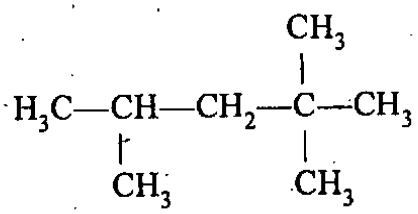
(b)



(c)



(d)



80. The enzyme pepsine hydrolyses :
(a) glucose to ethyl alcohol
(b) fats to fatty acids
(c) polysaccharides to monosaccharides
(d) proteins to aminoacids

81. One litre of a sample of hard water contains 111 mg of $CaCl_2$ and 95 mg of $MgCl_2$. What is the total hardness of water in terms of $CaCO_3$ per 10^6 parts of water by mass ?
[Atomic weights of Ca = 40, Mg = 24, Cl = 35.5]
(a) 100 ppm
(b) 200 ppm
(c) 206 ppm
(d) 103 ppm

82. The black ash formed in the manufacture of sodium carbonate by Le-Blanc process contains :
(a) $Na_2CO_3 + Na_2SO_4$
(b) $Na_2CO_3 + CO$
(c) $Na_2CO_3 + CaS$
(d) $Na_2CO_3 + C$

83. A compound X on heating gives a colourless gas. The residue was treated with water and filtered. The filtrate was a solution of Y. Excess CO_2 is bubbled through aqueous solution of Y, Z is formed. Z on gently heating gives back X. The compound X is :
(a) $CaCO_3$
(b) Na_2CO_3
(c) $Ca(HCO_3)_2$
(d) K_2CO_3

84. Borax glass is one form of borax. Borax contains 10 water molecules. How many water molecules are present in borax glass ?
(a) 10
(b) 7
(c) 5
(d) 0 (zero)

85. In acid base titration of Borax with HCl :
(a) no indicator is used
(b) phenolphthalein is used as indicator
(c) 1 mole of borax reacts with two moles of HCl
(d) 1 mole of borax reacts with four moles of HCl

(Contd.)

86. In the manufacture of H_2SO_4, SO_2 is oxidized to SO_3 according to the reaction :

$$SO_2 + \frac{1}{2}O_2 \rightarrow SO_3, \Delta H = -96 \text{ kJ mol}^{-1}$$

The yield of SO_3 can be increased by :

(a) the use of V_2O_5 as catalyst and high temperature

(b) the use of V_2O_5 as catalyst and high pressure

(c) the use of P_2O_5 as catalyst and high temperature

(d) the use of N_2O_5 as catalyst and high temperature

87. Consider the following statements in respect of zeolites :

1. These act as molecular sieves.
2. Natrolite is a natural ion exchanger.
3. These can be used to separate straight chain hydrocarbons from branched chain hydrocarbons.

Which of the statements given above are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

88. The pair of metals which evolves hydrogen, when treated with caustic soda solution is :

(a) Cu, Zn

(b) Hg, Au

(c) Al, Zn

(d) Ni, Al

89. The CN^- ion and N_2 are iso-electronic. But in contrast to CN^-, N_2 is chemically inert because of :

(a) low bond energy

(b) absence of bond polarity

(c) unsymmetrical electron distribution

(d) presence of more number of electrons in bonding orbitals

90. Ionic compounds are more soluble in H_2O than in D_2O. This is because :

(a) D_2O has a lower dielectric constant than H_2O

(b) Molecular weight of D_2O is more than that of H_2O

(c) Chemical reactivity of D_2O is less than that of H_2O

(d) None of the above

91. In Ostwald's process of manufacturing of HNO_3, the gases used and metallic catalyst are :

(a) N_2, steam; Pt

(b) H_2, N_2, O_2; Fe

(c) NH_3, air; Pt

(d) N_2, steam; Fe

(Contd.)

92. Why is the bond angle in water molecule less than that of tetrahedron bond angle ?

(a) Water molecule is in bent structure

(b) Four hybrid orbitals directed towards the corners of a tetrahedral

(c) The presence of two lone pairs of electrons on two uncombined hybrid orbitals

(d) Electro-negativity of oxygen is very high

93. Why can not hard water be used in boilers ?

(a) The boiling point of hard water is high

(b) The conductivity of hard water is less

(c) Hard water causes scales in boilers

(d) Hard water reacts with metals used in making boilers

94. Why do alkali metals impart colour to the flame ?

(a) They are electropositive elements

(b) They have low ionization energies

(c) They belong to IA group

(d) They form ionic compounds

95. A black mineral (A) on treatment with dilute sodium cyanide solution in presence of air gives solution containing (B) and (C). The solution of (B) on reaction with zinc gives precipitate of a metal (D). What are (B) and (C) respectively ?

(a) Ag_2S and Na_2SO_4

(b) [Na $Ag(CN)_2$] and Na_2SO_4

(c) Ag_2S and NaCN

(d) AgOCN and Na_2SO_4

96. The percentage of available chlorine in the commercial samples of bleaching powder is usually between 33—38%. Lower values are found sometimes due to which of the following reasons ?

1. Incomplete reaction between slaked lime and chlorine during its formation.
2. Impurities present in the original slaked lime used for the manufacture.
3. Decomposition of bleaching powder with time.

Select the correct answer using the code given below :

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

97. Which can be reduced to metal on heating in a stream of hydrogen ?

(a) Al_2O_3

(b) CaO

(c) CuO

(d) K_2O

98. Which one of the following molecules has zero dipole moment ?

(a) $CHCl_3$

(b) H_2S

(c) BF_3

(d) NF_3

(Contd.)

99. The same amount of zinc is treated separately with dilute sulphuric acid and sodium hydroxide. The volume of hydrogen gas evolved is same. The ratio of number of moles of H_2SO_4 and NaOH used is :

(a) 1 : 1

(b) 1 : 2

(c) 2 : 1

(d) 1 : 3

100. Consider the following observation :

M^{n+} + HCl → white precipitate $\xrightarrow{\Delta}$ completely soluble in water

What is the metal ion M^{n+} ?

(a) Hg^{2+}

(b) Ag^{+}

(c) Pb^{2+}

(d) Au^{+}

101. The energy of the second Bohr orbit of He^{+} is –13.62 eV. What will be the energy of the second Bohr orbit of hydrogen ?

(a) –54.48 eV

(b) –13.52 eV

(c) –3.41 eV

(d) –1.70 eV

102. What is the amount of copper liberated of copper sulphate solution by the same current for same time which liberates 0.252 g of hydrogen in one hour ?

[At. weight of Cu = 63.5]

(a) 16.0 g

(b) 8.0 g

(c) 6.0 g

(d) 4.0 g

103. The frequency of the radiation used in microwave oven is 2.45 GHz. What is the wavelength of the radiation ?

(a) 0.0122 m

(b) 0.122 m

(c) 12.2 m

(d) 122 m

104. Which involves the emission of least energy in the hydrogen atom ?

(a) an electron moving from n = 4 to n = 2

(b) an electron moving from n = 3 to n = 2

(c) an electron moving from n = 4 to n = 1

(d) an electron moving from n = 5 to n = 2

105. Which one of the following is ***not*** an allowable set of quantum numbers ?

(a) $n = 2, l = 0, m_l = 0, m_s = -\frac{1}{2}$

(b) $n = 1, l = 1, m_l = 0, m_s = \frac{1}{2}$

(c) $n = 2, l = 1, m_l = -1, m_s = -\frac{1}{2}$

(d) $n = 4, l = 2, m_l = 2, m_s = -\frac{1}{2}$

(Contd.)

106. Two elements have the following first through fourth ionization enthalpies. Deduce the groups in the periodic table to which they probably belong :

	IE / kJ mol^{-1}			
	First	Second	Third	Fourth
Element – 1	1086.2	2352	4620	6220
Element – 2	577.4	1816.6	2744.6	11575

(a) Element-1 belongs to Group-1 and element-2 belongs to Group-2
(b) Both elements belong to Group-1
(c) Element-1 belongs to Group-2 and element-2 belongs to Group-13
(d) Element-1 belongs to Group-14 and element-2 belongs to Group-13

107. What is the boiling point of a solution of 5 g of naphthalene ($C_{10}H_8$) in 100 g of benzene ?
[K_b of benzene is 2.53 °C/m and the normal boiling point of benzene is 80°C]
(a) 0.99 °C
(b) 0.79 °C
(c) 0.81 °C
(d) 0.85 °C

108. 100 g of ice at 0 °C is added to the contents of a can of diet cola (340 ml) at 20.5 °C. The heat of fusion of water is 333 Jg^{-1}. Assuming that the specific heat capacity and density of diet cola are the same as for water (4.184 Jg^{-1} K^{-1} and 1.00 g/mL respectively), what will be the final state of the system ?
(a) The cola will cool to –2.9 °C
(b) The cola will cool to 0 °C and no ice will remain
(c) The final temperature will be 0 °C and some ice will remain
(d) The final temperature will be greater than 0 °C and all ice will melt

109. 0.651 kg of ethylene glycol, $HOCH_2CH_2OH$, is dissolved in 1.5 kg of water. What is the approximate vapour pressure of the water over the solution at 90°C ?
[Assume ideal behaviour for the solution. The vapour pressure of water at 90 °C is 525.8 mm Hg]
(a) 525.8 mm Hg
(b) 467 mm Hg
(c) 59 mm Hg
(d) 760 mm Hg

110. What mass (approximate) of ethylene glycol, $HOCH_2CH_2OH$, must be added to 5.50 kg of water to lower the freezing point of water from 0.0 °C to –10.0 °C ?
[The freezing point depression constant of water K_f = 1.86 K kg mol^{-1}]
(a) 0.03 kg
(b) 1.8 kg
(c) 0.005 kg
(d) 1.2 kg

111. Consider the following reaction :
$PbO_2(s) + 4H^+ + Cu(s) \rightarrow Pb^{2+} + 2H_2O + Cu^{2+}$
and experiments given below :
1. Acid is added
2. PbO_2 is added
3. The $[Pb^{2+}]$ is increased
4. The pH is increased
5. Sulphide ion is added
How many of the above would shift the reaction to the right ?
(a) One
(b) Two
(c) Three
(d) Four

(Contd.)

112. The equilibrium constant for the equation below is very small, that is $K << 1$:

$HX(aq) + Y^-(aq) \rightleftharpoons X^-(aq) + HY(aq)$

Which one of the following is correct in respect of the above reaction ?

(a) The reaction goes nearly to completion

(b) HY is a weaker acid than HX

(c) X^- is a better proton acceptor than Y^-

(d) Y^- is a stronger base than X^-

113. A spoon having 10 cm^2 area is to be electroplated with silver. A current of 0.12 A is passed for 48 hours through the electrolyte. What is the approximate thickness of silver deposited ?

[E.C.E. of silver = 0.001118 gC^{-1} and specific gravity of silver = 10.5]

(a) 0.02 cm

(b) 0.11 cm

(c) 0.22 cm

(d) 2.2 cm

114. The neutron to proton ratio in an isotope can be increased by the emission of :

(a) an electron

(b) a neutron

(c) a gamma ray

(d) a positron

115. In spontaneous beta particle (β^{-1}) emission, what is the source of emitted electron ?

(a) the nucleus

(b) the 1s orbital

(c) the outermost occupied orbital

(d) a random orbital

116. Consider the following statements :

1. First order chemical reaction takes infinite time to complete.
2. Fractional life period of first order chemical reaction does not depend on reactant concentration.

Which one of the following is correct in respect of the above two statements ?

(a) Both the statements are true and statement-2 is the correct explanation of statement-1

(b) Both the statements are true but statement-2 is ***not*** the correct explanation of statement-1

(c) Statement-1 is true but statement-2 is false

(d) Statement-1 is false but statement-2 is true

117. Which electron configuration describes a neutral atom in an excited state ?

(a) $[Xe]\ 6s^1\ 4f^{14}\ 5d^{10}\ 6p^3$

(b) $[He]\ 2s^1$

(c) $[Ne]\ 3s^1\ 3p^1$

(d) $[Ar]\ 4s^1\ 3d^5$

118. Which one of the following does ***not*** define a covalent bond ?

(a) a shared pair of electrons

(b) an overlap of half-filled atoms or hybrid orbitals

(c) increased electron density in the region between atoms of two non-metals

(d) electrostatic attraction between species in which one or more electrons have been transferred

(Contd.)

119. Which is the most accurate description of Na^+ species in dilute aqueous solution ?

(a) The nearest neighbour is a Cl^- ion

(b) The nearest neighbour is the positive end of the water dipole

(c) The nearest neighbour is the negative end of the water dipole

(d) There are no interactions with any species in the solution

120. Two reactions with different activation energies have the same rate at room temperature. Which statement correctly describes the rates of these reactions at the same higher temperature ?

(a) The reaction with the greater activation energy will be faster

(b) The reaction with the smaller activation energy will be faster

(c) The two reactions will have the same rates

(d) A prediction can not be made without more information

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