S.C.R.A. ⇨ 2012

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

T.B.C. : Q–TDSB–M–QIT

Test Booklet Series

TEST BOOKLET

PHYSICAL SCIENCES

Paper—II

A

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. A sheet for rough work is 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 meteorite moves under a force $\vec{F}=\frac{\hat{r}}{r^2}$. If $\vec{r}$ denotes its position vector, then which of the following are correct ?
   1. Its linear momentum is conserved.
   2. Its angular momentum is conserved.
   3. Its torque vanishes.

   Select the correct answer using the code given below :
   (a) 1 and 2 only
   (b) 1 and 3 only
   (c) 2 and 3 only
   (d) 1, 2 and 3

2. Consider the following statements :
   Nuclear force is :
   1. charge independent
   2. long range
   3. central

   Which of the above statements is/are correct ?
   (a) 1 only
   (b) 1 and 2
   (c) 2 and 3
   (d) 1 and 3

3. What will happen when a 40 W, 220 V lamp and 100 W, 220 V lamp are connected in series across 440 V supply ?
   (a) 40 W lamp will fuse.
   (b) 100 W lamp will fuse.
   (c) Both the lamps will fuse.
   (d) Neither lamp will fuse.

4. A particle executing SHM has kinetic energy $k_o \cos^2 \omega t$. The maximum values of potential energy and total energy are respectively
   (a) $\frac{k_o}{2}$ and k_o
   (b) k_o and $2k_o$
   (c) k_o and k_o
   (d) 0 and $2k_o$

5. Consider a point P, the contact point of a wheel of radius r on the ground which rolls on the ground without slipping. What is the displacement of point P, when the wheel completes half rotation ?
   (a) $2r$
   (b) πr
   (c) $r\sqrt{\pi^2+4}$
   (d) $r\sqrt{\pi^2+2}$

6. The waves on the surface of water are a combination of longitudinal waves and transverse waves. They are called ripples. What is the motion of the particles of the medium ?
   (a) Linear
   (b) Parabolic
   (c) Circular
   (d) Elliptical

7. The displacement of a particle along x-axis is given by $y = a \sin^2 \omega t$. Which one of the following is correct ?
   (a) The motion of particle corresponds to SHM with frequency $\omega/(2\pi)$
   (b) The motion of particle corresponds to SHM with frequency ω/π
   (c) The motion of particle corresponds to SHM with frequency $3\,\omega/(2\pi)$
   (d) The motion is not SHM

8. A projectile is fired from the earth vertically with a velocity kv where v is the escape velocity and k is constant. The maximum height to which it rises as measured from the centre of earth of radius R is :
   (a) $\frac{R}{k^2}$
   (b) $\frac{R}{1+k^2}$
   (c) $\frac{R}{1-k^2}$
   (d) $\frac{kR}{1+k^2}$

   where $k < 1$.

9. If a body of density σ is immersed in a liquid of density ρ and its weight is observed to be W, then its true weight is :
   (a) $\frac{\sigma W}{\sigma+\rho}$
   (b) $\frac{\sigma W}{\sigma-\rho}$
   (c) $W\left(1+\frac{\rho}{\sigma}\right)$
   (d) $W\left(1-\frac{\rho}{\sigma}\right)$

(Contd.)

10. What is the external work done (approximately) when 1 g of helium is heated through 1 °C at constant pressure ?
    (a) 1 J
    (b) 2 J
    (c) 4 J
    (d) 8 J

11. A jet of water with area of cross section A striking against a wall at an angle θ to the horizontal rebounds elastically. If the velocity of the jet is v, density is d, then what is the normal force acting on the wall ?
    (a) $2Av^2d\cos\theta$
    (b) $Av^2d\cos\theta$
    (c) $2Avd\cos\theta$
    (d) $Avd\cos\theta$

12. Consider the following statements in respect of a nuclear fission reaction :
    1. Temperature becomes very high during the process.
    2. Pressure becomes very high during the process.
    3. Fission fragments are radioactive.
    4. γ-rays are emitted.

    Which of the above statements are correct ?
    (a) 3 and 4 only
    (b) 1, 2 and 3 only
    (c) 1, 2 and 4 only
    (d) 1, 2, 3 and 4

13. Heat supplied in a process is used completely to do work against the external surroundings. Then, the process may be identified as which one of the following ?
    (a) Adiabatic
    (b) Isochoric
    (c) Isothermal
    (d) None of the above

14. The rate at which work is done on a charge + q moving with velocity $\vec{v}$ in presence of electric field ($\vec{E}$) and magnetic field ($\vec{B}$) is equal to :
    (a) 0
    (b) $q(\vec{v}\bullet\vec{E})$
    (c) $q(\vec{v}\times\vec{B})$
    (d) $-q(\vec{v}\times\vec{B})$

15. The de-Broglie wavelength of a photon is equal to that of electron. Which one of the following statements is correct ?
    (a) The total energy of electron is less than that of photon.
    (b) The kinetic energy of photon is less than that of electron.
    (c) The total energy of electron is greater than that of photon.
    (d) The kinetic energy of photon is equal to that of photon.

16. What is the tension along the rigid rod in a dumb bell ?
    (a) Zero
    (b) Small (non-zero)
    (c) Large but finite
    (d) Infinite

17. The displacement of a particle varies according to $y = 4(\cos\pi t + \sin\pi t)$. The amplitude of the particle is :
    (a) 2
    (b) 4
    (c) $2\sqrt{2}$
    (d) $4\sqrt{2}$

18. A beam of light composed of red and green rays is incident obliquely at a point on the face of a rectangular glass slab. When coming out from the opposite face, the red and green colours emerge from
    (a) one point propagating in two directions
    (b) one point propagating in the same direction
    (c) two points propagating in the same direction
    (d) two points propagating in two different directions

19. A diver (at a depth d from the surface of water) in water of refractive index μ sees the world outside through a horizontal circle of radius :
    (a) $\frac{d}{\mu}$
    (b) $\frac{d}{\sqrt{\mu^2-1}}$
    (c) $\frac{d}{\sqrt{\mu^2+1}}$
    (d) None of the above

(Contd.)

20. A person covers one-third of the distance with 10 kmph, the second one-third distance with 20 kmph and the rest one-third distance with 60 kmph. What is the average speed ?
(a) 12 kmph
(b) 18 kmph
(c) 24 kmph
(d) 30 kmph

21. A Vernier Callipers has its main scale of 10 cm equally divided into 100 equal parts. Its Vernier scale of 20 divisions coincides with 19 divisions of main scale. What is the least count of the instrument ?
(a) 0·01 cm
(b) 0·001 cm
(c) 0·05 cm
(d) 0·005 cm

22. If ΔU and ΔW represent the increase in internal energy and work done by the system respectively in a thermodynamical process, then which one of the following is correct ?
(a) $\Delta U = \Delta W$ in adiabatic process
(b) $\Delta U = -\Delta W$ in isothermal process
(c) $\Delta U = -\Delta W$ in adiabatic process
(d) $\Delta U = \Delta W$ in isothermal process

23. The temperature determines the direction of net change of
(a) gross kinetic energy
(b) intermolecular kinetic energy
(c) gross potential energy
(d) intermolecular potential energy

24. Two rods copper and brass having initial lengths l_1 and l_2 respectively are connected together to form a single rod of length $l_1 + l_2$. The coefficients of linear expansion of copper and brass are α_c and α_b respectively. If the length of each rod increases by same amount when their temperatures are raised by t °C, then what is $\frac{l_1}{l_1 + l_2}$ equal to ?
(a) $\frac{\alpha_c}{\alpha_b}$
(b) $\frac{\alpha_c}{\alpha_c + \alpha_b}$
(c) $\frac{\alpha_b}{\alpha_c}$
(d) $\frac{\alpha_b}{\alpha_c + \alpha_b}$

25. In an adiabatic change, if pressure P and temperature T of a monoatomic gas are related as P is proportional to T^c, then what is c equal to ?
(a) 2/5
(b) 3/5
(c) 5/2
(d) 5/3

26. The velocity of sound increases with increase in temperature. What is the increase in velocity for every 1° rise of temperature ? (velocity of sound at 0 °C = 330 ms^{-1})
(a) 0·061 m/s
(b) 0·61 m/s
(c) 1·6 m/s
(d) 6·1 m/s

27. A constant potential difference is applied across the ends of a wire. Which one of the following operations will reduce the rate of heat generation to half ?
(a) Both length and diameter are halved.
(b) Both length and diameter are doubled.
(c) Diameter is halved and length is doubled.
(d) Diameter is doubled and length is halved.

28. A heater boils 1 kg of water in time T_1 and another heater boils the same amount of water in time T_2. If both the heaters are connected in parallel, the time taken to boil the same amount of water will be :
(a) $T_1 + T_2$
(b) $\frac{T_1 T_2}{T_1 + T_2}$
(c) $\frac{T_1^2}{T_1 + T_2}$
(d) $\frac{T_2^2}{T_1 + T_2}$

29. A small object placed on a rotating horizontal turn table just slips when it is placed at a distance 9 cm from the axis of rotation. If the angular velocity of the turn table is tripled the object slips when its distance from the axis of rotation is :
(a) 1 cm
(b) 2 cm
(c) 4 cm
(d) 9 cm

(Contd.)

30. An insect crawls up a hemispherical surface very slowly. The coefficient of friction between the insect and the surface is 1/3. If the line joining the centre of hemispherical surface and the insect makes an angle α with the vertical, what is the maximum value of α ?

(a) $\cot^{-1} 3$

(b) $\tan^{-1} 3$

(c) $\sec^{-1} 3$

(d) $\text{cosec}^{-1} 3$

31. The linear momentum p of a body varies with time as $p = \alpha + \beta t^2$ where α and β are constants. The net force acting on the body for one dimensional motion varies as

(a) t^2

(b) t^{-1}

(c) t^{-2}

(d) t

32. A wooden ball of density ρ is immersed in a liquid of density σ to a depth h below the surface of water and then released. The height to which the ball jumps out of water is :

(a) $\left(1-\frac{\rho}{\sigma}\right)h$

(b) $\left(1+\frac{\rho}{\sigma}\right)h$

(c) $\left(\frac{\rho}{\sigma}-1\right)h$

(d) $\left(\frac{\sigma}{\rho}-1\right)h$

33. γ-rays pass through a strong uniform electric field. In which direction are they deflected ?

(a) In the direction of electric field

(b) In the direction perpendicular to electric field

(c) In the direction opposite to electric field

(d) Do not get deflected

34. A simple pendulum has time period T_1. The point of suspension is now moved upward according to the relation $y = kt^2$, where y is the vertical displacement at any instant t. The time period now becomes T_2. What is T_1/T_2 equal to ? ($k = 1\ m/s^2$, $g = 10\ m/s^2$)

(a) $\sqrt{1{\cdot}2}$

(b) $\sqrt{0{\cdot}8}$

(c) $\sqrt{0{\cdot}9}$

(d) $\sqrt{1{\cdot}5}$

35. For the stationary wave $y = 4\sin\left(\frac{\pi x}{15}\right)\cos(96\,\pi t)$, what is distance between a node and next antinode ?

(a) 7·5 units

(b) 15 units

(c) 22·5 units

(d) 30 units

36. Consider the following statements :

1. The velocity of sound is greater in media whose compressibility is low.
2. The velocity of sound is greater in solids than in gases.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

37. A convex lens intercepts a converging beam of light which would have met 15 cm away from its centre. If the focal length of the lens is 30 cm, the shift of the meeting point would be :

(a) 10 cm

(b) 12 cm

(c) 7·5 m

(d) 5 cm

(Contd.)

38. An object is placed between 20 cm and 40 cm in front of a concave mirror having radius of curvature 40 cm. The image produced by the mirror will lie
(a) within 20 cm and 40 cm
(b) beyond 40 cm
(c) within 20 cm
(d) at infinity.

39. For a person having hypermetropia
(a) the near point shifts towards the eyes
(b) the near point shifts away from the eyes
(c) the far point shifts towards the eyes
(d) the far point shifts away from the eyes

40. If the second electronic orbit of Bohr's atom has a radius r, then the radius of the third orbit is :
(a) 2·25 r
(b) 3r
(c) 9r
(d) r/3

41. A ray of light from a denser medium strikes a rarer medium at an angle of incidence i. The reflected and refracted rays make an angle 90° with each other. The angle of reflection and angle of refraction are r, r' respectively. The critical angle is :
(a) $\sin^{-1}(\tan r)$
(b) $\cos^{-1}(\tan r)$
(c) $\sin^{-1}(\tan r')$
(d) $\sec^{-1}(\tan r)$

42. A body executes SHM. At a displacement x, its potential energy is E_1. At a displacement y, its potential energy is E_2. What is the potential energy of the body at a displacement (x + y) ?
(a) $\sqrt{E_1} + \sqrt{E_2}$
(b) $E_1 + E_2$
(c) $\sqrt{E_1^2 + E_2^2}$
(d) $\sqrt{E_1 E_2}$

43. A straight wire of mass 200 g and length 1·4 m carries a current of 2 A. It is suspended in mid-air by a uniform horizontal magnetic field B. What is the magnitude of the magnetic field ?
(a) 0·007 T
(b) 0·07 T
(c) 0·7 T
(d) 7 T

44. A particle moves in x-y plane according to the equations $x = 4t^2 + 5t + 16$ and $y = 5t$ where x, y are in meter and t is in second. What is the acceleration of the particle ?
(a) 8 ms^{-2}
(b) 12 ms^{-2}
(c) 14 ms^{-2}
(d) None of the above

45. A particle moves in x-y plane with velocity $\vec{v} = a\hat{i} + bx\hat{j}$ where a, b are constants. Initially the particle was located at x = 0 and y = 0. What is the equation of trajectory of the particle ?
(a) $ay = bx^2$
(b) $by = ax^2$
(c) $2ay = bx^2$
(d) $ay = 2bx^2$

46. Consider the following statements :
1. During the motion around the sun in elliptical orbit, the total mechanical energy of the earth remains constant.
2. The gravitational field in which the earth moves is a conservative force field.
Which of the above statements is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

47. Consider the following statements :
1. The main contribution to the binding energy of the nucleus comes from a term proportional to the mass number.
2. Volume of the nucleus is proportional to mass number.
Which of the above statements is/are correct ?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

48. A wire of magnetic material having length L is bent at its middle point at an angle of 60°. If the magnetic moment of original wire is M, what is the magnetic moment of the new form ?
(a) M
(b) $M/\sqrt{2}$
(c) $\sqrt{2}\,M$
(d) M/2

(Contd.)

49. A bar magnet is suspended from the middle point in a uniform magnetic field. The couple acting on the bar magnet is minimum when the magnet is
(a) parallel to the field
(b) perpendicular to the field
(c) at an angle of 45° to the field
(d) at an angle of 60° to the field

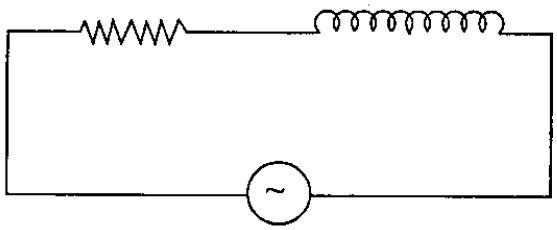
50. Horizontal component and dip of the earth's magnetic field are zero, respectively, at
(a) north and south poles
(b) equator and poles
(c) poles and equator
(d) None of the above

51. In which one of the following emissions, the electronic structure has no role to play ?
(a) x-ray emission
(b) γ-ray emission
(c) Cathode ray emission
(d) Photoelectric emission

52. A simple pendulum oscillates without damping. When the displacement of the bob is less than the maximum, then which one of the following statements is/are correct ?
1. The acceleration is directed along the tangent to the path of the motion of the bob of the pendulum.
2. The magnitude of velocity is greater than zero.

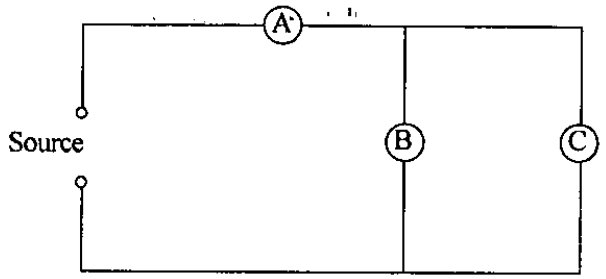
Select the correct answer using the code given below :
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

53.



In the figure given above, the reading of voltmeter across the resistor is 3 V. What is the reading of voltmeter across the inductor ?
(a) 2 V
(b) 3 V
(c) 4 V
(d) None of the above

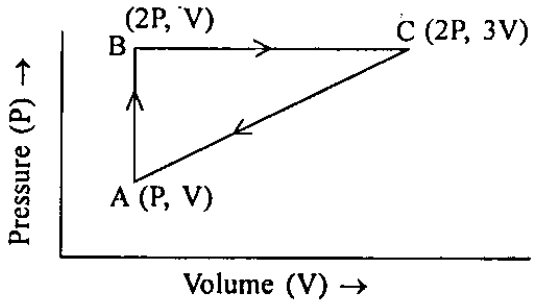
54.



In the figure given above three similar lamps A, B and C are connected to a source. If the lamp C fuses, how will the light emitted by A and B change ?
(a) No change
(b) Brilliance of A decreases and that of B increases.
(c) Brilliance of both A and B increase.
(d) Brilliance of both A and B decrease.

55. A point object is placed on the bottom of a glass vessel. A liquid of refractive index 4/3 is poured into the vessel till the level of the liquid reaches 12 cm from the bottom. When seen from above the glass vessel, the object appears to be shifted up by
(a) 9 cm
(b) 6 cm
(c) 3 cm
(d) 0

56.



An ideal gas is taken through a cycle ABCA as shown above in P-V diagram. What is the work done during the cycle ?
(a) PV/2
(b) PV
(c) 2 PV
(d) Zero

(Contd.)

57. A uniform disc of mass M and radius R is spinned to angular velocity ω and then carefully placed on a horizontal surface (coefficient of friction is μ). Assume that the pressure exerted by disc on the surface is uniform. What is the net torque acting on disc ?

(a) $\frac{2\mu MgR}{3}$

(b) $\frac{\mu MgR}{3}$

(c) $\frac{3\mu MgR}{2}$

(d) None of the above

58. If a thermometer reads melting point of water as 20 °C and boiling point as 180 °C, how much does the thermometer read when the actual temperature is 60 °C ?

(a) 98 °C

(b) 116 °C

(c) 120 °C

(d) 126 °C

59. A particle moves in a straight line with a velocity v and moves under a retardation equal to k times the distance described. What is the distance covered before it comes to rest ?

(a) $v\sqrt{k}$

(b) $v/\sqrt{k}$

(c) $2v/\sqrt{k}$

(d) None of the above

60. An amount of 100 g of copper with specific heat 0·1 cal g^{-1} $°C^{-1}$ at 200 °C is dipped into 100 cc of water at 24 °C. What is the final temperature of the system ?

(a) 30 °C

(b) 40 °C

(c) 50 °C

(d) 60 °C

61. The hydrogen line spectrum provides evidence for the

(a) Heisenberg Uncertainty principle

(b) Wave like properties of light

(c) Diatomic nature of Hydrogen

(d) Quantized nature of atomic energy states

62. Which one of the following arrangements shows the bonds H–H, C–C and Si–Si in order of increasing bond energy ?

(a) Si–Si < C–C < H–H

(b) C–C < H–H < Si–Si

(c) H–H < Si–Si < C–C

(d) H–H < C–C < Si–Si

63. Which molecule has the shortest bond length ?

(a) N_2

(b) O_2

(c) Cl_2

(d) Br_2

64. A mixture of 0·10 mol H_2 and 0·050 mol O_2 are placed in a bomb calorimeter with a heat capacity of $5·1\times10^4$ J $°C^{-1}$. The initial temperature is 25·00 °C and the temperature after combustion is 25·56 °C. What is the $\Delta H_f°$ for H_2O (l) ?
[Assume 100% conversion to water and neglect heat absorbed by water]

(a) – 286 kJ mol^{-1}

(b) + 190 kJ mol^{-1}

(c) –190 kJ mol^{-1}

(d) +286 kJ mol^{-1}

65. What is the amount of heat that is released when 8·17 g of Al(s) is converted to Al_2O_3(s) at 25 °C and 1 atm via the reaction $4\,Al(s) + 3\,O_2(g) \rightarrow 2\,Al_2O_3(s)$?
[For the reaction, $\Delta H = -3352$ kJ, atomic mass of Al = 27]

(a) 134 kJ

(b) 254 kJ

(c) 268 kJ

(d) $1·01 \times 10^3$ kJ

66. In which reaction will an increase in the volume of the container favour the formation of products ?

(a) $C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$

(b) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(c) $4\,NH_3(g) + 5O_2(g) \rightleftharpoons 4\,NO(g) + 6H_2O(l)$

(d) $3O_2(g) \rightleftharpoons 2O_3(g)$

(Contd.)

67. What is the concentration of a solution prepared by dissolving 4·20 g of NaF in 500 g of water ?
(a) 0·00840 Molal
(b) 0·00840 Molar
(c) 0·200 Molal
(d) 0·200 Molar

68. When 1·20 g of sulphur is melted with 15·00 g of naphthalene, the solution freezes at 77·2 °C. What is the molar mass of this form of sulphur ?
[Data for Naphthalene:
Melting point = 80·00 °C,
Freezing point depression constant, $K_f = 6{\cdot}80\ ^\circ C\ m^{-1}$]
(a) $160\ g\ mol^{-1}$
(b) $190\ g\ mol^{-1}$
(c) $260\ g\ mol^{-1}$
(d) $450\ g\ mol^{-1}$

69. Magnesium fluoride MgF_2 is a slightly soluble salt whose solubility product $K_{SP} = 3{\cdot}7\times10^{-8}$. What is the approximate solubility of MgF_2 ?
(a) $9{\cdot}2\times10^{-8}$ M
(b) $1{\cdot}2\times10^{-8}$ M
(c) $1{\cdot}4\times10^{-4}$ M
(d) $2{\cdot}1\times10^{-3}$ M

70. What is the $[H^+]$ in a 0·010 M solution of HCN ?
[The equilibrium constant, K_a, for HCN equals $6{\cdot}2\times10^{-10}$]
(a) $3{\cdot}6\times10^{-3}$ M
(b) $2{\cdot}5\times10^{-6}$ M
(c) $1{\cdot}0\times10^{-7}$ M
(d) $6{\cdot}2\times10^{-10}$ M

71. The half-life for the radioactive decay of ^{32}P is 14·3 days. How many days would be required for a sample of a radiopharmaceutical containing ^{32}P to decrease to 20% of its initial activity ? [$\log_{10} 2 = 0{\cdot}301$]
(a) 33·2 days
(b) 61·8 days
(c) 71·5 days
(d) 286 days

72. The activity of a radioactive isotope is 3000 counts per minute at a certain time and 2400 counts per minute 48 hours later. What is its half life ? [$\log_{10} 2 = 0{\cdot}30$]
(a) 831 hr
(b) 800 hr
(c) 144 hr
(d) 124 hr

73. Chromium is extensively used in electroplating industry. Oxidation of Cr(Atomic Number : 24) to Cr^{2+} ion involves removal of valence electrons from
(a) 4s and 3d orbitals
(b) 4s and 4p orbitals
(c) 3d orbital only
(d) 4s orbital only

74. Consider the following molecules /ions :
1. NH_4^+
2. H_3O^+
3. NH_3
4. $SiCl_4$
Which pair does ***not*** contain a lone pair ?
(a) 1 and 2
(b) 1 and 3
(c) 1 and 4
(d) 2 and 4

75. Closely sealed test tubes containing NO_2 gas are placed separately on water baths at 270 K and 363 K.
Consider the following equilibrium:
$2\ NO_2(g) \rightleftharpoons N_2O_4(g) \quad \Delta H = -57{\cdot}2\ kJ\ mol^{-1}$
(brown) (colourless)
Which one of the following is the correct observation ?
(a) The brown colour is discharged at both temperatures.
(b) The brown colour intensifies at both temperatures.
(c) The intensity of brown colour decreases at low temperature while it intensifies at high temperature.
(d) The intensity of brown colour increases at low temperature while it diminishes at high temperature

(Contd.)

76. A Scuba diver swimming in deep sea water comes towards the surface of water. The diver experiences

(a) high concentration of O_2 when under the deep sea

(b) high concentration of O_2 when moving towards the surface

(c) same concentration of O_2 under both conditions

(d) low concentration of O_2 when under the deep sea

77. Bacterial action on preserved meat is diminished by addition of common salt. This phenomenon is explained by

(a) depression in freezing point of water

(b) ionic nature of salt

(c) loss of water in the bacterium cell

(d) Gain in water in the bacterium cell

78. An isobaric product is formed if radioactivity proceeds by emission of

(a) one β- particle

(b) one α-particle

(c) one α and two β-particles

(d) two β-particles

79. Which bond would be expected to have the positive end of the bond dipole on the nitrogen atom ?

(a) N–H

(b) C–N

(c) Al–N

(d) N–O

80. The dissociation of HI molecule, as shown below occurs at a temperature of 629 K. The rate constant $k = 3{\cdot}02\times10^{-5}\ M^{-1}\ s^{-1}$

$$2\ HI(g) \rightarrow H_2(g) + I_2(g)$$

What is the reaction order ?

(a) 0

(b) 1

(c) 2

(d) 3

81. Which one among the following is a liquid at 0 °C ?

(a) HF

(b) HCl

(c) HBr

(d) HI

82. Consider the following ions :

1. Na^+
2. Al^{3+}
3. Si^{4+}

In naturally occurring zeolites which of the above ions are present ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

83. Which one of the following is ***not*** correct in respect of ortho-silicates ?

(a) They are not formed by discrete SiO_4^{4-} unit.

(b) The unit SiO_4^{4-} makes a cyclic frame work.

(c) There is no double bond between Si and O atoms

(d) They are used as gem-stone

84. Which one of the following is ***not*** correct in respect of hydrogen peroxide ?

(a) It is industrially produced from 2-ethylanthroquinol.

(b) It has a linear structure.

(c) It acts both as oxidizing and reducing agent.

(d) It is widely used as bleaching agent.

85. For simple molecules NO_2 and S_2, which one of the following statements is correct ?

(a) Both are diamagnetic.

(b) NO_2 is diamagnetic while S_2 is paramagnetic.

(c) S_2 is diamagnetic while NO_2 is paramagnetic.

(d) Both are paramagnetic.

(Contd.)

86. The standard electrode potential for half-cell reduction of $X_2(g)$ and $Y_2(g)$ are 2·87 and 1·36 E°/V. Which one of the following is correct ?

(a) X_2 is a stronger oxidizing agent than Y_2.

(b) Y_2 is a stronger oxidizing agent than X_2

(c) $X^{\ominus}$ is a stronger reducing agent than $Y^{\ominus}$ ion.

(d) The reducing strength of $X^{\ominus}$ and $Y^{\ominus}$ ions is the same.

87. A chemical substance (X) is commercially prepared by electrolysis of brine solution and is being sold under trade name, Chlorox as anti-bleaching agent. The compound 'X' is

(a) NaOCl

(b) $NaClO_2$

(c) $NaClO_3$

(d) $NaClO_4$

88. Among the following the most reactive is :

(a) S_2O

(b) SO_3

(c) SO_2

(d) SO_3^{2-}

89. In the extraction of copper, metal is formed in the bessemer converter due to which one of the following reactions ?

(a) $Cu_2S + 2\ Cu_2O \rightarrow 6\ Cu + SO_2$

(b) $Cu_2S \rightarrow 2\ Cu + S$

(c) $Cu_2O + Fe \rightarrow 2\ Cu + FeO$

(d) $2\ Cu_2O \rightarrow 4\ Cu + O_2$

90. Potash alum contains the metals like potassium and aluminium. What are the metal ions present in chrome alum ?

(a) Chromium and aluminium only

(b) Iron and aluminium

(c) Potassium and chromium only

(d) Potassium, chromium and aluminium

91. During extraction of Al from bauxite ore, the impurities of Fe_2O_3 are removed by boiling the ore with

(a) liquid NH_3

(b) aqueous NaOH

(c) conc. H_2SO_4

(d) conc. HNO_3

92. Consider the following statements in respect of oxides of sulphur :

1. In gas phase SO_2 molecules are V-shaped.
2. In gas phase SO_3 molecule has a planar structure.
3. γ-SO_3 is cyclic trimer and solid at 0 °C.

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

93. NH_3 on passing through which one of the following is most significantly absorbed ?

(a) P_2O_5

(b) CaO

(c) Na_2O

(d) TiO_2

94. In Haber's process for the manufacturing of ammonia best yields are obtained under which one of the following conditions ?

(a) 250 °C to 380 °C and 1 atm using a catalyst

(b) 380 °C to 450 °C and 100 atm using a catalyst

(c) 380 °C to 450 °C and 200 atm using a catalyst

(d) 200 °C to 250 °C and 100 atm using a catalyst

95. Bromine gas is commercially prepared from brine by displacement reaction

$$Cl_2 + 2\ Br^-(aq) \rightarrow 2\ Cl^-(aq) + Br_2$$

Br_2 gas thus formed is removed by passing a stream of air and then reabsorbed in a solution of

(a) KOH

(b) $Ca(OH)_2$

(c) Na_2CO_3

(d) H_3PO_4

(Contd.)

96. The basic chemical reaction that is used in the commercial extraction of zinc involves the reduction of ZnO with

(a) CO

(b) Na-Hg

(c) Mg

(d) SO_2

97. Which property of hydrogen points its more resemblance with halogen family members as compared to alkali metals ?

(a) Affinity for non-metals

(b) Ionization potential

(c) Electronic configuration

(d) Reducing nature

98. The total number of N-O bonds present in N_2O_5 molecule are :

(a) 4

(b) 5

(c) 6

(d) 7

99. If one litre of air is passed repeatedly on hot copper and hot magnesium till no further decrease in volume takes place, the residual gas contains :

(a) Carbon dioxide and argon

(b) Oxygen, nitrogen and carbon dioxide

(c) Argon only

(d) Oxygen and argon

100. Consider the following :

In the extraction of Au, from rocks containing Au which of the following are used ?

1. Hg
2. KOH
3. KCN

Which of the above are the correct extracting agents ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

101. The type of isomerism exhibited by

$$HO_2C\text{–}HC = CH - CH\text{–}\underset{\displaystyle CH_3}{\underset{|}{C}}HCO_2H$$

is

(a) Functional isomerism

(b) Geometric isomerism only

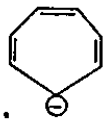
(c) Optical isomerism only

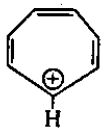
(d) Geometric and Optical isomerism

102. Aromatic compounds are stable with wide applications. Which one of following monocyclic rings with conjugated π electrons is aromatic ?

(a) 

(b) 

(c) 

(d) 

103. Chloroform is an anesthetic and a small amount of alcohol is added to its bottles because

(a) it retards anesthetic property of chloroform

(b) it accelerates the formation of phosgene

(c) it converts any phosgene formed to harmless carbonate

(d) None of the above

104. Freons, culprits in depletion of ozone layer are industrially produced from

(a) CF_4

(b) CH_2Cl_2

(c) Hexachlorobenzene

(d) $CHCl_3$ and CCl_4

(Contd.)

105. Consider the following isomeric butanes :

1. $H_3C\,CH_2\,CH_2\,CH_2\,Br$

2. $H_3C\,CH_2\,\underset{\displaystyle CH_3}{\underset{|}{CH}}\,Br$

3. $H_3C-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-Br$

4. $(H_3C)_2\,CH\,CH_2\,Br$

What is the correct order of the above isomeric butanes of S_N2 reaction ?

(a) 1 > 4 > 2 > 3

(b) 3 > 4 > 2 > 1

(c) 4 > 1 > 2 > 3

(d) 2 > 1 > 4 > 3

106. Lucas reagent reacts fastest with

(a) Butan-1-ol

(b) Butan–2–ol

(c) 2-Methylpropan-1-ol

(d) 2-Methylpropan-2-ol

107. PhCHO + HCN gives $Ph-\underset{\displaystyle CN}{\underset{|}{\overset{\displaystyle OH}{\overset{|}{C}}}}-H$ which is

(a) optically active

(b) a meso compound

(c) Racemate

(d) a mixture of diastereomers

108. Benzene can be converted to acetophenone by its treatment with

(a) $H_3CCOCl/AlCl_3$

(b) $H_3CCN/AlCl_3$

(c) $(H_3CCO)_2O/AlCl_3$

(d) All of the above

109. Consider the following :

1. Propionaldehyde
2. Benzaldehyde
3. Benzophenone
4. Acetophenone

What is the correct order of the reactivity of the above towards nucleophiles ?

(a) 3 > 2 > 4 > 1

(b) 3 > 4 > 2 > 1

(c) 2 > 1 > 3 > 4

(d) 1 > 2 > 4 > 3

110. A solution of aniline in commercial chloroform kept for months started giving a pungent odour. This is due to the formation of

(a) Phenyl isocyanate

(b) Phenyl cyanide

(c) Phenyl isocyanide

(d) Phenyl isothiocyanate

111. In wine making industry the fermentation of sugars is done under anaerobic conditions to

(a) accelerate the formation of ethanol

(b) oxidize the produced ethanol to ethanoic acid

(c) avoid the oxidation of ethanol to ethanoic acid

(d) None of the above

(Contd.)

112. Purity of ether before its use as an anesthetic agent is tested by

(a) KI and starch

(b) H_2SO_4

(c) $CuSO_4$

(d) None of the above

113. Consider the following statements :

Statement-I : 1-Butene reacts with HBr to give 1-bromobutane.

Statement-II : Reactive intermediate of the reaction is carbocation.

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

(a) Both statement-I and statement-II are correct and statement-II is the correct explanation of statement-I.

(b) Both statement-I and statement-II are correct but statement-II is ***not*** the correct explanation of statement-I.

(c) Statement-I is correct but statement-II is incorrect.

(d) Statement-I is incorrect but statement-II is correct.

114. An optically inactive natural α-amino acid is

(a) glycine

(b) alanine

(c) lysine

(d) valine

115. Which one of the following compounds is ***not*** a lipid ?

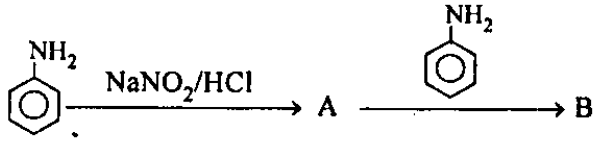
(a) Vitamin-A

(b) Tristearin

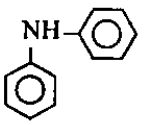
(c) Cholesterol

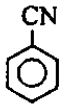
(d) Alanine

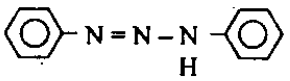
116. Consider the following reaction :

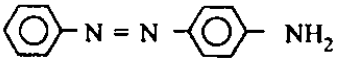


What is the major product (B) of the above reaction ?

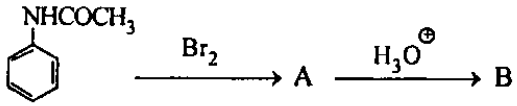
(a) 

(b) 

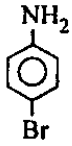
(c) 

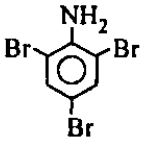
(d) 

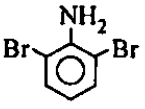
117. Consider the following reaction :

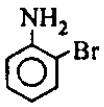


What is the major product (B) of the above reaction ?

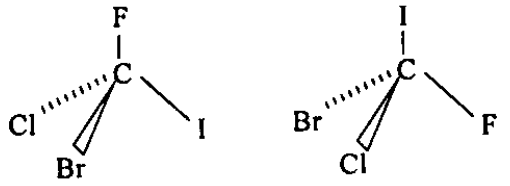
(a) 

(b) 

(c) 

(d) 

118. Consider the following molecules :



(A) (B)

The enantiomers rotate the plane polarized light in opposite directions. If the molecule A rotates the plane polarized light by (+) 56°, then B will exhibit rotation of

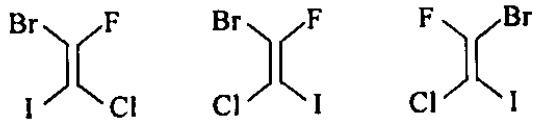
(a) 0°

(b) (–)56°

(c) (+)56°

(d) None of the above

119. Consider the following structures :



A B C

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

(a) The structures A and B are enantiomers.

(b) The structures A and C are geometrical isomers.

(c) The structures A and B are two molecules of the same compound.

(d) The structures A and C are two molecules of the same compound.

120. DDT can be synthesized from the chlorination product of which one of the following aldehydes ?

(a) HCHO

(b) H_3CCHO

(c) H_3CCH_2CHO

(d) C_6H_5CHO

SPACE FOR ROUGH WORK