WARNING	Any malpractice or any attempt to commit any kind of malpractice in the Examination will DISQUALIFY THE CANDIDATE.

PAPER – I PHYSICS & CHEMISTRY-2015

Version Code	A2	Question Booklet Serial Number :	
Time : 150 Minutes		Number of Questions : 120	Maximum Marks : 480
Name of Candidate			
Roll Number			
Signature of Candidate			

INSTRUCTIONS TO THE CANDIDATE

1. **Please ensure that the VERSION CODE shown at the top of this Question Booklet is the same as that shown in the Admit card issued to you.** If you have received a Question Booklet with a different Version Code, please get it replaced with a Question Booklet with the same Version Code as that of the Admit card. **THIS IS VERY IMPORTANT.**
2. Please fill in the items such as name, roll number and signature in the columns given above. Please also write Question Booklet Sl. No. given at the top of this page against item 3 in the OMR Answer Sheet.
3. This Question Booklet contains 120 questions. For each question, five answers are suggested and given against (A), (B), (C), (D) and (E) of which only one will be the **Most Appropriate Answer**. Mark the bubble containing the letter corresponding to the 'Most Appropriate Answer' in the OMR Answer Sheet, by using either **Blue or Black ball-point pen only**.
4. **Negative Marking:** In order to discourage wild guessing, the score will be subjected to penalization formula based on the number of right answers actually marked and the number of wrong answers marked. Each correct answer will be awarded FOUR marks. ONE mark will be deducted for each incorrect answer. More than one answer marked against a question will be deemed as incorrect answer and will be negatively marked.
5. Please read the instructions given in the OMR Answer Sheet for marking answers. Candidates are advised to strictly follow the instructions contained in the OMR Answer Sheet.

IMMEDIATELY AFTER OPENING THIS QUESTION BOOKLET, THE CANDIDATE SHOULD VERIFY WHETHER THE QUESTION BOOKLET ISSUED CONTAINS ALL THE 120 QUESTIONS IN SERIAL ORDER. IF NOT, REQUEST FOR REPLACEMENT.

DO NOT OPEN THE SEAL UNTIL THE INVIGILATOR ASKS YOU TO DO SO.

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PLEASE ENSURE THAT THIS QUESTION BOOKLET CONTAINS 120 QUESTIONS SERIALLY NUMBERED FROM 1 TO 120.
PRINTED PAGES : 32

1. A satellite revolves around the earth of radius R in a circular orbit of radius 3R. The percentage increase in energy required to lift it to an orbit of radius 5R is

(A) 10% (B) 20% (C) 30% (D) 40% (E) 67%

2. Two capillary tubes A and B of diameter 1 mm and 2 mm respectively are dipped vertically in a liquid. If the capillary rise in A is 6 cm, then the capillary rise in B is

(A) 2 cm (B) 3 cm (C) 4 cm (D) 6 cm (E) 9 cm

3. Two wires A and B of same material and of equal length with the radii in the ratio 1 : 2 are subjected to identical loads. If the length of A increases by 8 mm, then the increase in length of B is

(A) 2 mm (B) 4 mm (C) 8 mm (D) 16 mm (E) 1 mm

4. After terminal velocity is reached, the acceleration of a body falling through a fluid is

(A) equal to g (B) zero (C) less than g
(D) greater than g (E) constant but not zero

5. A liquid is filled upto a height of 20 cm in a cylindrical vessel. The speed of liquid coming out of a small hole at the bottom of the vessel is ($g = 10\ ms^{-2}$)

(A) $1.2\ ms^{-1}$ (B) $1\ ms^{-1}$ (C) $2\ ms^{-1}$ (D) $3.2\ ms^{-1}$ (E) $1.4\ ms^{-1}$

Space for rough work

6. A metallic bar of coefficient of linear expansion 10^{-5} K^{-1} is heated from 0°C to 100°C. The percentage increase in its length is

(A) 0.1% (B) 1% (C) 10% (D) 0.01% (E) 0.001%

7. Two perfectly black spheres A and B having radii 8 cm and 2 cm are maintained at temperatures 127°C and 527°C respectively. The ratio of the energy radiated by A to that by B is

(A) 1 : 2 (B) 1 : 1 (C) 2 : 1 (D) 1 : 4 (E) 1 : 16

8. For a monatomic gas, the molar specific heat at constant pressure divided by the molar gas constant R is equal to

(A) 2.5 (B) 1.5 (C) 5.0 (D) 3.5 (E) 4.0

9. Hot water in a vessel kept in a room, cools from 70°C to 65°C in t_1 minutes, from 65°C to 60°C in t_2 minutes and from 60°C to 55°C in t_3 minutes. Then

(A) $t_1 < t_2 > t_3$ (B) $t_1 = t_2 = t_3$ (C) $t_1 > t_2 > t_3$

(D) $t_1 > t_2 = t_3$ (E) $t_1 < t_2 < t_3$

Space for rough work

10. When two springs A and B with force constants k_A and k_B are stretched by the same force, then the respective ratio of the work done on them is

(A) $k_B : k_A$ (B) $k_A : k_B$ (C) $k_A k_B : 1$

(D) $\sqrt{k_B} : \sqrt{k_A}$ (E) $\sqrt{k_A} : \sqrt{k_B}$

11. For a particle moving according to the equation $x = a \cos \pi t$, the displacement in 3 s is

(A) 0 (B) $0.5a$ (C) $1.5a$ (D) $2a$ (E) a

12. Two oscillating simple pendulums with time periods T and $\frac{5T}{4}$ are in phase at a given time. They are again in phase after an elapse of time

(A) 4T (B) 3T (C) 6T (D) 5T (E) 8T

13. A wave of frequency 500 Hz travels with a speed of 360 ms^{-1}. The distance between two nearest points which are 60° out of phase is

(A) 12 cm (B) 18 cm (C) 50 cm (D) 24 cm (E) 6 cm

14. The apparent frequency observed by a moving observer away from a stationary source is 20% less than the actual frequency. If the velocity of sound in air is 330 ms^{-1}, then the velocity of the observer is

(A) 660 ms^{-1} (B) 330 ms^{-1} (C) 66 ms^{-1} (D) 33 ms^{-1} (E) 20 ms^{-1}

Space for rough work

15. A string under tension of 129.6 N produces 10 beats/second when it vibrates along with a tuning fork. When the tension in the string is increased to 160 N, it vibrates in unison with the tuning fork. Then frequency of the tuning fork is

(A) 100 Hz (B) 110 Hz (C) 90 Hz (D) 220 Hz (E) 95 Hz

16. An electric dipole of moment ($\vec{\mu}$) of 400 μC m is placed in a transverse electric field ($\vec{E}$) of 50 Vm^{-1} at an angle of 30° to $\vec{E}$. Then a torque of

(A) 10^{-2} Nm acts along the direction of $\vec{E}$

(B) 10^{-3} Nm acts along the direction of $\vec{\mu}$

(C) 10^{-5} Nm acts normal to both $\vec{E}$ and $\vec{\mu}$

(D) 10^{-3} Nm acts along the direction of $\vec{E}$

(E) 10^{-2} Nm acts normal to both $\vec{E}$ and $\vec{\mu}$

17. A charge Q is distributed over two concentric hollow spheres of radii a and b $(a > b)$, so that the surface charge densities are equal. The potential at the common centre is $\frac{1}{4\pi\epsilon_0}$ times

(A) $Q\left(\frac{a+b}{a^2+b^2}\right)$ (B) $2Q\left(\frac{a+b}{a^2+b^2}\right)$ (C) Q

(D) $\frac{Q}{2}\left(\frac{a+b}{a^2+b^2}\right)$ (E) $\frac{Q}{4}\left(\frac{a+b}{a^2+b^2}\right)$

Space for rough work

18. The velocity acquired by a charged particle of mass m and charge Q accelerated from rest by a potential of V is

(A) $\frac{QV}{m}$ (B) $\sqrt{\frac{m}{QV}}$ (C) $\sqrt{mQV}$ (D) mQV (E) $\sqrt{\frac{2QV}{m}}$

19. A 5 μF capacitor is fully charged by a 12 V battery and then disconnected. If it is connected now parallel to an uncharged capacitor, the voltage across it is 3 V. Then the capacity of the uncharged capacitor is

(A) 5 μF (B) 15 μF (C) 50 μF ((D) 10 μF (E) 25 μF

20. An electron moving with a constant velocity v along X-axis enters a uniform electric field applied along Y-axis. Then the electron moves

(A) with uniform acceleration along Y-axis

(B) without any acceleration along Y-axis

(C) in a trajectory represented as $y = ax^2$

(D) in a trajectory represented as $y = ax$

(E) with uniform deceleration along X-axis

21. The resistivity of the material of a potentiometer wire is $5 \times 10^{-6}\ \Omega$ m and its area of cross section is $5 \times 10^{-6}\ m^2$. If 0.2 A current is flowing through the wire, then the potential drop per metre length of the wire is

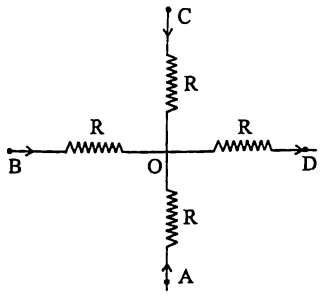
(A) $0.1\ Vm^{-1}$ (B) $0.5\ Vm^{-1}$ (C) $0.25\ Vm^{-1}$ (D) $0.2\ Vm^{-1}$ (E) $0.01\ Vm^{-1}$

Space for rough work

22. A battery of 6 V and internal resistance 2 Ω is connected to a silver voltameter. If the current of 1.5 A flows through the circuit, the resistance of the voltameter is

(A) 4 Ω (B) 2 Ω (C) 6 Ω (D) 1 Ω (E) 5 Ω

23. In the given circuit below, the points A, B and C are at same potential. If the potential difference between B and D is 30 V, then the potential difference between A and O is



(A) 7.5 V (B) 10 V (C) 15 V (D) 5 V (E) 3.75 V

24. The ratio of resistances of two copper wires of the same length and of same cross sectional area when connected in series to that when connected in parallel is

(A) 1 : 1 (B) 1 : 2 (C) 2 : 1 (D) 4 : 1 (E) 1 : 4

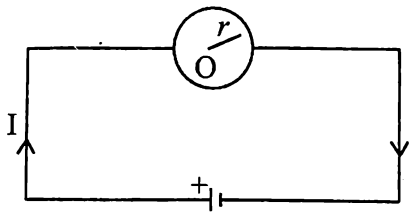
25. A flow of 10^6 electrons per second in a conducting wire constitutes a flow of current of

(A) 1.6×10^{-15}A (B) 1.6×10^{-11}A (C) 1.6×10^{-12}A

(D) 1.6×10^{-19}A (E) 1.6×10^{-13}A

Space for rough work

26. A single turn circular coil is connected to a cell as shown. Magnetic field at the centre O of the coil is



(A) $\frac{2\pi I}{r}$ (B) $2\pi Ir$ (C) zero (D) $\frac{I}{2\pi r}$ (E) $\frac{I}{\pi r}$

27. Identify the wrong statement

(A) Current loop is equivalent to a magnetic dipole

(B) Magnetic dipole moment of a planar loop of area A carrying current I is I^2A

(C) Particles like proton, electron carry an intrinsic magnetic moment

(D) The current loop (magnetic moment $\vec{m}$) placed in a uniform magnetic field, $\vec{B}$ experiences a torque $\vec{\tau} = \vec{m} \times \vec{B}$

(E) Ampere's circuital law is not independent of Biot Savart's law

28. A proton is travelling along the X-direction with velocity 5×10^6 ms^{-1}. The magnitude of force experienced by the proton in a magnetic field $\vec{B} = (0.2\hat{i} + 0.4\hat{k})$ tesla is

(A) 3.2×10^{-13} N (B) 5.3×10^{-13} N (C) 3.2×10^{13} N

(D) 6.3×10^{-13} N (E) 3.5×10^{-12} N

29. The shunt required to send 10 % of the main current through a moving coil galvanometer of resistance 99 Ω is

(A) 99 Ω (B) 9.9 Ω (C) 9 Ω (D) 10 Ω (E) 11 Ω

Space for rough work

30. Two identical coils of 5 turns each carry 1 A and 2 A current respectively. Assume they have common centre with their planes parallel to each other. If their radius is 1 m each and the direction of flow of current in the coils are in opposite directions, then the magnetic field produced on its axial line at a distance of $\sqrt{3}$ m from the common centre is (in tesla)

(A) 0 (B) $\frac{15}{16}\mu_0$ (C) $\frac{8}{16}\mu_0$ (D) $\frac{5}{16}\mu_0$ (E) $\frac{16}{5}\mu_0$

31. The ratio of the magnetic fields produced at the centre of a solenoid for a flow of current 1 A to that produced inside toroid for the flow of current 2 A both having same number of turns per unit length is

(A) 1 : 1 (B) 1 : 2 (C) 2 : 1 (D) 1 : 4 (E) 4 : 1

32. A transformer connected to 220 V mains is used to light a lamp of rating 100 W and 110 V. If the primary current is 0.5 A, the efficiency of the transformer is (approximately)

(A) 60% (B) 35% (C) 50% (D) 90% (E) 44%

33. Two long parallel wires carrying equal currents which are 8 cm apart produce a magnetic field of 200 μT mid way between them. The magnitude of the current in each wire is

(A) 10 A (B) 20 A (C) 30 A (D) 40 A (E) 50 A

Space for rough work

34. A lamp consumes only 25% of the peak power in an ac circuit. The phase difference between the applied voltage and the current is

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{2}$ (E) π

35. The amplitudes E_0 and B_0 of electric and the magnetic component of an electromagnetic wave respectively are related to the velocity c in vacuum as

(A) $E_0 B_0 = \frac{1}{c}$ (B) $E_0 = \frac{c}{B_0}$ (C) $B_0 = cE_0$

(D) $E_0 = cB_0$ (E) $E_0 = c^2 B_0$

36. Identify the mismatched pair

(A) Microwaves - Aircraft navigation

(B) Radio waves - Cellular phone

(C) Infrared waves - Remote switches

(D) Ultraviolet rays - LASIK

(E) γ – rays - Klystron

37. An aperture of size a is illuminated by a parallel beam of light of wavelength λ. The distance at which ray optics has a good approximation is

(A) $\frac{a^2}{\lambda}$ (B) $\frac{\lambda}{a^2}$ (C) $\frac{\lambda}{a}$ (D) $\frac{\lambda^2}{a}$ (E) $a^2\lambda$

Space for rough work

38. Two plane wavefronts of light, one incident on a thin convex lens and another on the refracting face of a thin prism. After refraction at them, the emerging wavefronts respectively become

(A) plane wavefront and plane wavefront

(B) plane wavefront and spherical wavefront

(C) spherical wavefront and plane wavefront

(D) spherical wavefront and spherical wavefront

(E) elliptical wavefront and spherical wavefront

39. If a ray of light is incident at a glass surface at the Brewster's angle of 60°, then the angle of deviation inside glass is

(A) 90° (B) 60° (C) 45° (D) 30° (E) 15°

40. Identify the wrong sign convention

(A) The magnification for virtual image formed by a convex lens is positive

(B) The magnification for real image formed by a convex lens is negative

(C) The height measured normal to the principal axis upwards is positive

(D) The distances measured in the direction of incident light is positive

(E) The magnification for virtual image formed by a concave lens is negative

Space for rough work

41. A ray of light is incident normally on one refracting surface of an equilateral prism. If the refractive index of the material of the prism is 1.5, then

(A) the emergent ray is deviated by 30°

(B) the emergent ray is deviated by 60°

(C) the emergent ray just graces the second reflecting surface

(D) the ray undergoes total internal reflection at second refracting surface

(E) the ray emerges normally from the second refracting surface

42. The maximum velocities of the photoelectrons ejected are v and $2v$ for the incident light of wavelength 400 nm and 250 nm on a metal surface respectively. The work function of the metal in terms of Planck's constant h and velocity of light c is

(A) $hc \times 10^6$ J (B) $2hc \times 10^6$ J (C) $1.5hc \times 10^6$ J

(D) $2.5hc \times 10^6$ J (E) $3hc \times 10^6$ J

43. A radioactive sample contains 10^{-3} kg each of two nuclear species A and B with half-life 4 days and 8 days respectively. The ratio of the amounts of A and B after a period of 16 days is

(A) 1 : 2 (B) 4 : 1 (C) 1 : 4 (D) 2 : 1 (E) 1 : 1

44. The binding energy per nucleon for deuteron ($_1H^2$) and helium ($_2He^4$) are 1.1 MeV and 7.0 MeV respectively. The energy released when two deuterons fuse to form a helium nucleus is

(A) 36.2 MeV (B) 23.6 MeV (C) 47.2 MeV

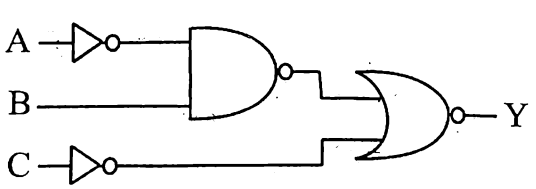
(D) 11.8 MeV (E) 9.31 MeV

Space for rough work

45. In a series of radioactive decays, if a nucleus of mass number 180 and atomic number 72 decays into another nucleus of mass number 172 and atomic number 69, then the number of alpha and beta particles released respectively are

(A) 2, 3 (B) 2, 2 (C) 2, 1 (D) 2, 0 (E) 1, 3

46. For which one of the following input combinations, the given logic circuit gives the output Y = 1?



(A) A = 0 ; B = 0 ; C = 0 (B) A = 0 ; B = 1 ; C = 1

(C) A = 0 ; B = 1 ; C = 0 (D) A = 1 ; B = 1 ; C = 1

(E) A = 1 ; B = 0 ; C = 1

47. In a semiconductor, $\frac{2}{3}$rd of the total current is carried by electrons and remaining $\frac{1}{3}$rd by the holes. If at this temperature, the drift velocity of electrons is 3 times that of holes, the ratio of number density of electrons to that of holes is

(A) $\frac{3}{2}$ (B) $\frac{2}{3}$ (C) $\frac{5}{3}$ (D) $\frac{3}{5}$ (E) $\frac{1}{3}$

48. In an PNP transistor, 10^{10} holes enter the emitter in 10^{-6} s. If 2% of holes is lost in the base, then the current amplification factor is

(A) 49 (B) 19 (C) 29 (D) 39 (E) 59

Space for rough work

49. The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 600 nm is incident on it. The energy band gap (in eV) for the semiconductor is

(A) 1.50 (B) 0.75 (C) 2.06 (D) 1.35 (E) 0.90

50. Identify the mismatched pair

(A) Noise - Unwanted signals
(B) Repeater - Communication satellite
(C) Transducer - Energy converter
(D) Demodulation - Retrieval of information
(E) Attenuation - Strengthening of signal

51. Pick out the wrong statement

(A) Analog signals provide a continuous set of values
(B) Digital signals represent values as discrete steps
(C) Analog signals cannot utilize the binary system
(D) Digital signals can be processed by logic gates
(E) Digital signals can utilize decimal as well as binary systems

52. A ground receiver receives a signal at 5 MHz, transmitted by a ground transmitter at a height of 320 m, which is 110 km away from it. Then it can communicate through (radius of earth R = 6400 km)

(A) space waves (B) ground waves (C) sky waves
(D) both sky and ground waves (E) sky waves, ground waves and space waves

53. The power radiated by a linear antenna of length ℓ at wavelength λ is

(A) directly proportional to ℓ (B) inversely proportional to λ
(C) inversely proportional to ℓ (D) directly proportional to λ^2
(E) inversely proportional to λ^2

Space for rough work

54. The physical quantity that does not have the dimensional formula $\left[ML^{-1}T^{-2}\right]$ is

(A) force (B) pressure (C) stress

(D) modulus of elasticity (E) energy density

55. A force F is applied onto a square plate of side L. If the percentage error in determining L is 2% and that in F is 4%, the permissible percentage error in determining the pressure is

(A) 2% (B) 4% (C) 6% (D) 8% (E) 1%

56. From a balloon moving upwards with a velocity of 12 ms^{-1}, a packet is released when it is at a height of 65 m from the ground. The time taken by it to reach the ground is $\left(g = 10\ ms^{-2}\right)$

(A) 5 s (B) 8 s (C) 4 s (D) 7 s (E) 10 s

57. A bus is moving with a velocity of 10 ms^{-1} on a straight road. A scootorist wishes to overtake the bus in one minute. If the bus is at a distance of 1.2 km ahead, then the velocity with which he has to chase the bus is

(A) 20 ms^{-1} (B) 25 ms^{-1} (C) 60 ms^{-1} (D) 40 ms^{-1} (E) 30 ms^{-1}

Space for rough work

58. If the displacement of a body varies as the square of elapsed time, then its

(A) velocity is constant
(B) velocity varies non-uniformly
(C) acceleration is constant
(D) acceleration changes continuously
(E) momentum is constant

59. The magnitudes of a set of 3 vectors are given below. The set of vectors for which the resultant cannot be zero is

(A) 15, 20, 30
(B) 20, 20, 30
(C) 25, 20, 35
(D) 10, 10, 20
(E) 10, 20, 40

60. A ball dropped from a point A falls down vertically to C, through the midpoint B. The descending time from A to B and that from A to C are in the ratio

(A) 1 : 1
(B) 1 : 2
(C) 1 : 3
(D) $1 : \sqrt{2}$
(E) $1 : \sqrt{3}$

61. A cricket ball is hit at an angle of 30° to the horizontal with a kinetic energy E. Its kinetic energy when it reaches the highest point is

(A) $\frac{E}{2}$
(B) 0
(C) $\frac{2E}{3}$
(D) $\frac{3E}{4}$
(E) E

Space for rough work

62. If n bullets each of mass m are fired with a velocity v per second from a machine gun, the force required to hold the gun in position is

(A) $(n+1)\,mv$ (B) $\frac{mv}{n^2}$ (C) $\frac{mv}{n}$ (D) n^2mv (E) mnv

63. The time required to stop a car of mass 800 kg, moving at a speed of 20 ms^{-1} over a distance of 25 m is

(A) 2 s (B) 2.5 s (C) 4 s (D) 4.5 s (E) 1 s

64. A car moves at a speed of 20 ms^{-1} on a banked track and describes an arc of a circle of radius $40\sqrt{3}$ m. The angle of banking is (g = 10 ms^{-2})

(A) 25° (B) 60° (C) 45° (D) 30° (E) 40°

65. When a body is projected vertically up from the ground with certain velocity, its potential energy and kinetic energy at a point A are in the ratio 2 : 3. If the same body is projected with double the previous velocity, then at the same point A the ratio of its potential energy to kinetic energy is

(A) 9 : 1 (B) 2 : 9 (C) 1 : 9 (D) 9 : 2 (E) 3 : 2

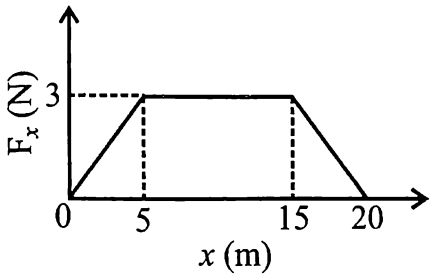
Space for rough work

66. A spring with force constant k is initially stretched by x_1. If it is further stretched by x_2, then the increase in its potential energy is

(A) $\frac{1}{2} k (x_2 - x_1)^2$ (B) $\frac{1}{2} k x_2 (x_2 + 2x_1)$ (C) $\frac{1}{2} k x_1^2 - \frac{1}{2} k x_2^2$

(D) $\frac{1}{2} k (x_1 + x_2)^2$ (E) $\frac{1}{2} k (x_1^2 + x_2^2)$

67. A force F_x acts on a particle such that its position x changes as shown in the figure.



The work done by the particle as it moves from $x = 0$ to 20 m is

(A) 37.5 J (B) 10 J (C) 15 J (D) 22.5 J (E) 45 J

68. Two objects P and Q initially at rest move towards each other under mutual force of attraction. At the instant when the velocity of P is v and that of Q is $2v$, the velocity of centre of mass of the system is

(A) v (B) $3v$ (C) $2v$ (D) $1.5v$ (E) zero

Space for rough work

69. A body rolls down an inclined plane. If its kinetic energy of rotation is 40% of its kinetic energy of translation motion, then the body is

(A) hollow cylinder (B) ring (C) solid disc

(D) solid sphere (E) hollow sphere

70. A circular disc A and a ring B have same mass and same radius. If they are rotated with the same angular speed about their own axis, then

(A) A has less moment of inertia than B

(B) A has less rotational kinetic energy than B

(C) A and B have the same angular momentum

(D) A has greater angular momentum than B

(E) A has the same moment of inertia as that of B

71. Angular momentum of earth revolving around the sun in a circular orbit of radius R is proportional to

(A) $\sqrt{R}$ (B) R (C) R^2 (D) $R^{1/3}$ (E) $R^{3/2}$

72. A body of mass *m* is released from a height equal to the radius R of earth. The velocity with which it will strike earth's surface is

(A) $\sqrt{2gR}$ (B) $\sqrt{gR}$ (C) $\sqrt{2mgR}$ (D) $\sqrt{mgR}$ (E) $m\sqrt{gR}$

Space for rough work

73. A binary solid has a primitive cubical structure with B^- ions constituting the lattice points and A^+ ions occupying 25% of its tetrahedral holes. The molecular formula of the crystal is

(A) A_2B (B) AB_3 (C) AB_2 (D) A_2B_3 (E) A_2B_5

74. The correct order of first ionisation enthalpies of the following elements is

(A) Be > Mg > Ca > Sr > Ra > Ba (B) Ra > Ba > Sr > Ca > Mg > Be

(C) Be > Mg > Ca > Sr > Ba > Ra (D) Ra > Sr > Ba > Mg > Ca > Be

(E) Be > Mg > Ca > Ra > Ba > Sr

75. Which one of the following is reduced by H_2O_2 in alkaline medium?

(A) Fe^{2+} (B) HOCl (C) $KMnO_4$ (D) PbS (E) Mn^{2+}

76. Match the following

Column I		Column II
(a) Sphalerite	-	(i) $FeCO_3$
(b) Malachite	-	(ii) $ZnCO_3$
(c) Calamine	-	(iii) Na_3AlF_6
(d) Cryolite	-	(iv) $CuCO_3.Cu(OH)_2$
(e) Siderite	-	(v) ZnS

(A) (a) - (iii), (b) - (i), (c) - (v), (d) - (ii), (e) - (iv)

(B) (a) - (v), (b) - (iv), (c) - (ii), (d) - (i), (e) - (iii)

(C) (a) - (v), (b) - (iii), (c) - (ii), (d) - (i), (e) - (iv)

(D) (a) - (v), (b) - (iv), (c) - (ii), (d) - (iii), (e) - (i)

(E) (a) - (ii), (b) - (iii), (c) - (i), (d) - (v), (e) - (iv)

Space for rough work

77. In the metallurgy of zinc the reducing agent employed in reducing the zinc oxide to crude zinc metal in the last stage is

(A) Al (B) Li (C) Coke (D) Water gas (E) H_2 gas

78. Which one of the following has the maximum number of P–OH bonds?

(A) H_3PO_2 (B) H_3PO_4 (C) H_3PO_3 (D) $H_4P_2O_5$ (E) $H_4P_2O_6$

79. The relative strengths of trichlorides of boron group to accept a pair of electron is given by

(A) $GaCl_3 < AlCl_3 < BCl_3$ (B) $AlCl_3 < BCl_3 < GaCl_3$

(C) $AlCl_3 < GaCl_3 < BCl_3$ (D) $BCl_3 < AlCl_3 < GaCl_3$

(E) $GaCl_3 < BCl_3 < AlCl_3$

80. The hybridised state of bromine in bromine pentafluoride is

(A) sp^3d (B) dsp^3 (C) d^2sp^3 (D) sp^2d (E) sp^3d^2

81. In which one of the following, d-d transition involves absorption in the ultraviolet region

(A) $[Cu(H_2O)_4]^{2+}$ (B) $[Ti(H_2O)_6]^{3+}$ (C) $[Co(NH_3)_6]^{3+}$

(D) $[Co(CN)_6]^{3-}$ (E) $[Co(NH)_5Cl]^{2+}$

82. Which one of the following has a different crystal lattice from those of the rest?

(A) Ag (B) V (C) Cu (D) Pt (E) Au

83. The hardest lanthanide element is

(A) Sm (B) La (C) Gd (D) Dy (E) Yb

Space for rough work

84. The enthalpy change for a reaction at equilibrium is –20.5 kJ mol^{-1}. Then the entropy change for this equilibrium at 410 K is

(A) +50 $JK^{-1}mol^{-1}$ (B) +55 $JK^{-1}mol^{-1}$ (C) +75 $JK^{-1}mol^{-1}$

(D) –50 $JK^{-1}mol^{-1}$ (E) –55 $JK^{-1}mol^{-1}$

85. The enthalpy of combustion of glucose (mol. wt: 180 g mol^{-1}) is –2840 kJ mol^{-1}. Then the amount of heat evolved when 0.9 g of glucose is burnt, will be

(A) 14.2 kJ (B) 14.2 J (C) 28.4 kJ (D) 1420 kJ (E) 142 kJ

86. If the ionic product of $M(OH)_2$ is 5×10^{-10}, then the molar solubility of $M(OH)_2$ in 0.1M NaOH is

(A) 5×10^{-12}M (B) 5×10^{-8}M (C) 5×10^{-10}M

(D) 5×10^{-9}M (E) 5×10^{-16}M

87. Equilibrium constants are given for the following two equilibria

(i) $A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$; $K = 2 \times 10^{-4}$

(ii) $2AB(g) + C_2(g) \rightleftharpoons 2ABC(g)$; $K = 2 \times 10^{-2}$ L mol^{-1}

Calculate the equilibrium constant for the following equilibrium

$ABC(g) \rightleftharpoons \frac{1}{2}A_2(g) + \frac{1}{2}B_2(g) + \frac{1}{2}C_2(g)$

(A) 500 $mol^{1/2}$ $L^{1/2}$ (B) 4×10^{-6} $mol^{1/2}$ $L^{1/2}$ (C) 500 $mol^{-1/2}$ $L^{1/2}$

(D) 200 $mol^{1/2}$ $L^{-1/2}$ (E) 500 $mol^{1/2}$ $L^{-1/2}$

Space for rough work

88. The equilibrium constant for the equilibrium $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ at a particular temperature is 2×10^{-2} mol L^{-1}. The number of moles of PCl_5 that must be taken in a one-litre flask at the same temperature to obtain a concentration of 0.20 mol of chlorine at equilibrium is

(A) 2.2 (B) 2.0 (C) 1.8 (D) 0.2 (E) 0.1

89. 18 g of glucose is dissolved in 178.2 g of water. The vapour pressure of the solution at 100°C is (vapour pressure of pure water at 100° C is 760 mm Hg)

(A) 767.6 mm Hg (B) 760 mm Hg (C) 752.4 mm Hg

(D) 725.4 mm Hg (E) 745.2 mm Hg

90. Which one of the following binary liquid mixtures exhibit positive deviation from Raoult's law?

(A) Carbon disulphide – acetone (B) Chloroform – acetone

(C) Bromobenzene – chlorobenzene (D) Benzene – toluene

(E) Phenol – aniline

91. The standard electrode potentials of Zn and Ni are respectively – 0.76 V and – 0.25 V. Then the standard emf of the spontaneous cell by coupling these under standard conditions is

(A) + 1.01 V (B) – 0.51 V (C) + 0.82 V (D) + 0.25 V (E) + 0.51 V

Space for rough work

92. How many moles of platinum will be deposited on the cathode when 0.60 F of electricity is passed through a 1.0M solution of Pt^{4+}?

(A) 0.60 mol (B) 0.15 mol (C) 0.30 mol (D) 0.45 mol (E) 1.0 mol

93. The half-life period of a first order reaction having rate constant $k = 0.231 \times 10^{-10} s^{-1}$ will be

(A) 32×10^{10}s (B) 2×10^{10}s (C) 3×10^{10}s

(D) 2×10^{-10}s (E) 3×10^{-12}s

94. For the reaction X → Y, the concentrations of 'X' are 1.2M, 0.6M, 0.3M and 0.15M at 0, 1, 2 and 3 hours respectively. The order of the reaction is

(A) zero (B) half (C) one (D) two (E) three

95. The enzyme that converts glucose into ethyl alcohol and carbon dioxide is

(A) invertase (B) maltase (C) urease (D) diastase (E) zymase

Space for rough work

96. List I contains the type of colloid while List II contains the examples

List I	List II
(a) Sol	(i) dust
(b) Aerosol	(ii) cheese
(c) Gel	(iii) soap lather
(d) Foam	(iv) plants cell fluids

Choose the correct match

(A) (a) - (iv), (b) - (iii), (c) - (i), (d) - (ii)

(B) (a) - (iv), (b) - (i), (c) - (ii), (d) - (iii)

(C) (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)

(D) (a) -(iii), (b) - (i), (c) - (iv), (d) - (ii)

(E) (a) - (i), (b) - (iii), (c) - (iv), (d) - (ii)

97. The chelating ligand used to remove excess of copper and iron in chelate therapy is

(A) D-Penicillamine (B) Oxalate ion (C) EDTA

(D) Ethylene diamine (E) Dimethyl glyoxime

98. The correct ascending order of ligand field strengths of the given ligands is

(A) $F^- < I^- < CN^- < H_2O < CO$ (B) $I^- < F^- < H_2O < CO < CN^-$

(C) $I^- < F^- < H_2O < CN^- < CO$ (D) $F^- < H_2O < I^- < CN^- < CO$

(E) $F^- < I^- < CO < H_2O < CN^-$

99. An organic compound contains 90% carbon and 10% hydrogen by mass. Its empirical formula is

(A) C_2H_4 (B) C_3H_6 (C) C_3H_8 (D) C_3H_4 (E) C_2H_6

Space for rough work

100. Glycerol can be separated from spent-lye in soap industry by

(A) crystallization (B) sublimation

(C) differential extraction (D) chromatography

(E) distillation under reduced pressure

101. The IUPAC name of $(CH_3)_3\ C - CH = CH_2$ is

(A) 2, 2-dimethylbut-3-ene (B) 2, 2-dimethylpent-3-ene

(C) 3, 3-dimethylbut-1-ene (D) hex-1-ene

(E) 2, 2-dimethylhex-2-ene

102. When methane is heated with dioxygen in the presence of Mo_2O_3 catalyst, the organic product obtained is

(A) methanal (B) ethanoic acid (C) methanol

(D) ethanol (E) 2-methylpropan-2-ol

103. Isomers which can be interconverted through rotation about C–C single bond are

(A) diasteromers (B) enantiomers (C) conformers

(D) chain isomers (E) position isomers

104. Which one of the following compounds shows cis-trans isomerism?

(A) Pent-1-ene (B) But-2-ene (C) But-1-ene

(D) Propene (E) Ethene

Space for rough work

105. Among the following, the ambident nucleophile is

(A) iodide (B) alkoxy (C) hydroxyl (D) hydride (E) cyanide

106. Which one of the following is an allylic halide ?

(A) 2-chlorobutane (B) Chloroethene (C) 3-bromopropene
(D) 2-chlorotoluene (E) Dichloromethane

107. Out of the following isomeric alcohols containing five carbon atoms, the alcohol that exhibits optical isomerism is

(A) 1-pentanol (B) 2-pentanol (C) 3-pentanol
(D) 2-methyl-2-butanol (E) 2,2-dimethyl-1-propanol

108. Which one of the following undergoes iodoform test?

(A) Propanal (B) Ethanal (C) Benzophenone
(D) Benzaldehyde (E) Phenol

109. Which one of the following is used as a test for aliphatic primary amines?

(A) Tollen's test (B) Fehling's test (C) Isocyanide test
(D) Azo dye test (E) Phthalein fusion test

110. When methanamine is treated with benzoyl chloride, the major product is

(A) N-phenylethanamide (B) N-methylbenzamide
(C) benzanilide (D) acetophenone
(E) N-ethylethanamide

Space for rough work

111. In DNA, the consecutive deoxynucleotides are connected by

(A) phosphodiester linkage (B) phosphomonoester linkage

(C) phosphotriester linkage (D) amide linkage

(E) imide linkage

112. Which one of the following monomers form biodegradable polymer?

(A) Urea and formaldehyde

(B) Ethylene glycol and terephthalic acid

(C) 3-hydroxybutanoic acid and 3-hydroxypentanoic acid

(D) Phenol and caproic acid

(E) Adipic acid and hexamethylenediamine

113. Match the following

Drug		Class
(a) Dimetapp	-	(i) Antidepressant
(b) Furacine	-	(ii) Analgesic
(c) Phenelzine	-	(iii) Antiseptic
(d) Aspirin	-	(iv) Antifertility
(e) Norethindrone	-	(v) Antihistamine

(A) (a) - (ii), (b) - (iv), (c) - (v), (d) - (iii), (e) - (i)

(B) (a) - (iii), (b) - (v), (c) - (ii), (d) - (i), (e) - (iv)

(C) (a) - (v), (b) - (iv), (c) - (ii), (d) - (i), (e) - (iii)

(D) (a) - (v), (b) - (iii), (c) - (i), (d) - (ii), (e) - (iv)

(E) (a) - (ii), (b) - (iii), (c) - (i), (d) - (v), (e) - (iv)

Space for rough work

114. The threshold frequency of a metal corresponds to the wavelength of x nm. In two separate experiments 'A' and 'B', incident radiations of wavelengths $\frac{1}{2}x$ nm and $\frac{1}{4}x$ nm respectively are used. The ratio of kinetic energy of the released electrons in experiment 'B' to that in experiment 'A' is

(A) $\frac{1}{3}$ (B) 2 (C) 4 (D) 3 (E) $\frac{1}{2}$

115. The minimum values of uncertainties involved in the determination of both the position and velocity of a particle are respectively 1×10^{-10}m and 1×10^{-10}ms^{-1}. Then, the mass (in kg) of the particle is

(A) 5.270×10^{-15} (B) 5.270×10^{-20} (C) 5.270×10^{-16}
(D) 5.270×10^{-10} (E) 5.270×10^{-14}

116. The number of electrons with azimuthal quantum number $l = 1$ and $l = 2$ for Cr in ground state are respectively

(A) 16, 5 (B) 16, 4 (C) 12, 4 (D) 16, 3 (E) 12, 5

Space for rough work

117. An odd electron molecule among the following is

(A) CO (B) SO_2 (C) CO_2 (D) NO (E) OF_2

118. Aluminium (Atomic mass = 27) crystallizes in a cubic system with edge length of 4 A°. Its density is 2.7 g cm^{-3}. The number of aluminium atoms present per unit cell is

(A) 5 (B) 6 (C) 4 (D) 2 (E) 3

119. Which of the following changes in the respective bond order values are caused by removal of an electron from N_2 and F_2 molecules?

(A) decrease by 0.5 in both

(B) increase by 0.5 in both

(C) increase by 0.5 in the former and decrease by 0.5 in the later

(D) decrease by 0.5 in the former and increase by 0.5 in the later

(E) no change in both

120. For two isomorphous crystals A and B, the ratio of density of A to that of B is 1.6 while the ratio of the edge length of B to that of A is 2. If the molar mass of crystal B is 200 g mol^{-1}, then that of crystal A is

(A) 240 g mol^{-1} (B) 120 g mol^{-1} (C) 80 g mol^{-1}

(D) 160 g mol^{-1} (E) 40 g mol^{-1}

Space for rough work

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