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

PAPER I PHYSICS - CHEMISTRY

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 OMR Answer Sheet 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 OMR Answer Sheet from the Invigilator. **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 4 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 subject 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 4 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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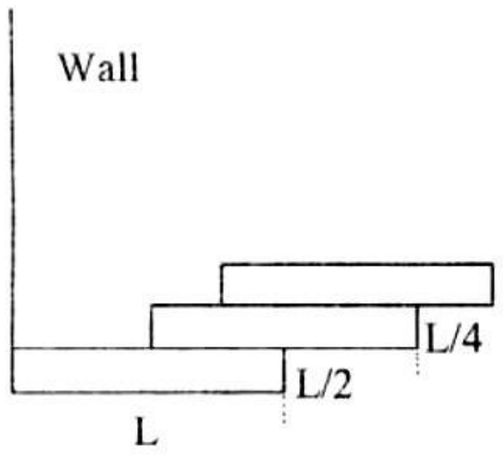
PLEASE ENSURE THAT THIS QUESTION BOOKLET CONTAINS 120 QUESTIONS SERIALLY NUMBERED FROM 1 TO 120
PRINTED PAGES : 32

1. Identify the false statement from the following

(A) Work-energy theorem is not independent of Newton's second law
(B) Work-energy theorem holds in all inertial frames
(C) Work done by friction over a closed path is zero
(D) No potential energy can be associated with friction
(E) Work done is a scalar quantity

2. Three bricks each of length L and mass M are arranged as shown from the wall. The distance of the centre of mass of the system from the wall is



(A) L/4 (B) L/2 (C) (3/2)L (D) (11/12)L (E) (5/6)L

3. A fly wheel of moment of inertia 3×10^2 kg m^2 is rotating with uniform angular speed of 4.6 $rads^{-1}$. If a torque of 6.9×10^2 Nm retards the wheel, then the time in which the wheel comes to rest is

(A) 1.5 s (B) 2 s (C) 0.5 s (D) 1 s (E) 2.5 s

Space for rough work

4. Moment of inertia of a ring of mass M and radius R about a tangent to the circle of the ring is

(A) $\frac{5}{2}MR^2$ (B) $\frac{3}{2}MR^2$ (C) $\frac{1}{2}MR^2$ (D) MR^2 (E) $\frac{7}{2}MR^2$

5. If the escape velocity of a planet is 3 times that of the earth and its radius is 4 times that of the earth, then the mass of the planet is

(Mass of the earth = 6×10^{24}kg)

(A) 1.62×10^{22} kg (B) 0.72×10^{22} kg (C) 2.16×10^{26} kg
(D) 1.22×10^{22} kg (E) 3.6×10^{22} kg

6. The total energy of a circularly orbiting satellite is

(A) twice the kinetic energy of the satellite
(B) half the kinetic energy of the satellite
(C) twice the potential energy of the satellite
(D) equal to the potential energy of the satellite
(E) half the potential energy of the satellite

7. If an earth satellite of mass *m* orbiting at a distance 2 R from the centre of earth has to be transferred into the orbit of radius 3 R, the amount of energy required is (R: radius of Earth)

(A) *mg*R (B) $\frac{mgR}{3}$ (C) $\frac{mgR}{2}$ (D) $\frac{mgR}{12}$ (E) $\frac{mgR}{9}$

8. The compressibility of water is $6 \times 10^{-10}\ N^{-1}\ m^2$. If one litre is subjected to a pressure of $4 \times 10^7\ N\ m^{-2}$, the decrease in its volume is

(A) 2.4 cc (B) 10 cc (C) 24 cc (D) 15 cc (E) 12 cc

Space for rough work

9. Bernoulli's principle is not involved in the working/explanation of

(A) movement of spinning ball (B) carburetor of automobile
(C) blades of a kitchen mixer (D) heart attack
(E) dynamic lift of an aeroplane

10. Which one of the following statements is correct? In the case of

(A) shearing stress there is change in volume
(B) tensile stress there is no change in volume
(C) shearing stress there is no change in shape
(D) hydraulic stress there is no change in volume
(E) tensile stress there is no change in shape

11. The onset of turbulence in a liquid is determined by

(A) Pascal's law (B) Magnus effect (C) Reynold's number
(D) Bernoulli's principle (E) Torricelli's law

12. The temperature at which oxygen molecules have the same root mean square speed as that of hydrogen molecules at 300 K is

(A) 600 K (B) 2400 K (C) 1200 K (D) 300 K (E) 4800 K

13. Mean free path of a gas molecule is

(A) inversely proportional to number of molecules per unit volume
(B) inversely proportional to diameter of the molecule
(C) directly proportional to the square root of the absolute temperature
(D) directly proportional to the molecular mass
(E) independent of temperature

Space for rough work

14. A refrigerator with coefficient of performance $\frac{1}{3}$ releases 200 J of heat to a hot reservoir. Then the work done on the working substance is

(A) $\frac{100}{3}$ J (B) 100 J (C) $\frac{200}{3}$ J (D) 150 J (E) 50 J

15. The heat capacity per mole of water is (R is universal gas constant)

(A) 9 R (B) $\frac{9}{2}$R (C) 6 R (D) 5 R (E) 3 R

16. If the frequency of human heart beat is 1.25 Hz, the number of heart beats in 1 minute is

(A) 80 (B) 65 (C) 90 (D) 75 (E) 120

17. A particle oscillating under a force $\overline{F} = -k\overline{x} - b\overline{v}$ is a (k and b are constants)

(A) simple harmonic oscillator (B) non linear oscillator (C) damped oscillator
(D) forced oscillator (E) linear oscillator

18. A mass of 4 kg suspended from a spring of force constant 800 Nm^{-1} executes simple harmonic oscillations. If the total energy of the oscillator is 4 J, the maximum acceleration (in ms^{-2}) of the mass is

(A) 5 (B) 15 (C) 45 (D) 20 (E) 25

19. The principle of superposition is basic to the phenomenon of

(A) total internal reflection (B) interference (C) reflection
(D) refraction (E) polarisation

Space for rough work

20. Velocity of sound in air is 320 ms^{-1}. A pipe closed at one end has a length of 1 m. Neglecting end correction, the air column in the pipe cannot resonate with sound of frequency

(A) 80 Hz (B) 240 Hz (C) 320 Hz (D) 400Hz (E) 560 Hz

21. A whistle is blown from the tower of a factory with a frequency of 220 Hz. The apparent frequency of sound heard by a worker moving towards the factory with a velocity of 30 ms^{-1} is (Velocity of sound = 330 ms^{-1})

(A) 280 Hz (B) 200 Hz (C) 300 Hz (D) 240 Hz (E) 330 Hz

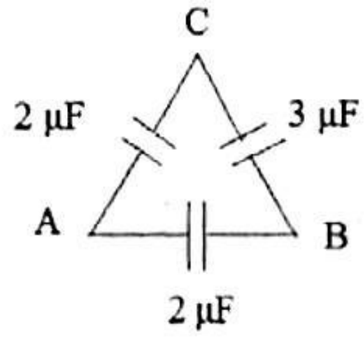
22. 'n' identical drops, each of capacitance C and charged to a potential V, coalesce to form a bigger drop. Then the ratio of the energy stored in the big drop to that in each small drop is

(A) $n^{5/3} : 1$ (B) $n^{4/3} : 1$ (C) $n : 1$ (D) $n^3 : 1$ (E) $n^{2/3} : 1$

23. Two charged spherical conductors of radii R_1 and R_2 are connected by a wire. Then the ratio of surface charge densities of the spheres σ_1 / σ_2 is

(A) R_1 / R_2 (B) R_2 / R_1 (C) $\sqrt{(R_1 / R_2)}$ (D) R_1^2 / R_2^2 (E) R_2^2 / R_1^2

24. Three capacitors are connected in the arms of a triangle ABC as shown in figure. 5 V is applied between A and B. The voltage between B and C is



(A) 2 V (B) 1 V (C) 3 V (D) 1.5 V (E) 0.5 V

Space for rough work

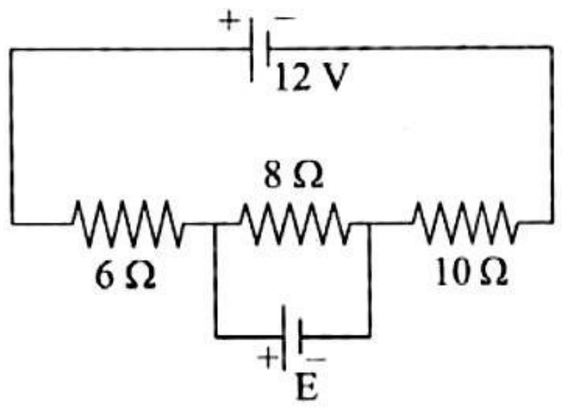
25. Two point charges +5 μC and −2 μC are kept at a distance of 1 m in free space. The distance between the two zero potential points on the line joining the charges is

(A) $\frac{2}{7}$ m (B) $\frac{2}{3}$ m (C) $\frac{22}{21}$ m (D) $\frac{20}{21}$ m (E) $\frac{8}{21}$ m

26. A negatively charged oil drop is prevented from falling under gravity by applying a vertical electric field 100 Vm^{-1}. If the mass of the drop is 1.6×10^{-3} g, the number of electrons carried by the drop is ($g = 10\ m\ s^{-2}$)

(A) 10^{18} (B) 10^{15} (C) 10^{6} (D) 10^{9} (E) 10^{12}

27. In the circuit shown, the current through 8 ohm is same before and after connecting E. The value of E is



(A) 12 V (B) 6 V (C) 4 V (D) 2 V (E) 8 V

28. An electric bulb rated 500 W at 100 V is used in a circuit having a 200 V supply. The resistance R that must be put in series with the bulb, so that the bulb draws 500 W is

(A) 10 Ω (B) 15 Ω (C) 2.5 Ω (D) 25 Ω (E) 20 Ω

Space for rough work

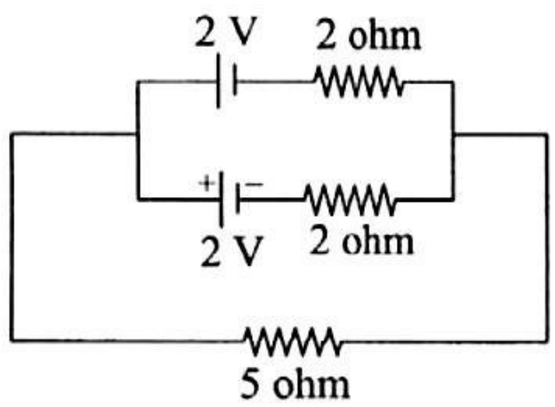
29. Two resistors of resistances 200 kΩ and 1 MΩ respectively form a potential divider with outer junctions maintained at potentials of +3 V and –15 V. Then, the potential at the junction between the resistors is

(A) +1 V (B) – 0.6 V (C) 0 V (D) – 12 V (E) +12 V

30. The graph between resistivity and temperature, for a limited range of temperatures, is a straight line for a material like

(A) copper (B) nichrome (C) silicon (D) mercury (E) gallium arsenide

31. In the circuit shown, the current through the 5 Ω resistor is



(A) $\frac{8}{3}$ A (B) $\frac{9}{13}$ A (C) $\frac{4}{13}$ A (D) $\frac{1}{3}$ A (E) $\frac{2}{3}$ A

32. A solenoid has core of a material with relative permeability 500 and its windings carry a current of 1 A. The number of turns of the solenoid is 500 per metre. The magnetization of the material is nearly

(A) 2.5×10^3 A m^{-1} (B) 2.5×10^5 A m^{-1} (C) 2.0×10^3 A m^{-1}
(D) 2.0×10^5 A m^{-1} (E) 5×10^5 A m^{-1}

Space for rough work

33. Choose the correct statement:

(A) A paramagnetic material tends to move from a strong magnetic field to weak magnetic field

(B) A magnetic material is in the paramagnetic phase below its Curie temperature

(C) The resultant magnetic moment in an atom of a diamagnetic substance is zero

(D) Typical domain size of a ferromagnetic material is 1 nm

(E) The susceptibility of a ferromagnetic material is slightly greater than 1

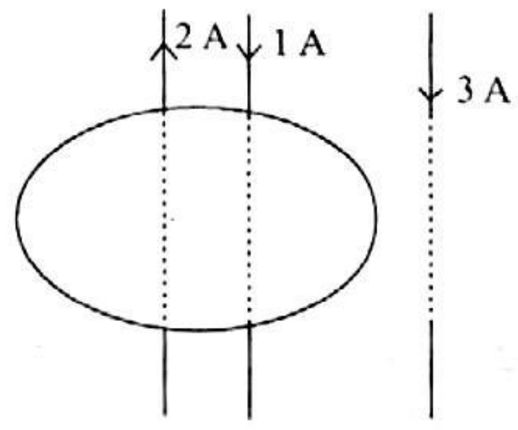
34. A 2 μC charge moving around a circle with a frequency of 6.25×10^{12} Hz produces a magnetic field 6.28 tesla at the centre of the circle. The radius of the circle is

(A) 2.25 m (B) 0.25 m (C) 13.0 m (D) 1.25 m (E) 3.25 m

35. A galvanometer of resistance 100 Ω is converted to a voltmeter of range 10 V by connecting a resistance of 10 kΩ . The resistance required to convert the same galvanometer to an ammeter of range 1 A is

(A) 0.4 Ω (B) 0.3 Ω (C) 1.2 Ω (D) 0.2 Ω (E) 0.1 Ω

36. Two wires with currents 2 A and 1 A are enclosed in a circular loop. Another wire with current 3 A is situated outside the loop as shown. Then $\oint \vec{B}.\overline{dl}$ around the loop is



(A) μ_0 (B) $3\,\mu_0$ (C) $6\,\mu_0$ (D) $2\,\mu_0$ (E) Zero

Space for rough work

37. An LCR series ac circuit is at resonance with 10 V each across L, C and R. If the resistance is halved, the respective voltages across L, C and R are

(A) 10 V, 10 V and 5 V (B) 10 V, 10 V and 10 V (C) 20 V, 20 V and 5 V
(D) 20 V, 20 V and 10 V (E) 5 V, 5 V and 5 V

38. A 50 Hz ac current of peak value 2 A flows through one of the pair of coils. If the mutual inductance between the pair of coils is 150 mH, then the peak value of voltage induced in the second coil is

(A) 30 πV (B) 60 πV (C) 15 πV (D) 300 πV (E) 3 πV

39. A transformer is used to light a 100 W and 110 V lamp from a 220 V main supply. If the main current is 0.5 A, then the efficiency of the transformer is nearly

(A) 89 % (B) 100 % (C) 95 % (D) 85 % (E) 91 %

40. An LCR series circuit is at resonance. Then

(A) the phase difference between current and voltage is 90^{o}
(B) the phase difference between current and voltage is 45^{o}
(C) its impedance is purely resistive
(D) its impedance is zero
(E) the current is minimum

41. A 100 W bulb produces an electric field of 2.9 V/m at a point 3 m away. If the bulb is replaced by 400 W bulb without distributing other conditions, then the electric field produced at the same point is

(A) 2.9 V/m (B) 3.5 V/m (C) 5 V/m (D) 5.8 V/m (E) 1.45 V/m

Space for rough work

42. In the total electromagnetic energy falling on a surface is U, then the total momentum delivered (for complete absorption) is

(A) $\frac{U}{c}$ (B) cU (C) $\frac{U}{c^2}$ (D) c^2U (E) $\sqrt{\frac{U}{c}}$

43. The focal lengths of the objective and of the eye-piece of a compound microscope are f_o and f_e respectively. If L is the tube length and D, the least distance of distinct vision, then its angular magnification, when the image is formed at infinity, is

(A) $\left(1-\frac{L}{f_o}\right)\left(\frac{D}{f_e}\right)$ (B) $\left(1+\frac{L}{f_o}\right)\left(\frac{D}{f_e}\right)$ (C) $\frac{L}{f_o}\left(1-\frac{D}{f_e}\right)$ (D) $\frac{L}{f_o}\left(1+\frac{D}{f_e}\right)$ (E) $\frac{L}{f_o}\left(\frac{D}{f_e}\right)$

44. The velocity of a moving galaxy is 300 kms^{-1} and the apparent change in wavelength of a spectral line emitted from the galaxy is observed as 0.5 nm. Then, the actual wavelength of the spectral line is

(A) 3000 Å (B) 5000 Å (C) 6000 Å (D) 4500 Å (E) 5500 Å

45. An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The separation between the objective and the eye piece is 36 cm and the final image is formed at infinity. The focal length f_0 of the objective and f_e of the eye piece are respectively

(A) 45 cm and 9 cm (B) 50 cm and 10 cm (C) 7.2 cm and 5 cm
(D) 30 cm and 6 cm (E) 5 cm and 7.2 cm

46. If the reflected image formed is magnified and virtual, then the mirror system is

(A) concave only (B) convex only (C) plane
(D) concave or convex (E) convex or plane

Space for rough work

47. A vessel of depth 'x' is half filled with oil of refractive index μ_1 and the other half is filled with water of refractive index μ_2. The apparent depth of the vessel when viewed from above is

(A) $\frac{x(\mu_1+\mu_2)}{2\mu_1\mu_2}$ (B) $\frac{x\mu_1\mu_2}{2(\mu_1+\mu_2)}$ (C) $\frac{x\mu_1\mu_2}{(\mu_1+\mu_2)}$ (D) $\frac{2x(\mu_1+\mu_2)}{\mu_1\mu_2}$ (E) $\frac{4(\mu_1+\mu_2)x}{\mu_1\mu_2}$

48. If 'm' is the mass of an electron and 'c' is the speed of light, the ratio of the wavelength of a photon of energy E to that of the electron of the same energy is

(A) $c\sqrt{\frac{2m}{E}}$ (B) $\sqrt{\frac{2m}{E}}$ (C) $\sqrt{\frac{2m}{cE}}$ (D) $\sqrt{\frac{m}{E}}$ (E) $\sqrt{\frac{cm}{E}}$

49. The set which represents the isotope, isobar and isotone respectively is

(A) $\left({}_1H^2, {}_1H^3\right)$, $\left({}_{79}Au^{197}, {}_{80}Hg^{198}\right)$ and $\left({}_2He^3, {}_1H^2\right)$

(B) $\left({}_2He^3, {}_1H^1\right)$, $\left({}_{79}Au^{197}, {}_{80}Hg^{198}\right)$ and $\left({}_1H^1, {}_1H^3\right)$

(C) $\left({}_2He^3, {}_1H^3\right)$, $\left({}_1H^2, {}_1H^3\right)$ and $\left({}_{79}Au^{197}, {}_{80}Hg^{198}\right)$

(D) $\left({}_1H^2, {}_1H^3\right)$, $\left({}_2He^3, {}_1H^3\right)$ and $\left({}_{79}Au^{197}, {}_{80}Hg^{198}\right)$

(E) $\left({}_1H^1, {}_1H^3\right)$, $\left({}_{79}Au^{197}, {}_{80}Hg^{198}\right)$ and $\left({}_2He^3, {}_1H^3\right)$

50. Two samples X and Y contain equal amount of radioactive substances. If $\frac{1}{16}$th of the sample X and $\frac{1}{256}$th of the sample Y, remain after 8 hours, then the ratio of half periods of X and Y is

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

Space for rough work

51. Radioactive $^{60}_{27}Co$ is transformed into stable $^{60}_{28}Ni$ by emitting two γ-rays of energies

(A) 1.33 MeV and 1.17 MeV in succession
(B) 1.17 MeV and 1.33 MeV in succession
(C) 1.37 MeV and 1.13 MeV in succession
(D) 1.13 MeV and 1.37 MeV in succession
(E) 1.17 MeV and 1.13 MeV in succession

52. A pure semiconductor has equal electron and hole concentration of $10^{16} m^{-3}$. Doping by indium increases n_h to $5 \times 10^{22}\ m^{-3}$. Then, the value of n_e in the doped semiconductor is

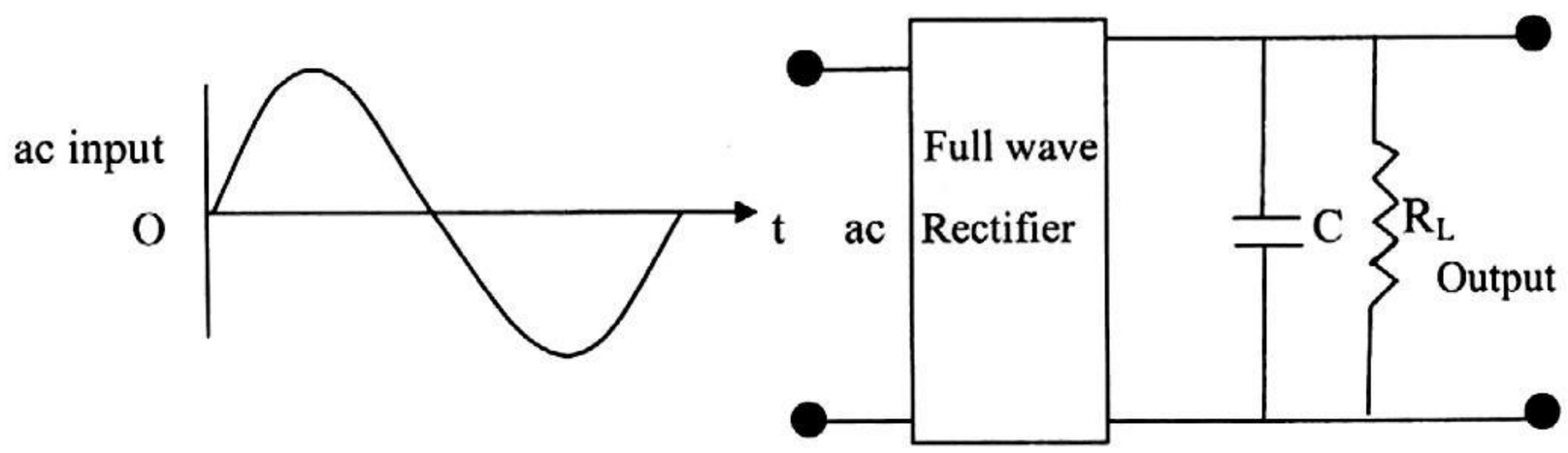
(A) $10^6 / m^3$ (B) $10^{22} / m^3$ (C) $2 \times 10^6 / m^3$ (D) $10^{19} / m^3$ (E) $2 \times 10^9 / m^3$

53. The collector supply voltage is 6 V and the voltage drop across a resistor of 600 Ω in the collector circuit is 0.6 V, in a transistor connected in common emitter mode. If the current gain is 20, the base current is

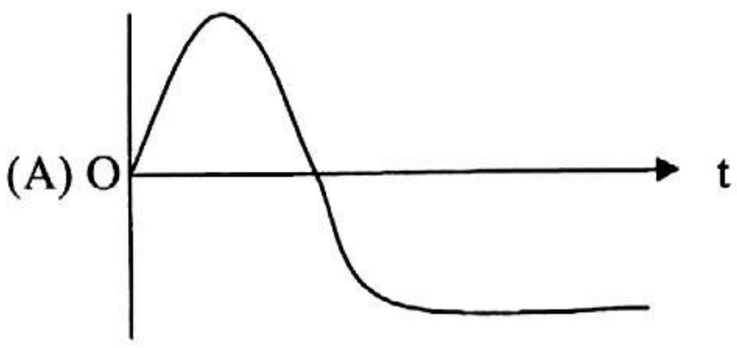
(A) 0.25 mA (B) 0.05 mA (C) 0.12 mA (D) 0.02 mA (E) 0.07 mA

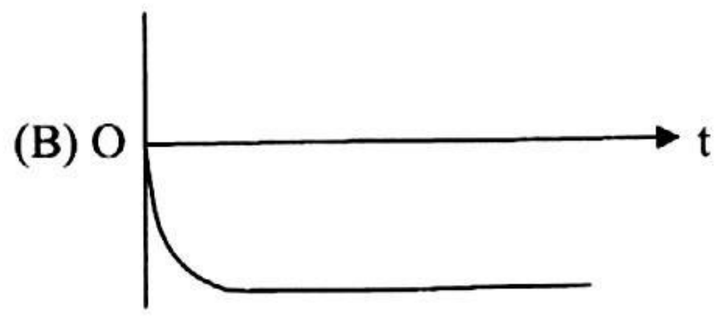
Space for rough work

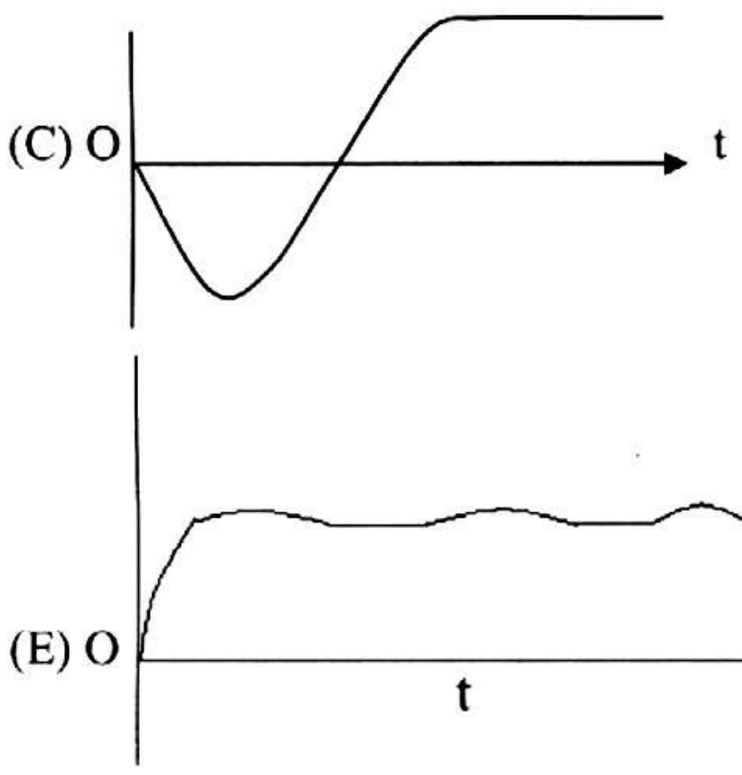
54. A full-wave rectifier circuit with an ac input is shown

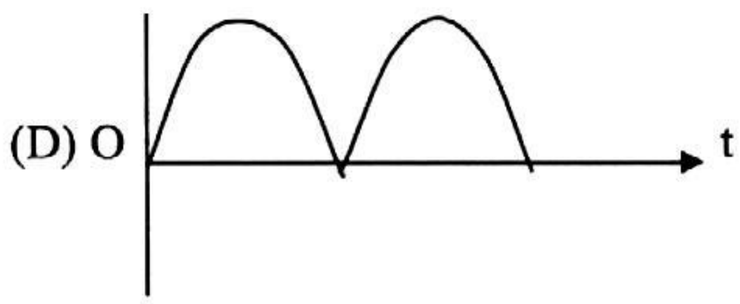


The output voltage across R_L is represented as









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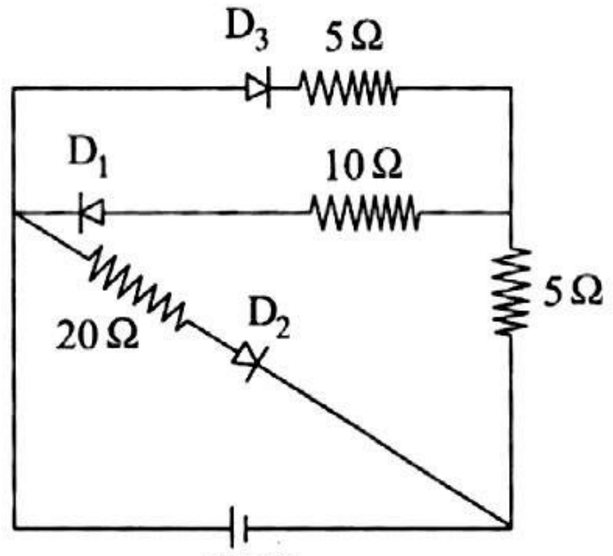
55. In the given circuit



the current through the battery is

(A) 0.5 A (B) 1 A (C) 1.5 A (D) 2 A (E) 2.5 A

56. A carrier frequency of 1 MHz and peak value of 10 V is amplitude modulated with a signal frequency of 10 kHz with peak value of 0.5 V. Then the modulation index and the side band frequencies respectively are

(A) 0.05 and 1 ± 0.010 MHz (B) 0.5 and 1 ± 0.010 MHz
(C) 0.05 and 1 ± 0.005 MHz (D) 0.5 and 1 ± 0.005 MHz
(E) 0.05 and 1 ± 0.100 MHz

57. The maximum line-of-sight distance d_M between two antennas having heights h_T and h_R above the earth is

(A) $\sqrt{R(h_T + h_R)}$ (B) $\sqrt{2R/(h_T + h_R)}$ (C) $\sqrt{Rh_T} + \sqrt{2Rh_R}$
(D) $\sqrt{2Rh_T} + \sqrt{2Rh_R}$ (E) $\sqrt{2Rh_T} + \sqrt{Rh_R}$

Space for rough work

58. The frequency band used in the downlink of satellite communication is

(A) 9.5 to 2.5 GHz (B) 896 to 901 MHz (C) 3.7 to 4.2 GHz
(D) 840 to 935 MHz (E) 3.7 to 4.2 MHz

59. In amplitude modulation, the bandwidth is

(A) twice the audio signal frequency
(B) thrice the audio signal frequency
(C) thrice the carrier wave frequency
(D) twice the carrier wave frequency
(E) sum of audio signal frequency and carrier wave frequency

60. The quantities RC and $\left(\frac{L}{R}\right)$ (where R, L and C stand for resistance, inductance and capacitance respectively) have the dimensions of

(A) force (B) linear momentum (C) linear acceleration
(D) time (E) linear velocity

61. The number of significant figures in 0.002305 is

(A) 6 (B) 4 (C) 7 (D) 2 (E) 3

Space for rough work

62. A body travelling with uniform acceleration crosses two points A and B with velocities 20 ms^{-1} and 30 ms^{-1} respectively. The speed of the body at the mid-point of A and B is nearest to

(A) 25.5 ms^{-1} (B) 25 ms^{-1} (C) 24 ms^{-1} (D) $10\sqrt{6}\ ms^{-1}$ (E) 22 ms^{-1}

63. An aeroplane flies around a square field ABCD of each side 1000 km. Its speed along AB is 250 kmh^{-1}, along BC 500 kmh^{-1}, along CD 200 kmh^{-1}, and along DA 100 kmh^{-1}. Its average speed (in kmh^{-1}) over the entire trip is

(A) 225.5 (B) 175.5 (C) 125.5 (D) 310.5 (E) 190.5

64. Free fall of an object (in vacuum) is a case of motion with

(A) uniform velocity (B) uniform acceleration (C) variable acceleration
(D) constant momentum (E) uniform speed

65. The maximum height of a projectile is half of its range on the horizontal. If the velocity of projection is u, its range on the horizontal is

(A) $\frac{2u^2}{5g}$ (B) $\frac{3u^2}{5g}$ (C) $\frac{u^2}{g}$ (D) $\frac{u^2}{5g}$ (E) $\frac{4u^2}{5g}$

66. A stone of mass 2 kg is tied to a string of length 0.5 m. If the breaking tension of the string is 900 N, then the maximum angular velocity, the stone can have in uniform circular motion is

(A) 30 rad s^{-1} (B) 20 rad s^{-1} (C) 10 rad s^{-1} (D) 25 rad s^{-1} (E) 40 rad s^{-1}

Space for rough work

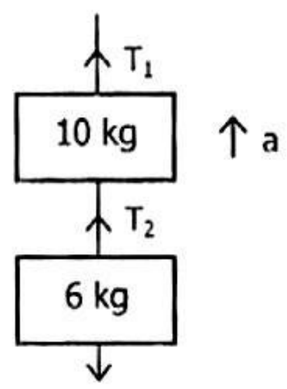
67. The position of a particle is given by $\vec{r} = 2t^2\hat{i} + 3t\,\hat{j} + 4\hat{k}$, where t is in second and the coefficients have proper units for $\vec{r}$ to be in metre. The $\vec{a}(t)$ of the particle at $t = 1$ s is

(A) 4 ms^{-2} along y–direction (B) 3 ms^{-2} along x–direction
(C) 4 ms^{-2} along x–direction (D) 2 ms^{-2} along z–direction
(E) 3 ms^{-2} along z–direction

68. A passenger getting down from a moving bus, falls in the direction of the motion of the bus. This is an example for

(A) moment of inertia (B) second law of motion (C) third law of motion
(D) inertia of rest (E) inertia of motion

69. A body of mass 6 kg is hanging from another body of mass 10 kg as shown in figure. This combination is being pulled up by a string with an acceleration of 2 ms^{-2}.
The tension T_1 is, (g = 10 ms^{-2})



(A) 240 N (B) 150 N (C) 220 N (D) 192 N (E) 178 N

Space for rough work

70. Which one of the following is not a contact force?

(A) Viscous force (B) Air resistance (C) Friction
(D) Buoyant force (E) Magnetic force

71. A force $(4\hat{i} + \hat{j} - 2\hat{k})$ N acting on a body maintains its velocity at $(2\hat{i} + 2\hat{j} + 3\hat{k})$ ms^{-1}. The power exerted is

(A) 4 W (B) 5 W (C) 2 W (D) 8 W (E) 1 W

72. Energy required to break one bond in DNA is

(A) 10^{-10} J (B) 10^{-18} J (C) 10^{-7} J (D) 10^{-20} J (E) 10^{-3} J

73. Halogens exist in –1, +1, +3, +5 and +7 oxidation states. The halogen that exists only in –1 state is

(A) F (B) Cl (C) Br (D) I (E) At

74. Among the oxyacids of phosphorus, the dibasic acid is

(A) $H_4P_2O_7$ (B) H_3PO_2 (C) HPO_3 (D) H_3PO_4 (E) H_3PO_3

Space for rough work

75. Pick out the correct statement(s)

1) Manganese exhibits + 7 oxidation state
2) Zinc forms coloured ions
3) $[CoF_6]^{3-}$ is diamagnetic
4) Sc forms +4 oxidation state
5) Zn exhibits only +2 oxidation state

(A) 1 and 2 (B) 1 and 5 (C) 2 and 4 (D) 3 and 4 (E) 2 and 5

76. The maximum oxidation state exhibited by actinide ions is

(A) +5 (B) +4 (C) +7 (D) +8 (E) +6

77. Calculate the standard enthalpy change (in $kJmol^{-1}$) for the reaction

$$H_2(g) + O_2(g) \rightarrow H_2O_2(g)$$

given that bond enthalpies of H–H, O=O, O–H and O–O (in $kJmol^{-1}$) are respectively 438, 498, 464 and 138

(A) –130 (B) –65 (C) +130 (D) –334 (E) +334

Space for rough work

78. According to the first law of thermodynamics which of the following quantities represents the change in a state function?

(A) q_{rev} (B) $q_{rev} - w_{rev}$ (C) q_{rev} / w_{rev} (D) w_{rev} (E) $q_{rev} + w_{rev}$

79. The aqueous solution of which of the salt has pH close to 7 ?

(A) $FeCl_3$ (B) CH_3COONa (C) Na_2CO_3 (D) CH_3COONH_4 (E) KCN

80. Consider the following reactions in which all the reactants and the products are in gaseous state.

$$2PQ \rightleftarrows P_2 + Q_2 \qquad K_1 = 2.5 \times 10^5$$

$$PQ + \tfrac{1}{2} R_2 \rightleftarrows PQR \qquad K_2 = 5 \times 10^{-3}$$

The value of K_3 for the equilibrium $\tfrac{1}{2} P_2 + \tfrac{1}{2} Q_2 + \tfrac{1}{2} R_2 \rightleftarrows PQR$, is

(A) 2.5×10^{-3} (B) 2.5×10^{3} (C) 1.0×10^{-5} (D) 5×10^{3} (E) 5×10^{-3}

81. The amount of solute (molar mass 60 $g.mol^{-1}$) that must be added to 180 g of water so that the vapour pressure of water is lowered by 10% is

(A) 30 g (B) 60 g (C) 120 g (D) 12 g (E) 24 g

Space for rough work

82. 200 ml of water is added to a 500 ml of 0.2 M solution. What is the molarity of this diluted solution?

(A) 0.5010 M (B) 0.2897 M (C) 0.7093 M (D) 0.1428 M (E) 0.4005 M

83. Which of the following species can function both as oxidizing as well as reducing agent?

(A) Cl^- (B) ClO_4^- (C) ClO^- (D) MnO_4^- (E) NO_3^-

84. One Faraday of electricity is passed through molten Al_2O_3, aqueous solution of $CuSO_4$ and molten NaCl taken in three different electrolytic cells connected in series. The mole ratio of Al, Cu and Na deposited at the respective cathode is

(A) 2:3:6 (B) 6:2:3 (C) 6:3:2 (D) 1:2:3 (E) 3:6:2

85. Half lives of a first order and a zero order reactions are same. Then the ratio of the initial rates of first order reaction to that of the zero order reaction is

(A) $\frac{1}{0.693}$ (B) 2×0.693 (C) 0.693 (D) $\frac{2}{0.693}$ (E) 6.93

86. If the activation energy for the forward reaction is 150 kJ mol^{-1} and that of the reverse reaction is 260 kJ mol^{-1}, what is the enthalpy change for the reaction ?

(A) 410 kJ mol^{-1} (B) 110 kJ mol^{-1} (C) –110 kJ mol^{-1}
(D) –410 kJ mol^{-1} (E) 90 kJ mol^{-1}

Space for rough work

87. The dispersed phase and dispersion medium in soap lather are respectively

(A) Gas and liquid (B) Liquid and gas (C) Solid and gas
(D) Solid and liquid (E) Gas and solid

88. In petrochemical industry, alcohols are directly converted to gasoline by passing over heated

(A) Platinum (B) ZSM-5 (C) Iron (D) Nickel (E) Palladium

89. Which among the following statements are true for the complex $[Co(NH_3)_6]\ [Cr(CN)_6]$?

1) It is a non-electrolyte
2) The magnitude of the charge on each complex ion is 3
3) The complex will not conduct current
4) The complex will exhibit coordination isomerism
5) The magnitude of the charge on each complex ion is 1

(A) 1 and 4 (B) 1 and 2 (C) 1 and 3 (D) 3 and 5 (E) 2 and 4

90. An example of ambidendate ligand is

(A) Ammine (B) Aquo (C) Chloro (D) Oxalato (E) Thiocyanato

91. In Lassaigne's test for the detection of halogens, the sodium fusion extract is first boiled with concentrated nitric acid. This is

(A) to remove silver halides
(B) to decompose Na_2S and NaCN, if present
(C) to dissolve Ag_2S
(D) to dissolve AgCN, if formed
(E) because Ag_2S and AgCN are insoluble in nitric acid

Space for rough work

92. All carbon atoms are sp^2 hybridised in

(A) 1, 3-butadiene (B) $CH_2=C=CH_2$ (C) cyclohexane
(D) 2-butene (E) $CH\equiv C-C\equiv CH$

93. The decreasing order of acidic character among ethane (I), ethene (II), ethyne (III) and propyne (IV) is

(A) (I) > (II) > (III) > (IV) (B) (II) > (III) > (I) > (IV) (C) (III) > (IV) > (II) > (I)
(D) (IV) > (III) > (II) > (I) (E) (III) > (IV) > (I) > (II)

94. The alkene that will give the same product with HBr in the absence as well as in the presence of peroxide is

(A) 2-Butene (B) 1-Butene (C) Propene (D) 1-Hexene (E) 2-Methylpropene

95. Hyperconjugation is most useful for stabilizing which of the following carbocations?

(A) neopentyl (B) tert-butyl (C) isopropyl (D) ethyl (E) methyl

96. Choose the weakest acid among the following

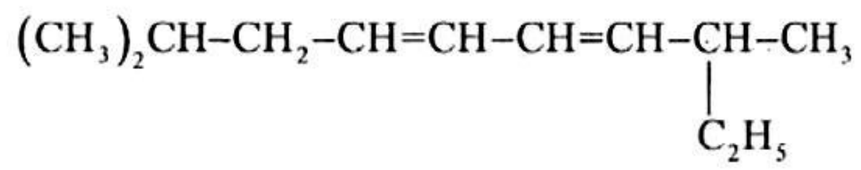
(A) $F_3C-COOH$ (B) $F-CH_2-COOH$ (C) CH_3-COOH
(D) CH_3-CH_2-COOH (E) $(CH_3)_2CH-COOH$

97. The isomerism that arises due to restricted bond rotation is

(A) Metamerism (B) Optical isomerism (C) Position isomerism
(D) Geometrical isomerism (E) Functional isomerism

Space for rough work

98. The IUPAC name of the following compound



is

(A) 1, 1, 7, 7-Tetramethyl 2, 5-octadiene

(B) 2, 8-Dimethyl 3, 6-decadiene

(C) 1, 5-Diisopropyl 1, 4-hexadiene

(D) 3, 9-Dimethyl 4, 6-decadiene

(E) 2, 8-Dimethyl 4, 6-decadiene

99. Chlorination of benzene in the presence of halogen carrier is an example of

(A) Aromatic nucleophilic substitution (B) Aromatic electrophilic substitution

(C) Aromatic nucleophilic addition (D) Aromatic electrophilic addition

(E) Free radical substitution

100. Aryl halides do not undergo nucleophilic substitution reactions under ordinary conditions because of

1) approach of nucleophile is retarded
2) carbon carrying halogen atom is sp^3 hybridised
3) the substrate molecule is destabilised due to resonance
4) partial double bond character between carbon and halogen

(A) 2 and 4 only (B) 1 and 4 only (C) 2 and 3 only

(D) 2, 3 and 4 only (E) 1 and 3 only

Space for rough work

101. Aldehydes that do not undergo aldol condensation are

1) propanal 2) trichloroethanal 3) methanal 4) ethanal 5) benzaldehyde

(A) 3 and 4 only (B) 3 and 5 only (C) 1, 2 and 3 only (D) 2, 3 and 5 only (E) 5 only

102. Which compound among the following give/s positive iodoform test ?

1) Ethanol 2) Ethanal 3) 1-butanol 4) 2-butanol 5) Phenyl ethanal

(A) 1, 2 and 5 (B) 1, 3 and 4 (C) 1, 2 and 3 (D) 2, 4 and 5 (E) 1, 2 and 4

103. Amine that can not be prepared by Gabriel phthalimide synthesis is

(A) aniline (B) benzylamine (C) methylamine
(D) isobutylamine (E) tertiary butylamine

104. Which of the following is the least basic amine?

(A) Ethylamine (B) Diethylamine (C) Aniline
(D) Benzylamine (E) Methylamine

105. Which of the following bases is not present in DNA?

(A) Uracil (B) Adenine (C) Thymine (D) Guanine (E) Cytosine

106. Lactose is made of

(A) α-D-glucose only (B) α-D-glucose and β-D-glucose
(C) α-D-galactose and β-D-glucose (D) β-D-galactose and β-D-glucose
(E) β-D-galactose and α-D-glucose

Space for rough work

107. The artificial sweetener containing chlorine that has the appearance and taste as that of sugar and stable at cooking temperature is

(A) Aspartame (B) Saccharin (C) Sucrolose (D) Alitame (E) Bithionol

108. Cetyltrimethyl ammonium bromide is a popular

(A) Anionic detergent (B) Cationic detergent (C) Non-ionic detergent
(D) Sweetener (E) Antioxidant

109. The number of electrons, neutrons and protons in a species are equal to 10, 8 and 8 respectively. The proper symbol of the species is

(A) $^{16}O_8$ (B) $^{18}O_8$ (C) $^{18}Ne_{10}$ (D) $^{16}O_8^-$ (E) $^{16}O_8^{2-}$

110. A 600 W mercury lamp emits monochromatic radiation of wavelength 331.3 nm. How many photons are emitted from the lamp per second ? ($h = 6.626 \times 10^{-34}$ Js; velocity of light $= 3 \times 10^8$ ms^{-1})

(A) 1×10^{19} (B) 1×10^{20} (C) 1×10^{21} (D) 1×10^{23} (E) 1×10^{22}

111. The shortest wavelength in hydrogen spectrum of Lyman series when $R_H = 109678$ cm^{-1} is

(A) 1002.7 Å (B) 1215.67 Å (C) 1127.30 Å (D) 911.7 Å (E) 1234.7 Å

Space for rough work

112. Which of the following statements is false?

(A) H_2 molecule has one sigma bond
(B) HCl molecule has one sigma bond
(C) Water molecule has two sigma bonds and two lone pairs
(D) Ethylene molecule has five sigma bonds and one pi bond
(E) Acetylene molecule has three pi bonds and three sigma bonds

113. N_2 and O_2 are converted to monopositive cations N_2^+ and O_2^+ respectively. Which is incorrect?

(A) In N_2^+, the N-N bond is weakened
(B) In O_2^+, the bond order increases
(C) In O_2^+, paramagnetism decreases
(D) N_2^+ becomes diamagnetic
(E) Both O_2, O_2^+ are paramagnetic

114. A neutral molecule XF_3 has a zero dipole moment. The element X is most likely

(A) Chlorine (B) Boron (C) Nitrogen (D) Carbon (E) Bromine

115. 56 g of nitrogen and 96 g of oxygen are mixed isothermally and at a total pressure of 10 atm. The partial pressures of oxygen and nitrogen (in atm.) are respectively

(A) 4, 6 (B) 5, 5 (C) 2, 8 (D) 8, 2 (E) 6, 4

116. How much time (in hours) would it take to distribute one Avagadro number of wheat grains if 10^{20} grains are distributed each second?

(A) 0.1673 (B) 1.673 (C) 16.73 (D) 167.3 (E) 1673

Space for rough work

117. The first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionization enthalpies (in kJ mol^{-1}) and the ($\Delta_{eg} H$) electron gain enthalpy (in kJ mol^{-1}) of the elements I, II, III, IV and V are given below

Element	$\Delta_i H_1$	$\Delta_i H_2$	$\Delta_{eg} H$
I	520	7300	–60
II	419	3051	–48
III	1681	3374	–328
IV	1008	1846	–295
V	2372	5251	+48

The most reactive metal and the least reactive non-metal of these are respectively

(A) I and V (B) V and II (C) II and V (D) IV and V (E) V and III

118. Which one of the following undergoes reduction with hydrogen peroxide in alkaline medium?

(A) Mn^{2+} (B) HOCl (C) PbS (D) Fe^{2+} (E) I_2

119. According to Ellingham diagram, the oxidation reaction of carbon to carbon monoxide may be used to reduce which one of the following oxides at the lowest temperature ?

(A) Al_2O_3 (B) Cu_2O (C) MgO (D) ZnO (E) FeO

120. The metal that produces red-violet color in the non-luminous flame is

(A) Ba (B) Ag (C) Rb (D) Pb (E) Zn

Space for rough work