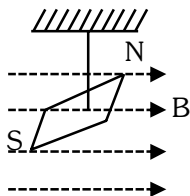


7. In a uniform magnetic field of 0.049 T, a magnetic needle performs 20 complete oscillations in 5 seconds as shown. The moment of inertia of the needle is $9.8 \times 10^{-6} \text{ kg m}^2$. If the magnitude of magnetic moment of the needle is $x \times 10^{-5} \text{ Am}^2$; then the value of 'x' is :



- (1) $5 \pi^2$ (2) $128 \pi^2$
 (3) $50 \pi^2$ (4) $1280 \pi^2$

Ans. (4)

8. In an ideal transformer, the turns ratio $\frac{N_p}{N_s} = \frac{1}{2}$. The ratio $V_s : V_p$ is equal to (the symbols carry their usual meaning) :

- (1) 1 : 2 (2) 2 : 1
 (3) 1 : 1 (4) 1 : 4

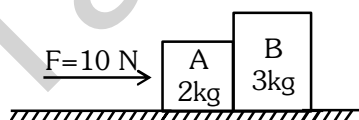
Ans. (2)

9. In a vernier calipers, (N+1) divisions of vernier scale coincide with N divisions of main scale. If 1 MSD represents 0.1 mm, the vernier constant (in cm) is :

- (1) $\frac{1}{10N}$ (2) $\frac{1}{100(N+1)}$
 (3) 100N (4) 10(N+1)

Ans. (2)

10. A horizontal force 10 N is applied to a block A as shown in figure. The mass of blocks A and B are 2 kg and 3 kg, respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is :



- (1) zero (2) 4 N
 (3) 6 N (4) 10 N

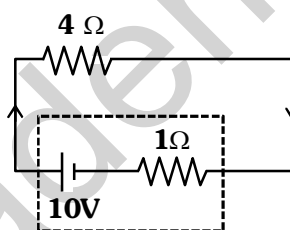
Ans. (3)

11. If $x = 5 \sin\left(\pi t + \frac{\pi}{3}\right) \text{ m}$ represents the motion of a particle executing simple harmonic motion, the amplitude and time period of motion respectively, are :

- (1) 5 cm, 2 s (2) 5 m, 2 s
 (3) 5 cm, 1 s (4) 5 m, 1 s

Ans. (2)

12. The terminal voltage of the battery, whose emf is 10V and internal resistance 1Ω , when connected through an external resistance of 4Ω as shown in the figure.



- (1) 4V (2) 6V
 (3) 8V (4) 10V

Ans. (3)

13. Given below are two statements :

Statement I : Atoms are electrically neutral as they contain equal number of positive and negative charges.

Statement II : Atoms of each element are stable and emit their characteristic spectrum.

In the light of the above statements, choose the *most appropriate* answer from the options given below :

- (1) Both Statement I and Statement II are correct.
 (2) Both Statement I and Statement II are incorrect.
 (3) Statement I is correct but Statement II is incorrect.
 (4) Statement I is incorrect but Statement II is correct.

Ans. (3)

14. If c is the velocity of light in free space, the correct statements about photon among the following are :
- A. The energy of a photon is $E = hv$
 B. The velocity of a photon is c .
 C. The momentum of a photon, $p = \frac{hv}{c}$
 D. In a photon-electron collision, both total energy and total momentum are conserved.
 E. Photon possesses positive charge.
- Choose the correct answer from the options given below :

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

Ans. (2)

15. Match List I with List II.

List I (Spectral Lines of Hydrogen for transitions from)	List II (Wavelengths (nm))
A. $n_2 = 3$ to $n_1 = 2$	I. 410.2
B. $n_2 = 4$ to $n_1 = 2$	II. 434.1
C. $n_2 = 5$ to $n_1 = 2$	III. 656.3
D. $n_2 = 6$ to $n_1 = 2$	IV. 486.1

Choose the correct answer from the options given below :

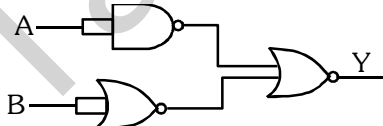
- (1) A-II, B-I, C-IV, D-III
 (2) A-III, B-IV, C-II, D-I
 (3) A-IV, B-III, C-I, D-II
 (4) A-I, B-II, C-III, D-IV

Ans. (2)

16. A tightly wound 100 turns coil of radius 10 cm carries a current of 7 A. The magnitude of the magnetic field at the centre of the coil is (Take permeability of free space as $4\pi \times 10^{-7}$ SI units) :
- (1) 44 mT (2) 4.4 T
 (3) 4.4 mT (4) 44 T

Ans. (3)

17. The output (Y) of the given logic gate is similar to the output of an/a :

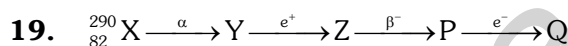


- (1) NAND gate (2) NOR gate
 (3) OR gate (4) AND gate

Ans. (4)

18. A wire of length ' l ' and resistance 100Ω is divided into 10 equal parts. The first 5 parts are connected in series while the next 5 parts are connected in parallel. The two combinations are again connected in series. The resistance of this final combination is:
- (1) 26Ω (2) 52Ω
 (3) 55Ω (4) 60Ω

Ans. (2)



In the nuclear emission stated above, the mass number and atomic number of the product Q respectively, are :

- (1) 280, 81 (2) 286, 80
 (3) 288, 82 (4) 286, 81

Ans. (4)

20. The maximum elongation of a steel wire of 1m length if the elastic limit of steel and its Young's modulus, respectively, are $8 \times 10^8 \text{ N m}^{-2}$ and $2 \times 10^{11} \text{ N m}^{-2}$ is :
- (1) 4 mm (2) 0.4 mm
 (3) 40 mm (4) 8 mm

Ans. (1)

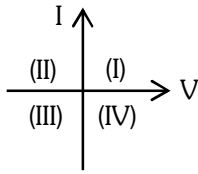
21. If the monochromatic source in Young's double slit experiment is replaced by white light, then
- (1) interference pattern will disappear.
 (2) there will be a central dark fringe surrounded by a few coloured fringes.
 (3) there will be a central bright white fringe surrounded by a few coloured fringes.
 (4) all bright fringes will be of equal width.

Ans. (3)

22. At any instant of time t , the displacement of any particle is given by $2t - 1$ (SI unit) under the influence of force of 5N. The value of instantaneous power is (in SI unit) :
- (1) 10 (2) 5
 (3) 7 (4) 6

Ans. (1)

23. Consider the following statements A and B and identify the correct answer :



A. For a solar-cell, the I-V characteristics lies in the IV quadrant of the given graph.

B. In a reverse biased *pn* junction diode, the current measured in (μA), is due to majority charge carriers.

- (1) A is correct but B is incorrect.
- (2) A is incorrect but B is correct.
- (3) Both A and B are correct.
- (4) Both A and B are incorrect.

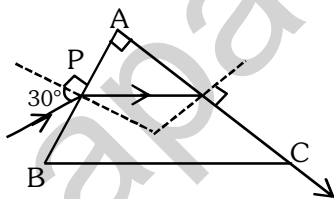
Ans. (1)

24. Two bodies A and B of same mass undergo completely inelastic one dimensional collision. The body A moves with velocity v_1 while body B is at rest before collision. The velocity of the system after collision is v_2 . The ratio $v_1 : v_2$ is :

- (1) 1 : 2
- (2) 2 : 1
- (3) 4 : 1
- (4) 1 : 4

Ans. (2)

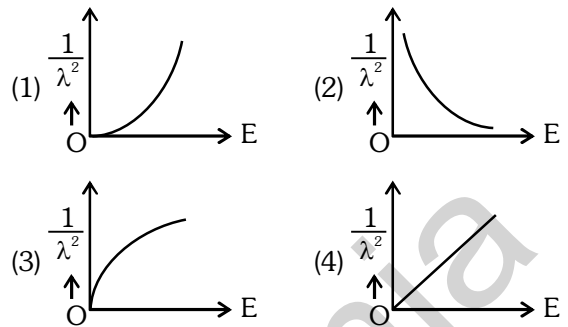
25. A light ray enters through a right angled prism at point P with the angle of incidence 30° as shown in figure. It travels through the prism parallel to its base BC and emerges along the face AC. The refractive index of the prism is :



- (1) $\frac{\sqrt{5}}{4}$
- (2) $\frac{\sqrt{5}}{2}$
- (3) $\frac{\sqrt{3}}{4}$
- (4) $\frac{\sqrt{3}}{2}$

Ans. (2)

26. The graph which shows the variation of $\left(\frac{1}{\lambda^2}\right)$ and its kinetic energy, E is (where λ is de Broglie wavelength of a free particle) :



Ans. (4)

27. The quantities which have the same dimensions as those of solid angle are :

- (1) strain and angle
- (2) stress and angle
- (3) strain and arc
- (4) angular speed and stress

Ans. (1)

28. An unpolarised light beam strikes a glass surface at Brewster's angle Then

- (1) the reflected light will be partially polarised.
- (2) the refracted light will be completely polarised.
- (3) both the reflected and refracted light will be completely polarised.
- (4) the reflected light will be completely polarised but the refracted light will be partially polarised.

Ans. (4)

29. The moment of inertia of a thin rod about an axis passing through its mid point and perpendicular to the rod is 2400 g cm^2 . The length of the 400 g rod is nearly :

- (1) 8.5 cm
- (2) 17.5 cm
- (3) 20.7 cm
- (4) 72.0 cm

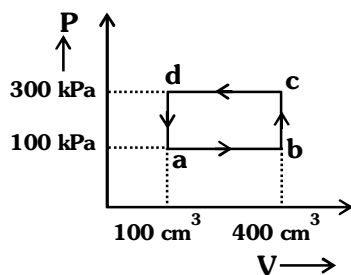
Ans. (1)

30. A thin flat circular disc of radius 4.5 cm is placed gently over the surface of water. If surface tension of water is 0.07 Nm^{-1} , then the excess force required to take it away from the surface is :

- (1) 19.8 mN
- (2) 198 N
- (3) 1.98 mN
- (4) 99 N

Ans. (1)

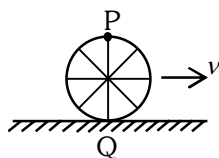
31. A thermodynamic system is taken through the cycle abcd. The work done by the gas along the path bc is :



- (1) zero (2) 30 J (3) -90 J (4) -60 J

Ans. (1)

32. A wheel of a bullock cart is rolling on a level road as shown in the figure below. If its linear speed is v in the direction shown, which one of the following options is correct (P and Q are any highest and lowest points on the wheel, respectively) ?



- (1) Point P moves slower than point Q.
 (2) Point P moves faster than point Q.
 (3) Both the points P and Q move with equal speed.
 (4) Point P has zero speed.

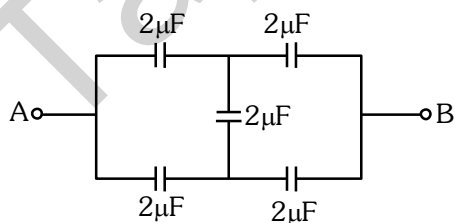
Ans. (2)

33. The mass of a planet is $\frac{1}{10}$ th that of the earth and its diameter is half that of the earth. The acceleration due to gravity on that planet is :

- (1) 19.6 m s^{-2} (2) 9.8 m s^{-2}
 (3) 4.9 m s^{-2} (4) 3.92 m s^{-2}

Ans. (4)

34. In the following circuit, the equivalent capacitance between terminal A and terminal B is :

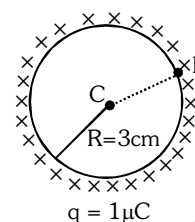


- (1) $2 \mu\text{F}$ (2) $1 \mu\text{F}$ (3) $0.5 \mu\text{F}$ (4) $4 \mu\text{F}$

Ans. (1)

35. A thin spherical shell is charged by some source. The potential difference between the two points C and P (in V) shown in the figure is :

(Take $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ SI units)

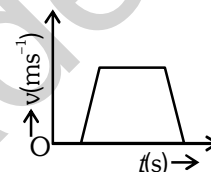


- (1) 3×10^5 (2) 1×10^5
 (3) 0.5×10^5 (4) zero

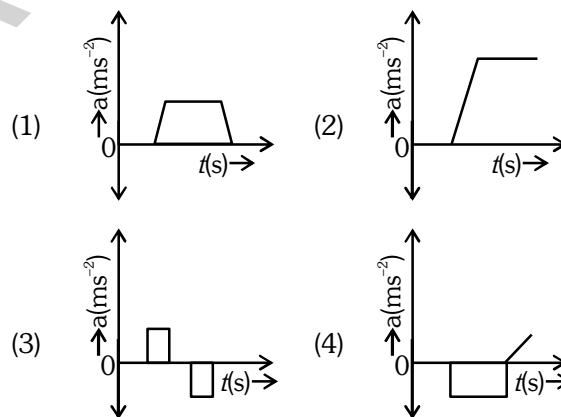
Ans. (4)

Physics : Section-B (Q. No. 36 to 50)

36. The velocity (v) - time (t) plot of the motion of a body is shown below :



The acceleration (a) - time (t) graph that best suits this motion is :



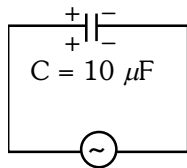
Ans. (3)

37. If the mass of the bob in a simple pendulum is increased to thrice its original mass and its length is made half its original length, then the new time period of oscillation is $\frac{x}{2}$ times its original time period. Then the value of x is :

- (1) $\sqrt{3}$ (2) $\sqrt{2}$
 (3) $2\sqrt{3}$ (4) 4

Ans. (2)

38. A $10 \mu\text{F}$ capacitor is connected to a 210 V , 50 Hz source as shown in figure. The peak current in the circuit is nearly ($\pi = 3.14$) :

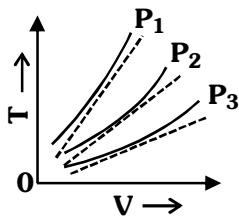


210 V , 50 Hz

- (1) 0.58 A
 (2) 0.93 A
 (3) 1.20 A
 (4) 0.35 A

Ans. (2)

39. The following graph represents the T - V curves of an ideal gas (where T is the temperature and V the volume) at three pressures P_1 , P_2 and P_3 compared with those of Charles's law represented as dotted lines.



Then the correct relation is :

- (1) $P_3 > P_2 > P_1$
 (2) $P_1 > P_3 > P_2$
 (3) $P_2 > P_1 > P_3$
 (4) $P_1 > P_2 > P_3$

Ans. (4)

40. An iron bar of length L has magnetic moment M . It is bent at the middle of its length such that the two arms make an angle 60° with each other. The magnetic moment of this new magnet is : $^\circ$

- (1) M (2) $\frac{M}{2}$ (3) $2M$ (4) $\frac{M}{\sqrt{3}}$

Ans. (2)

41. The minimum energy required to launch a satellite of mass m from the surface of earth of mass M and radius R in a circular orbit at an altitude of $2R$ from the surface of the earth is :

- (1) $\frac{5GmM}{6R}$ (2) $\frac{2GmM}{3R}$
 (3) $\frac{GmM}{2R}$ (4) $\frac{GmM}{3R}$

Ans. (1)

42. A parallel plate capacitor is charged by connecting it to a battery through a resistor. If I is the current in the circuit, then in the gap between the plates :

- (1) there is no current.
 (2) displacement current of magnitude equal to I flows in the same direction as I .
 (3) displacement current of magnitude equal to I flows in a direction opposite to that of I .
 (4) displacement current of magnitude greater than I flows but can be in any direction.

Ans. (2)

43. The property which is not of an electromagnetic wave travelling in free space is that :

- (1) they are transverse in nature.
 (2) the energy density in electric field is equal to energy density in magnetic field.
 (3) they travel with a speed equal to $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$
 (4) they originate from charges moving with uniform speed.

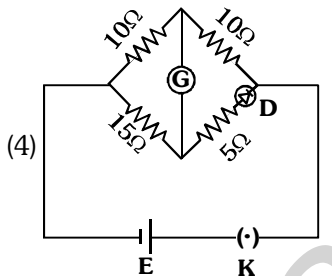
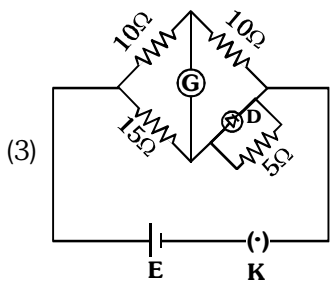
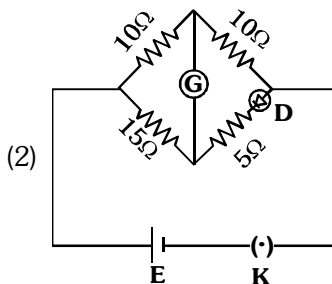
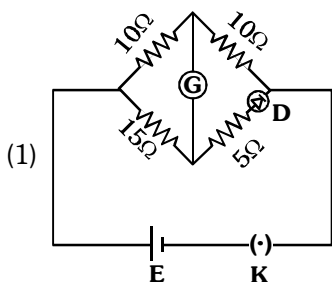
Ans. (4)

44. A metallic bar of Young's modulus, $0.5 \times 10^{11} \text{ N m}^{-2}$ and coefficient of linear thermal expansion $10^{-5} \text{ }^\circ\text{C}^{-1}$, length 1 m and area of cross-section 10^{-3} m^2 is heated from 0°C to 100°C without expansion or bending. The compressive force developed in it is:

- (1) $5 \times 10^3 \text{ N}$ (2) $50 \times 10^3 \text{ N}$
 (3) $100 \times 10^3 \text{ N}$ (4) $2 \times 10^3 \text{ N}$

Ans. (2)

45. Choose the correct circuit which can achieve the bridge balance.



Ans. (1)

46. A sheet is placed on a horizontal surface in front of a strong magnetic pole. A force is needed to :

- A. hold the sheet there if it is magnetic.
- B. hold the sheet there if it is non-magnetic.
- C. move the sheet away from the pole with uniform velocity if it is conducting.
- D. move the sheet away from the pole with uniform velocity if it is both, non-conducting and non-polar.

Choose the correct statement(s) from the options given below:

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

Ans. (2)

47. If the plates of a parallel plate capacitor connected to a battery are moved close to each other, then

- A. the charge stored in it, increases.
- B. the energy stored in it, decreases.
- C. its capacitance increases.
- D. the ratio of charge to its potential remains the same.
- E. the product of charge and voltage increases.

Choose the most appropriate answer from the options given below :

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

Ans. (2)

48. Two heaters A and B have power rating of 1 kW and 2 kW, respectively. Those two are first connected in series and then in parallel to a fixed power source. The ratio of power outputs for these two cases is :

- (1) 1 : 1
- (2) 2 : 9
- (3) 1 : 2
- (4) 2 : 3

Ans. (2)

49. A small telescope has an objective of focal length 140 cm and an eye piece of focal length 5.0 cm. The magnifying power of telescope for viewing a distant object is :

- (1) 34
- (2) 28
- (3) 17
- (4) 32

Ans. (2)

50. A force defined by $F = \alpha t^2 + \beta t$ acts on a particle at a given time t . The factor which is dimensionless, if α and β are constants, is :

- (1) $\frac{\beta t}{\alpha}$
- (2) $\frac{\alpha t}{\beta}$
- (3) $\alpha \beta t$
- (4) $\frac{\alpha \beta}{t}$

Ans. (2)