

Section : Physics

Q.1 Two point charges,  $q_1 = 3 \mu\text{C}$  and  $q_2 = -2 \mu\text{C}$ , are placed 6 cm apart.

The magnitude of the electric force between them is:

1. 21.6 N
2. 6.75 N
3. 15 N
4. 39.6 N

- Options
1. 1
  2. 2
  3. 3
  4. 4

Q.2 A closely wound coil of 50 turns and radius 15 cm carries a current of 3 A.

The magnetic moment of the coil is:

1.  $33.76 \text{ A}\cdot\text{m}^2$
2.  $32.75 \text{ A}\cdot\text{m}^2$
3.  $10.59 \text{ A}\cdot\text{m}^2$
4.  $1.59 \text{ A}\cdot\text{m}^2$

- Options
1. 1
  2. 2
  3. 3
  4. 4

Q.3 If both the number of turns and length of an inductor are tripled, keeping other factors constant, the self-inductance of the inductor will be

1. tripled
2. doubled
3. four times its initial value
4. Unchanged

- Options
1. 1
  2. 2
  3. 3
  4. 4

Q.4 Two resistances,  $6 \Omega$  and  $3 \Omega$ , are connected in parallel to an electrical cell of EMF 6 V and  $1 \Omega$  internal resistance.

The reading of the voltmeter connected to the circuit will be:

1. 4 V
2. 2.4 V
3. 3 V
4. 6 V

- Options
1. 1
  2. 2
  3. 3
  4. 4

Q.5 A voltage  $V = 200 \sin(400t)$  V AC source is connected to a series combination of an inductance 20 mH and resistance  $6 \Omega$ .

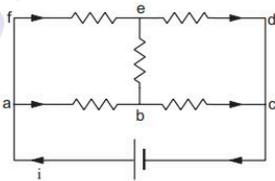
The rms current in the AC circuit is:

1. 33.3 A
2. 20 A
3. 14.14 A
4. 10 A

- Options 1. 1  
2. 2  
3. 3  
4. 4

Q.6

Each resistor shown in figure has a resistance of  $20\ \Omega$  and the battery has an emf of 12 V. The current supplied by the battery is



1. 0.3 A  
2. 0.6 A  
3. 1.2 A  
4. 2.4 A

- Options 1. 1  
2. 2  
3. 3  
4. 4

- Q.7 A power transmission line feeds input power at 2400 V to a step-down transformer with its primary windings having 5000 turns. The output power is delivered at 240 V by the transformer. If the current in the primary coil of the transformer is 5 A and its efficiency is 95% then the current in the secondary will be
1. 50 A  
2. 47.5 A  
3. 45 A  
4. 4.75 A

- Options 1. 1  
2. 2  
3. 3  
4. 4

- Q.8 The capacitances of three capacitors are in the ratio 2:3:4. Their equivalent capacitance in parallel combination is more than the equivalent capacitance in series combination by  $(21/26)$  pF. The capacitances of the capacitors are, respectively:
1. 2.0 pF, 3.0 pF and 4.0 pF  
2. 0.2 pF, 0.3 pF and 0.4 pF  
3. 10 pF, 15 pF and 20 pF  
4. 0.4 pF, 0.3 pF and 0.2 pF

- Options 1. 1  
2. 2  
3. 3  
4. 4

- Q.9 Two concentric coils, each of radius  $2\pi$  cm, are placed at right angles to each other.

Currents of 3 A and 4 A respectively are flowing through the two coils.

The magnetic induction at the center of the coils will be:

1.  $50\ \mu\text{T}$   
2.  $70\ \mu\text{T}$   
3.  $12\ \mu\text{T}$   
4.  $0.1\ \mu\text{T}$

- Options 1. 1  
2. 2  
3. 3  
4. 4

Q.10 Match List-I with List-II

List-I	List-II
Electromagnetic wave	Production
(A) Light	(I) Klystron valve or magnetron valve
(B) X-rays	(II) Rapid acceleration and deceleration of electrons in aerials
(C) Microwave	(III) Electrons in atoms move from one energy level to a lower energy level
(D) Radiowave	(IV) inner shell electrons/ fast-moving electrons decelerated by a metal target

Choose the correct answer from the options given below:

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

- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.11** There are four media in which light is traveling. The speed of light in each medium along with relative permeability of the medium are given as below. Arrange the relative permittivity of each of the medium in increasing order.

- (A) Medium I:  $v_I = 2 \times 10^8 \text{ m/s}, \mu_r = 1$
- (B) Medium II:  $v_{II} = 1.5 \times 10^8 \text{ m/s}, \mu_r = 1$
- (C) Medium III:  $v_{III} = 3 \times 10^8 \text{ m/s}, \mu_r = 1$
- (D) Medium IV:  $v_{IV} = 2 \times 10^8 \text{ m/s}, \mu_r = 2$

Choose the correct answer from the options given below:

1. (A), (B), (C), (D)
2. (A), (B), (D), (C)
3. (C), (D), (A), (B)
4. (C), (B), (D), (A)

- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.12** The magnifying power of a telescope is 6 in normal adjustment. The distance between its two lenses is 35 cm. The focal lengths of objective and eye-piece are, respectively:

1. 30 cm, 5 cm
2. 25 cm, 5 cm
3. 5 cm, 30 cm
4. 20 cm, 15 cm

- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.13** The ratio of total energy of an electron in 3rd orbit to that in 5th orbit in a hydrogen atom is:

1. 9 : 25
2. 25 : 9
3. 3 : 5
4. 5 : 3

- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.14** What will be the ratio of radii of two nuclei having their mass numbers in the ratio of 64:125?

1. 8 : 5
2. 4 : 5
3.  $8 : 5\sqrt{2}$
4. 5 : 4

- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.15** An electron placed in a magnetic field of  $3.14 \times 10^{-4} \text{ T}$  moves in a circle. The frequency of the revolution of the electron is:

1.  $8.79 \times 10^6 \text{ Hz}$

2.  $8.79 \times 10^5 \text{ Hz}$

3.  $6.08 \times 10^6 \text{ Hz}$

4.  $2.8 \times 10^6 \text{ Hz}$

Options 1. 1

2. 2

3. 3

4. 4

**Q.16** Read the following statements carefully and identify the correct statements.  
(A) Most interference and diffraction effects exist even for longitudinal waves like sound in air  
(B) Optical fibers work on the phenomenon of total internal reflection  
(C) Optical density and mass density are the same  
(D) Polarisation phenomena are specific to transverse waves like light waves  
Choose the correct answer from the options given below:

1. (A) and (D) only

2. (A), (B) and (C) only

3. (A), (B) and (D) only

4. (B), (C) and (D) only

Options 1. 1

2. 2

3. 3

4. 4

**Q.17** Visible light of wavelength 600 nm falls normally on a single slit and diffraction pattern is obtained on a screen.

It is found that the second diffraction minima is at  $\frac{\pi}{3}$ .

If the first minimum is obtained at  $\theta_1$ , then  $\theta_1$  is:

Given:  $\sin 25^\circ = \frac{\sqrt{3}}{4}$

1.  $\frac{\pi}{3}$

2.  $\frac{\pi}{4}$

3.  $\frac{5\pi}{36}$

4.  $\frac{\pi}{9}$

Options 1. 1

2. 2

3. 3

4. 4

**Q.18** A spherical conductor placed in vacuum has capacitance of  $3.14 \times 10^{-9} \text{ F}$ . Its radius will be:

1. 28.3 m

2. 2.8 m

3. 31.4 m

4. 9 m

Options 1. 1

2. 2

3. 3

4. 4

Q.19 A diverging lens of glass ( $\mu = 1.5$ ) has both surfaces of the same radius of curvature ( $R$ ).

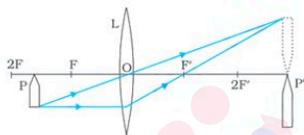
On immersion in a medium of refractive index ( $\mu = 1.8$ ), it will behave as:

1. diverging lens with focal length  $f = 3R$
2. diverging lens with focal length  $f = 0.3R$
3. Converging lens with focal length  $f = 3R$
4. Converging lens with focal length  $f = 6R$

Options 1. 1  
2. 2  
3. 3  
4. 4

Q.20

To find the focal length of a convex lens, a student obtains the real, inverted and magnified image on the screen as shown in the figure below



Now the whole set up is immersed in water without disturbing the object and position of the screen. What will be student's observation on the screen?

1. No change in the image will be observed
2. Size of image decreases
3. Image disappears from the screen
4. Size of image increases

Options 1. 1  
2. 2  
3. 3  
4. 4

Q.21 Three particles, each having a charge of  $10 \mu\text{C}$ , are placed at the vertices of an equilateral triangle of 10 mm.

Find the work done by a person in pulling them apart to infinite separation.

1. 270 J
2.  $-270 \text{ J}$
3.  $-198 \text{ J}$
4. 4.5 J

Options 1. 1  
2. 2  
3. 3  
4. 4

Q.22 Read the following statements and identify the correct statements.

(A) In a semiconductor doped with trivalent impurity, the holes are the majority carriers and electrons are minority carriers.

(B) In pure semiconductors, the number of free electrons is equal to the number of holes.

(C) In a semiconductor doped with pentavalent impurity, electrons become the majority carriers and holes the minority carriers.

(D) Important electronic devices can be developed using intrinsic semiconductors.

Choose the correct answer from the options given below:

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

Options 1. 1  
2. 2  
3. 3  
4. 4

Q.23 For a photosensitive surface, work function is  $3.3 \times 10^{-19} \text{ J}$ . Taking Planck's constant to be  $6.6 \times 10^{-34} \text{ Js}$ , the threshold frequency would be:

1.  $6 \times 10^{13} \text{ Hz}$
2.  $2 \times 10^{12} \text{ Hz}$
3.  $5 \times 10^{14} \text{ Hz}$

4.  $1.8 \times 10^{12}$  Hz

Options 1. 1

2. 2
3. 3
4. 4

Q.24 Identify the correct statements among the following:

- (A) The gravitational force is much stronger than the Coulomb force.
  - (B) The nuclear force between two nucleons falls rapidly to zero as their distance is more than a few femtometers.
  - (C) The nuclear force depends on the electric charge.
  - (D) The nuclear force is much stronger than the coulomb force.
- Choose the correct answer from the options given below:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.25 Which of the following statements are true?

- (A) Rheostat can be used both as a variable resistance and a potential divider.
  - (B) An electrical circuit is functional only if all the components of the circuit are connected in proper order, assuming that all circuit components/ devices are in working condition and key is closed.
  - (C) An open circuit means a break in some part of a circuit which could be deliberate such as a key in open position or a fault such as broken wire or burnt out component(s) or loose connection.
  - (D) Rheostat as a potential divider gives variable resistance.
- Choose the correct answer from the options given below:

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

Options 1. 1

2. 2
3. 3
4. 4

Q.26 The sensitivity of a moving coil galvanometer can be increased by decreasing

1. magnetic field
2. area of the coil
3. number of turns of the coil
4. restoring couple per unit twist of suspension wire

Options 1. 1

2. 2
3. 3
4. 4

Q.27 Arrange the following electromagnetic waves in increasing order of their wavelengths.

- (A) Visible Light
  - (B) Microwave
  - (C) X rays
  - (D) Infra-red rays
- Choose the correct answer from the options given below:

1. (A), (B), (C), (D)
2. (B), (A), (C), (D)
3. (C), (A), (D), (B)
4. (C), (B), (D), (A)

Options 1. 1

2. 2
3. 3
4. 4

Q.28 The electric field at 20 cm from the center of a conducting sphere of radius 2 cm is  $4.5 \times 10^3$  N C<sup>-1</sup>.

The magnitude of charge on the sphere is:

1.  $2 \times 10^{-9}$  C
2.  $2 \times 10^{-8}$  C
3.  $1 \times 10^{-7}$  C
4.  $2 \times 10^{-7}$  C

Options 1. 1

2. 2
3. 3
4. 4

Q.29 A  $14.0 \mu\text{F}$  capacitor is connected to a 220 V, 50 Hz source. The value of peak current in the circuit is

(Given:  $\pi = \frac{22}{7}$  and  $\sqrt{2} = 1.414$ )

1. 1.57 A

2. 1.47 A
3. 1.37 A
4. 1.27 A

- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.30** A circular coil of radius 2.0 cm carries a current of 1.0 A. If the coil has 50 turns, the magnetic field at the centre of the coil will be:

1.  $5\pi \times 10^{-5}$  T
2.  $50\pi \times 10^{-4}$  T
3.  $1.57 \times 10^{-4}$  T
4.  $1.57 \times 10^{-3}$  T

- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.31** Identify the correct statements among the following.

- (A) The wavefront for a point source of light is in a spherical shape, rays are all radial from the point source,
  - (B) All the points on a cylindrical wavefront vibrate in the same phase,
  - (C) A set of straight lines perpendicular to a wavefront are called rays of light. Light energy does not flow along these lines.
  - (D) Every point of a given wavefront acts as a fresh source of a secondary wavelet
- Choose the correct answer from the options given below:
1. (A) and (B) only
  2. (B) and (D) only
  3. (A), (B) and (D) only
  4. (A) and (C) only

- Options
1. 1
  2. 2
  3. 3
  4. 4

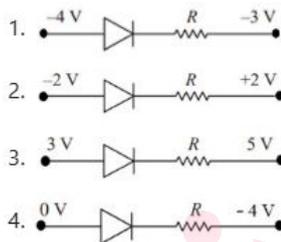
**Q.32** Identify the correct statements among the following.

- (A) Electrical appliances in a household are always connected in series.
  - (B) Electrical appliances in a household are always connected in parallel.
  - (C) The potential difference across different electrical appliances in households is not equal.
  - (D) The potential difference across different electrical appliances in households is equal.
- Choose the correct answer from the options given below:
1. (A) and (D) only
  2. (A) and (C) only
  3. (B) and (D) only
  4. (B) and (C) only

- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.33**

Which one of the following represents a forward biased diode?



- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.34** The mutual inductance of a pair of solenoids depends on

1. their separation as well as their relative orientation
2. the material of the wires of the solenoid
3. the currents in the two solenoids
4. rate of change of currents in the two solenoids

- Options
1. 1
  2. 2
  3. 3
  4. 4

**Q.35** The energy of a photon of wavelength  $\lambda$  is

1.  $hc\lambda$

2.  $\frac{hc}{\lambda}$   
3.  $\frac{\lambda h}{c}$   
4.  $\frac{\lambda}{hc}$

Options 1. 1

2. 2  
3. 3  
4. 4

Q.36 A coil with an inductance of 0.2 H has an inductive reactance of 62.8  $\Omega$  at a certain frequency. The frequency is

1. 20 Hz  
2. 30 Hz  
3. 40 Hz  
4. 50 Hz

Options 1. 1

2. 2  
3. 3  
4. 4

Q.37 Germanium and silicon behave as semiconductors because

1. At room temperature, germanium and silicon behave as good conductors  
2. the energy gap between their conduction and valence bands is of the order of 1 eV  
3. the energy required to take out an electron from these atoms is very high  
4. their valence and conduction bands are overlapping

Options 1. 1

2. 2  
3. 3  
4. 4

Q.38 In a Young's double slit experiment, interference fringes were produced on a screen placed 1.8 m from the two slits

- 0.3 mm apart and illuminated by light of wavelength 600 nm. The fringe width is  
1. 0.9 mm  
2. 1.0 mm  
3. 3.6 mm  
4. 7.2 mm

Options 1. 1

2. 2  
3. 3  
4. 4

Q.39 Which of the following is the wrong statement? Coulomb's law describes the electric force that

1. has inverse-square dependence on the distance between the charges together to form molecules  
2. can be repulsive or attractive  
3. binds the electrons of an atom to its nucleus.  
4. binds the protons and neutrons in the nucleus of an atom.

Options 1. 1

2. 2  
3. 3  
4. 4

Q.40 The magnetic flux through a coil perpendicular to the plane is varying according to the relation

$\phi = (7t^3 + 3t^2 - 2t - 2)$  Wb. If the resistance of the coil is 10  $\Omega$ , the induced current through the coil at  $t = 2$  s, will be

1. 10 A  
2. 9.4 A  
3. 4.9 A  
4. 7.8 A

Options 1. 1

2. 2  
3. 3  
4. 4

Q.41 The current in a wire varies with time according to the relationship;  $I = (2 + 2t)$  A, where  $t$  is time in seconds.

The charge passing through a cross-section of the wire in the time interval between  $t = 0$  s to  $t = 4$  s is

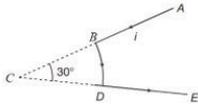
1. 24 C  
2. 32 C  
3. 20 C  
4. 22 C

Options 1. 1

2. 2  
3. 3  
4. 4

Q.42

The radius of the arc BD representing a wire is 60 cm. The magnitude of the magnetic field produced at centre C, if a current of 3.0 A flows in the wire, will be



1.  $\frac{5\pi}{6} \times 10^{-7} T$
2.  $\frac{5\pi}{12} \times 10^{-7} T$
3.  $\frac{5}{6} \times 10^{-7} T$
4.  $\frac{\pi}{6} \times 10^{-7} T$

- Options
1. 1
  2. 2
  3. 3
  4. 4

Q.43 A proton, an electron, a neutron and an alpha particle have the same energy. Their de Broglie's wavelengths are given below:

- (A)  $\lambda_{\text{proton}}$
- (B)  $\lambda_{\text{electron}}$
- (C)  $\lambda_{\text{neutron}}$
- (D)  $\lambda_{\text{alpha}}$

Arrange these wavelengths in decreasing order. Choose the correct answer from the options given below:

1. (A), (B), (C), (D)
2. (B), (A), (C), (D)
3. (D), (C), (A), (B)
4. (C), (B), (D), (A)

- Options
1. 1
  2. 2
  3. 3
  4. 4

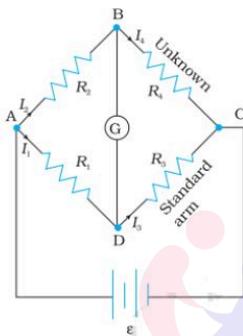
Q.44 What will be the internal resistance of a cell of emf 2.2 V which gives a current of 0.2 A through a resistance of  $10\Omega$  ?

1.  $8.9\Omega$
2.  $11.0\Omega$
3.  $1.0\Omega$
4.  $0.5\Omega$

- Options
1. 1
  2. 2
  3. 3
  4. 4

Q.45

The Wheatstone bridge is an arrangement of four resistances:  $R_1, R_2, R_3, R_4$  as shown in the figure given below. The null-point condition is not given by



1.  $R_2/R_1 = R_4/R_3$
2.  $R_1/R_2 = R_3/R_4$
3.  $R_1 R_4 = R_2 R_3$
4.  $R_1 R_2 = R_3 R_4$

- Options
1. 1
  2. 2
  3. 3
  4. 4

Q.46 Which of the following statements is correct about the effect of the presence of a third charge on Coulomb force between the two charges?

1. The Coulomb force between the two charges would increase.
2. The Coulomb force between the two charges would decrease.
3. The Coulomb force between the two charges would become zero.
4. The Coulomb force between the two charges does not depend upon the presence of a third charge.

- Options 1. 1  
2. 2  
3. 3  
4. 4

Q.47 Which of the following is not based on total internal reflection?

1. Real and Apparent depth of a pond
2. Prisms designed to bend light by  $90^\circ$  or by  $180^\circ$
3. Light pipe to facilitate visual examination of internal organs
4. Transmission of signals over long distances through optical fibres

- Options 1. 1  
2. 2  
3. 3  
4. 4

Q.48 Match List-I with List-II

List-I List-II

- (A) Shunt resistance (I) infinite resistance  
(B) An ammeter resistance (I) connected in parallel with the galvanometer coil  
(C) An ideal voltmeter (III) zero resistance  
(D) An ideal ammeter (IV) less than that of the shunt resistance

Choose the correct answer from the options given below:

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

- Options 1. 1  
2. 2  
3. 3  
4. 4

Q.49 When an  $\alpha$ -particle of mass  $M$  moving with velocity  $v$  bombards a heavy nucleus of charge  $Ze$ , its distance of closest approach from the nucleus depends on  $M$  as

1. Independent of  $M$

2.  $\propto \frac{1}{M^2}$

3.  $\propto \frac{1}{M}$

4.  $\propto \frac{1}{\sqrt{M}}$

- Options 1. 1  
2. 2  
3. 3  
4. 4

Q.50 Identify the incorrect statement(s) among the following:

(A) Two electric field lines of force never intersect.

(B) Two opposite charges, each of  $10 \times 10^{-9}$  C, separated by 5 mm. The magnitude of the dipole moment is  $5 \times 10^{-11}$  C-m.

(C) Electric field intensity due to a single charge varies as the square of the distance from the charge, whereas electric field intensity due to an electric dipole varies inversely as the cube of the distance of the point.

(D) Electric field intensity due to an electric dipole has spherical symmetry around it in space.

Choose the correct answer from the options given below:

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

- Options 1. 1  
2. 2  
3. 3  
4. 4