

1. If the protons and electrons are the only basic charges in the universe, all observable charges must be integral multiples of e .

If an object contains x electrons and y protons, the net charge on the object will be:

1. $(x - y)e$
2. $(x + y)e$
3. $(y - x)e$
4. $(y + x)e$

2. A charge of magnitude $3 \times 10^{-7} \text{ C}$ is located at a distance of 0.09 m from a point P .

Obtain the work done in bringing a charge $2 \times 10^{-9} \text{ C}$ from infinity to point P .

1. $1.6 \times 10^{-4} \text{ J}$
2. $6 \times 10^{-2} \text{ J}$
3. $4 \times 10^{-3} \text{ J}$
4. $6 \times 10^{-3} \text{ J}$

3. In a **series combination of capacitors** connected across a battery:

1. Each capacitor has equal charge for certain capacitance values only
2. Each capacitor has different charge for certain capacitance values
3. Each capacitor has equal charge for any value of capacitance
4. Each capacitor has different charge for any value of capacitance

4. Two point charges $+4 \mu\text{C}$ and $-3 \mu\text{C}$ (with no external field) are located at $(-6 \text{ cm}, 0, 0)$ and $(6 \text{ cm}, 0, 0)$ respectively.

The work required to separate them infinitely away from each other is:

1. 0.9 J
2. 0.18 J
3. -0.9 J
4. -0.018 J

5. If the net flux through a cube is $1.05 \text{ N m}^2 \text{ C}^{-1}$, what will be the total charge inside the cube?

(Given: $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$)

1. $9.29 \times 10^{-11} \text{ C}$
2. $9.27 \times 10^{-10} \text{ C}$
3. $9.22 \times 10^{-6} \text{ C}$
4. $9.29 \times 10^{-12} \text{ C}$

6. A **parallel plate capacitor** having plates of area 200 cm^2 and separation 2.0 mm holds a charge $0.06 \mu\text{C}$ when 60 V potential difference is applied.

The dielectric constant of the material between the plates is:

1. 0.113
2. 1.13
3. 11.3
4. 113

7. The electric potential due to an electric dipole:

- (A) depends on r
(B) depends on angle between position vector and

dipole moment
(C) falls off as $1/r^2$
(D) does not depend on separation between charges

4. Temperature only

Choose the correct option:

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

11. In absence of electric field and presence of electric field, paths of electrons between collisions are:

1. Straight line, straight line
2. Curved, straight line
3. Curved, curved
4. Straight line, curved

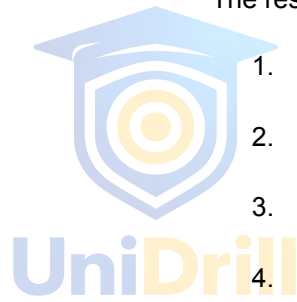
8. Two point charges placed at distance d exert force F .
If one charge is doubled, to keep force same, separation should become:

1. $2d$
2. $d/2$
3. $\sqrt{2}d$
4. $d/\sqrt{2}$

12. A resistor develops **800 J** thermal energy in **20 s** when **20 V** is applied.

The resistance is:

1. 20Ω
2. 10Ω
3. 40Ω
4. 0.5Ω



9. Conductors develop electric currents in them:

1. Only applying electric field
2. Placing the conductor in magnetic field
3. Applying gravitational field only
4. Applying magnetic and gravitational field

13. A wire of resistance 4Ω is used to make a coil of radius **7 cm**.

Wire diameter = **1.4 mm**

Resistivity = $2 \times 10^{-7} \Omega m$

Number of turns in coil:

1. 70
2. 40
3. 140
4. 20

10. Resistivity of a conductor depends on:

1. Material and dimensions
2. Material and temperature
3. Dimensions only

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14. A battery of emf **12 V** and internal resistance **3 Ω** is connected to external resistor.

If current = **0.6 A**, voltage across external resistor is:

1. 10.2 V
2. 17.0 V
3. 12.0 V
4. 13.8 V

15. A **12 Ω** wire is cut into three pieces in ratio **1 : 2 : 3**. These pieces form a triangle. A cell of **8 V** with internal resistance **5 Ω** is connected across largest side. Current in circuit is:

1. 2 A
2. 0.5 A
3. 0.4 A
4. 1 A

16. A bar magnet of magnetic moment **5.0 A m²** has poles **20 cm apart**. Pole strength is:

1. 2.0 A m
2. 30 A m
3. 1 A m
4. 2.5 A m

17. Match the following:

List I	List II
Magnetic field	J T ⁻¹

Magnetic moment	T m A ⁻¹
Pole strength	J T ⁻¹ m ⁻¹
Permeability	Wb m ⁻²

Choose correct combination.

18. A current element **1 cm** carrying **10 A** current along x-axis.

Magnetic field on y-axis at **0.5 m** distance is:

1. 4×10^{-8} T
2. 5×10^{-8} T
3. 6×10^{-8} T
4. 2×10^{-8} T

19. A conductor carrying current along **z-axis** placed in magnetic field along **y-axis**.

Direction of magnetic force will be:

1. +x-axis
2. +z-axis
3. -x-axis
4. -z-axis

20. A galvanometer of resistance **520 Ω** is shunted with **20 Ω** to convert into ammeter.

Resistance of ammeter is:

1. 16.8 Ω
2. 540 Ω
3. 19.3 Ω
4. 18 Ω

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21. Magnetic field inside solenoid:
Length **0.3 m**, turns **800**, current **6 A**

1. 2.03 T
2. 0.03 mT
3. 20 mT
4. 6.03 T

22. A charged particle accelerated by **V** volts acquires speed **u**.

When moving perpendicular to magnetic field **B**, radius of path \propto

1. \sqrt{V}
2. V
3. $\sqrt{V^2}$
4. $1/V$

23. A coil connected to galvanometer.

When north pole of magnet moves toward coil, deflection occurs.

Which statements are correct?

- (A) Indicates electric current in coil
- (B) Deflection smaller when magnet pushed faster
- (C) Repulsion occurs
- (D) If magnet stationary, no current

Choose correct option.

24. Rectangular conductor moves in magnetic field **B** with velocity **v**.

Magnetic flux and induced emf expressions are:

(Options given in diagram question)

25. Average emf induced when current changes **5 A** \rightarrow **2 A** in **0.4 s**:

- (A) self-inductance 0.266 mH
- (B) 0.10 mH

Choose correct statement.

26. For **L = 500 mH** and frequency **0.4 kHz**, capacitance for resonance is:

1. 2.3 μF
2. 0.32 μF
3. 6.3 μF
4. 0.6 μF

27. A **12 V** battery connected to **10 mH** coil. Switch opened in **1 ms**. Average induced emf:

1. 10 V
2. 20 V
3. 200 V
4. 12 V

28. AC supply **220 V, 50 Hz**.

Correct statement about average value over a cycle:

1. 220 V
2. $220\sqrt{2}$ V
3. 0 V
4. $220/\sqrt{2}$ V

29. Which statement is **NOT correct** for electromagnetic induction?

1. emf proportional to rate of change of flux
2. emf equals total change of flux
3. emf increases with number of turns
4. induced current opposes change in flux

30. Maxwell displacement current is due to:

1. flow of charges
2. changing gravitational field
3. changing electric field
4. twice rate of change of magnetic flux

31. Match **List-I (Electromagnetic waves)** with **List-II (Wavelength range)**.

List-I	List-II
(A) X-rays	(i) 1 nm to 700 nm
(B) Radio waves	(ii) 0.1 m to 1 mm
(C) Infrared waves	(iii) 1 nm to 10^{-3} nm
(D) Microwaves	(iv) > 0.1 m

Choose the correct answer.

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

32. The electric field associated with a progressive electromagnetic wave is

$$E = E_0 \sin(kx - \omega t)$$

If B_0 is the amplitude of the magnetic field, then the relation between E_0 and B_0 is:

1. $E_0/B_0 = \omega/k$
2. $E_0/B_0 = \omega^2/k^2$
3. $E_0/B_0 = k/\omega$
4. $E_0/B_0 = k^2/\omega^2$

33. Which of the following statements are correct?

- (A) All mirrors follow the laws of reflection
 (B) Angle between incident ray and mirror surface equals angle between reflected ray and mirror surface
 (C) Rays parallel to principal axis reflect through focus in curved mirror
 (D) Rays through pole reflect symmetrically about axis

Choose the correct answer:

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

34. Which statements about **power of a lens** are correct?

- (A) Power is ability of lens to converge or diverge rays
 (B) SI unit is dioptre if focal length in cm
 (C) For large focal length, power is smaller
 (D) Power of combination of lenses is not algebraic sum

Choose correct option:

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

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4. (A) only

35. In an experiment with a convex lens, image length = **1 cm**, object length = **5 cm**, object distance = **40 cm**.
The focal length of the lens is:

1. 6.67 cm
 2. 3.35 cm
 3. 5.6 cm
 4. 3.6 cm
-

36. In Young's double slit experiment:

Slit separation = **1.5 mm**
Screen distance = **1.2 m**
Wavelength = **600 nm**

Fringe width will be:

1. 0.48 mm
 2. 4.5 mm
 3. 4.8 mm
 4. 4.2 mm
-

37. The **critical angle** for light passing from denser to rarer medium is the angle for which:

1. Angle of reflection = 90°
 2. Angle of refraction = 90°
 3. Angle of reflection = 0°
 4. Angle of refraction = 0°
-

38. A polaroid sheet is rotated between two crossed polarizers.

Maximum transmitted intensity occurs when angle between first polarizer and sheet is:

1. $\pi/2$
 2. $\pi/4$
 3. π
 4. $\pi/3$
-

39. Which statements about **total internal reflection** are correct?

- (A) Occurs when light travels from rarer to denser medium
(B) Angle of incidence equals angle of reflection
(C) In denser medium there is no refracted ray

Choose correct option:

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

40. If focal length of a **concave lens** is **50 cm**, the power of lens is:

1. +5 D
 2. -5 D
 3. +2 D
 4. -2 D
-

41. Photoelectric current is directly proportional to number of photoelectrons emitted per second.

This implies:

1. Proportional to frequency of radiation
2. Inversely proportional to intensity
3. Directly proportional to intensity
4. Independent of intensity

42. The **de-Broglie wavelength** associated with a ball of mass **150 g** moving with speed **30 m/s** is:

1. 1.47×10^{-34} m
2. 14.7×10^{-34} m
3. 0.147×10^{-34} m
4. 7.14×10^{-34} m

43. Which statements about **nuclear properties** are correct?

- (A) Nuclear radius $R = R_0 A^{1/3}$
- (B) Nuclear volume \propto mass number
- (C) Density increases with radius
- (D) Density independent of mass number

Choose correct option:

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

44. An electron in the ground state of hydrogen absorbs **12.09 eV**.

The angular momentum increases by:

1. $h/2\pi$
2. $2h/2\pi$
3. $3h/2\pi$
4. $4h/2\pi$

45. Which statements about **nuclear forces** are correct?

- (A) Electrostatic repulsion between protons can exceed nuclear force
- (B) Electrostatic repulsion is smaller in small nuclei
- (C) Gravitational force between nucleons is much smaller than nuclear force
- (D) Binding energy per nucleon constant because nuclear force is long-range

Choose correct option:

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

46. Which statements about **electronic devices** are correct?

- (A) Diodes rectify AC
- (B) Semiconductor band gap $E_g > 3$ eV
- (C) Junction barrier changes with applied voltage
- (D) p-n junction is basis of semiconductor devices

Options:

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

47. Device **X** connected in series with battery and resistor allows current in one direction. When polarity reversed, current almost zero. Device X is:

1. p-type semiconductor
2. n-type semiconductor
3. p-n junction diode
4. capacitor

50. A proton accelerated through potential **V** has de-Broglie wavelength λ .

To obtain the same wavelength for an **α -particle**, the required accelerating potential is:

1. $V/16$
 2. $V/8$
 3. $2V$
 4. $4V$
-

48. Which statements are true for **p-type semiconductors**?

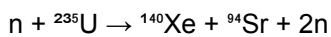
- (A) Holes are minority carriers
- (B) Electrons majority carriers
- (C) Holes majority carriers and trivalent dopants
- (D) Electrons minority carriers and pentavalent dopants

Options:

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



49. In the nuclear reaction



Values of **a** and **b** are:

1. $a = 38, b = 94$
 2. $a = 94, b = 38$
 3. $a = 94, b = 40$
 4. $a = 96, b = 38$
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