CUET (UG)

Physics Sample Paper - 6

Solved

Time Allowed: 45 minutes **Maximum Marks: 200**

General Instructions:

1. The test is of 45 Minutes duration.
2. The test contains 50 questions out of which 40 questions need to be attempted.
3. Marking Scheme of the test:

a. Correct answer or the most appropriate answer: Five marks (+5).
b. Any incorrectly marked option will be given minus one mark (-1).
c. Unanswered/Marked for Review will be given zero mark (0).

Attempt any 40 questions

1. Which of the following is deflected by electric field? **[5]**

a) γ-rays
b) Neutrons
c) α-particles
d) X-rays

2. The unit of permittivity of free space ($\in_0$) is **[5]**

a) $C\ N^{-1}\ m^{-1}$
b) $N\ m^2\ C^{-2}$
c) $C^2\ N^{-2}\ m^{-2}$
d) $C^2\ N^{-1}\ m^{-2}$

3. The number of electrons for one coulomb of charge is **[5]**

a) 6.25×10^{19}
b) 6.25×10^{23}
c) 6.25×10^{21}
d) 6.25×10^{18}

4. With the rise in temperature, the dielectric constant K of a liquid: **[5]**

a) increases
b) decreases
c) changes erratically
d) remains unchanged

5. Van de Graaff electrostatic generator is based on: **[5]**

a) phenomenon of corona discharge only
b) Coloumb's law
c) both phenomenon of corona discharge and charge always

resides on the outer surface of a hollow conductor

d) charge always resides on the outer surface of a hollow conductor

6. The angle between the electric lines of force and an equipotential surface: **[5]**

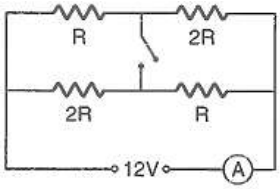
a) 45°

b) 0°

c) 180°

d) 90°

7. Two resistors R and 2R are connected in series. Two more resistors R and 2R are connected in series and the combination is connected in parallel to the first combination. A DC source of 12 volts and an ammeter are connected to this as shown in the figure. If there is a key between resistors of each combination as shown in the figure, what will be the ratio of ammeter reading before and after closing the key? **[5]**



a) 1 : 2

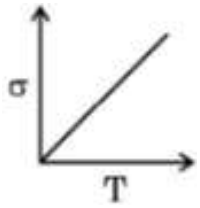
b) 8 : 9

c) 2 : 1

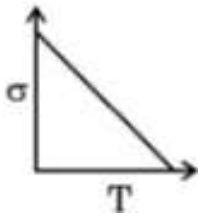
d) 1 : 1

8. Which one of the following is the correct representation of variation of conductivity of a conductor with temperature? **[5]**

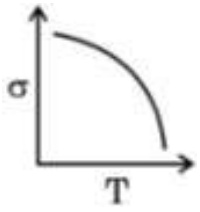
a)



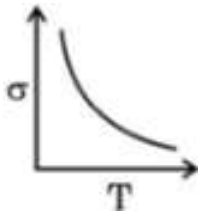
b)



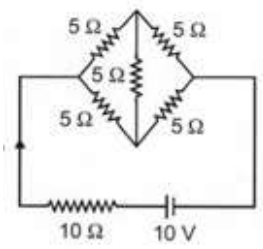
c)



d)



9. Find I in the circuit. **[5]**



a) 1A

b) $\frac{5}{3}A$

c) $\frac{2}{3}A$

d) $\frac{1}{3}A$

10. The force on a charge due to a magnetic field can act **[5]**

a) on a charge which is at rest

b) moving in the opposite direction of the magnetic field

c) which is moving in the direction of the magnetic field

d) moving in the perpendicular direction

11. A constant current is flowing through a solenoid. An iron rod is inserted in the solenoid along its axis. Which of the following quantities will not increase? **[5]**

a) The magnetic field at the centre

b) The self-inductance of the solenoid

c) The rate of heating

d) The magnetic flux linked with the solenoid

12. A long straight wire of circular cross section of radius a carries a steady current I. The current is uniformly distributed across its cross section. The ratio of the magnitudes of magnetic field at a point at a distance $\frac{a}{2}$ above the surface of wire to that at a point at a distance $\frac{a}{2}$ below its surface is **[5]**

a) 1 : 1

b) 4 : 3

c) 4 : 1

d) 3 : 4

13. Two parallel conductors carrying current of 4.0 A and 10.0 A are placed 2.5 cm apart in vacuum. The force per unit length between them is **[5]**

a) $6.4 \times 10^{-2}\ \mathrm{N/m}$

b) $6.4 \times 10^{-5}\ \mathrm{N/m}$

c) $3.2 \times 10^{-4}\ \mathrm{N/m}$

d) $4.6 \times 10^{-4}\ \mathrm{N/m}$

14. At a given place on the earth's surface, horizontal component of earth's magnetic field is $3 \times 10^{-5}T$ and resultant magnetic field is $6 \times 10^{-5}T$. The angle of dip at the place is: **[5]**

a) 40°

b) 30°

c) 60°

d) 50°

15. A bar magnet has magnetic dipole moment $\vec{M}$. Its initial position is parallel to the direction of uniform magnetic field $\vec{B}$. In this position, the magnitudes of torque and force acting on it respectively are **[5]**

a) 0 and MB

b) $|\vec{M} \times \vec{B}|$ and 0

c) 0 and 0

d) MB and MB

16. The vertical component of earth's magnetic field is zero at a place where angle of dip is **[5]**

a) 90°

b) 60°

c) 0°

d) 45°

17. Time period of oscillation of a magnetic needle is **[5]**

a) $T = \sqrt{\frac{I}{MB}}$

b) $T = \pi\sqrt{\frac{MB}{I}}$

c) $T = 2\pi\sqrt{\frac{MB}{I}}$

d) $T = 2\pi\sqrt{\frac{I}{MB}}$

18. The arrangement fo two magnetic poles of equal and opposite strengths separated by a finite distance is called: **[5]**

a) Magnetic dipole

b) None of these

c) Magnetic field

d) Magnetic pole

19. Two tangent galvanometers having coils of the same radius are connected in series. A current flowing in them produces a deflection of 60° and 45° respectively. The ratio of the number of turns in the coils is: **[5]**

a) $\frac{\sqrt{3}}{1}$

b) $\frac{\sqrt{3+1}}{1}$

c) $\frac{(\sqrt{3+1})}{(\sqrt{3}-1)}$

d) $\frac{4}{3}$

20. A bar magnet having a magnetic moment of 2×10^4 JT^{-1} is free to rotate in a horizontal plane. A horizontal magnetic field B = 6×10^{-4} T exists in the space. The work done in taking the magnet slowly from a direction parallel to the field to a direction 60° from the field is **[5]**

a) 0.6 J

b) 12 J

c) 2 J

d) 6 J

21. A bar magnet is oscillating in the earth's magnetic fields with a time period T. If its mass is quadrupled, then its time period will be: **[5]**

a) $\frac{T}{2}$ b) 4T

c) T d) 2T

22. A circular ring of diameter 20 cm has a resistance of 0.01 Ω. The charge that will flow through the ring if it is turned from a position perpendicular to a uniform magnetic field of 2.0 T to a position parallel to the field is about: **[5]**

a) 0.063 C b) 63 C

c) 0.63 C d) 6.3 C

23. If the speed of rotation of a dynamo is doubled, then the induced emf will **[5]**

a) remain unchanged b) become double

c) become four times d) become half

24. Lenz's law is a consequence of the law of conservation of **[5]**

a) energy b) charge

c) momentum d) mass

25. Suppose the number of turns in a coil be tripled, the value of magnetic flux linked with it **[5]**

a) is doubled b) becomes $\frac{1}{3}$

c) remains unchanged d) is tripled

26. When an alternating voltage $E = E_0 \sin \omega t$ is applied to a circuit, a current $I = I_0 \sin \left(\omega t + \frac{\pi}{2}\right)$ flows through it. The average power dissipated in the circuit is **[5]**

a) $E_{rms} \cdot I_{rms}$ b) $\frac{E_0 I_0}{\sqrt{2}}$

c) Zero d) $E_0 I_0$

27. If the current is halved in a coil, then the energy stored is how much times the previous value? **[5]**

a) $\frac{1}{2}$ b) $\frac{1}{4}$

c) 2 d) 4

28. An electric bulb marked 40 W and 200 V is used in a circuit of supply voltage 100 V. Its power would be: **[5]**

a) 20 W b) 100 W

c) 10 W d) 40 W

29. In a series LCR circuit, the voltage across the resistance, capacitance and inductance is 10 V each. If the capacitance is short-circuited the voltage across the inductance will be **[5]**

a) $\frac{10}{\sqrt{2}}$ V b) 20 V

c) 10 V d) $10\sqrt{2}$ V

30. Part of the electromagnetic spectrum to which 5890 $\overset{0}{A}$ - 5896 $\overset{0}{A}$ [double lines of sodium] belongs to is **[5]**

a) Microwaves b) Visible rays

c) Ultraviolet rays d) Gamma rays

31. State the part of the electromagnetic spectrum to which 21 cm wavelength emitted by atomic hydrogen in interstellar space belongs to? **[5]**

a) Microwave b) Ultraviolet

c) Visible d) Radio

32. The phenomenon which shows quantum nature of electromagnetic radiation is **[5]**

a) Tyndall effect b) Photoelectric effect

c) Piezoelectric effect d) Hall effect

33. To print a photograph from a negative, the time of exposure to light from a lamp placed 60 cm away is 2.5 s. What exposure time is required if the lamp is placed 1.2 m away? **[5]**

a) 5 s b) 10 s

c) 15 s d) 20 s

34. The refractive index of glass is $1 \cdot 520$ for red light and $1 \cdot 525$ for blue light. $\delta_1 \; and \; \delta_2$ be angles of minimum deviation for red and blue light respectively in a prism of this glass, then **[5]**

a) $\delta_1 = \delta_2$ b) $\delta_1 \; < \; \delta_2$

c) δ_1 can be less than or greater than δ_2, depending upon the values of δ_1 and δ_2.

d) $\delta_1 > \delta_2$

35. To get three images of a single object, one should have two plain mirrors at an angle of **[5]**

a) 90°

b) 120°

c) 30°

d) 60°

36. In two positions concave mirror produces magnified image of given object The positions are **[5]**

a) (i) Beyond C, (ii) Between P and F

b) (i) At C, (ii) at F

c) (i) At C, (ii) between P and F

d) (i) Between F and C, (ii) Between P and F

37. The penetration of light into the region of geometrical shadow is called **[5]**

a) Interference

b) Polarisation

c) Refraction

d) Diffraction

38. Wavefront generated from a line source is **[5]**

a) either cylindrical wavefront or spherical wavefront

b) cylindrical wavefront

c) spherical wavefront

d) plane wavefront

39. For Bragg's diffraction by a crystal to occur, then the X-ray of wavelength λ and interatomic distance d must be such that **[5]**

a) λ is greater than 2d

b) λ is smaller than 2d

c) λ is smaller than or equal to 2d

d) λ equals 2d

40. The work function for Al, K and Pt is 4.28 eV, 2.30 eV and 5.65 eV respectively. Their respective threshold frequencies would be **[5]**

a) K > Al > Pt

b) Al > K > Pt

c) Pt > Al > K

d) Al > Pt > K

41. The $\frac{e}{m}$ value of electron is **[5]**

a) 9.11×10^{21} C/kg

b) 1.62×10^{10} C/kg

c) 1.76×10^{11} C/kg

d) 1.67×10^{27} C/kg

42. In a photoelectric cell, the photoelectric current depends on the **[5]**

a) wavelength of light

b) potential difference applied

c) intensity of light

d) frequency of light

43. The longest wavelength in Balmer series of hydrogen spectrum will be **[5]**

a) $5600\ \mathring{A}$

b) $1216\ \mathring{A}$

c) $4800\ \mathring{A}$

d) $6557\ \mathring{A}$

44. When an electron jumps from the fourth orbit to the second orbit, one gets the **[5]**

a) Second line of Balmer series

b) First line of Pfund series

c) Second line of Paschen series

d) Second line of Lyman series

45. A set of atoms in an excited state decays **[5]**

a) into a lower state only when excited by an external electric field

b) to emit photons only when they collide

c) in general to any of the states with lower energy

d) all together simultaneously into a lower state

46. Whenever a stream of electrons collides with a stream of photons, in this collision, which of the following is not conserved? **[5]**

a) Total energy

b) Linear momentum

c) No. of electrons

d) No. of photons

47. If number of nucleons increases, then binding energy per nucleon of the nucleus **[5]**

a) remains constant with mass number

b) continuously decreases with mass number

c) continuously increases with mass number

d) first increases and then decreases with mass number

48. When two nuclei ($A \leq 10$) fuse together to form a heavier nucleus, the: **[5]**

a) binding energy per nucleon increases

b) binding energy per nucleon does not change

c) total binding energy decreases

d) binding energy per nucleon decreases

49. The heavily and lightly doped regions of a bipolar junction transistor are respectively: **[5]**

a) base and collector

b) collector and emitter

c) base and emitter

d) emitter and base

50. Digital weighing balance uses **[5]**

a) a velocity transducer

b) a position transducer

c) an acceleration transducer

d) a force transducer

Solutions

1.
(c) α-particles
Explanation: α-particles are charged particles, so they are deflected by an electric field.

2.
(d) $C^2\ N^{-1}\ m^{-2}$
Explanation: $C^2\ N^{-1}\ m^{-2}$

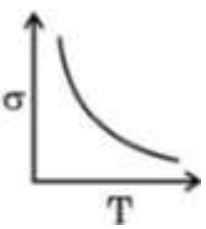
3.
(d) 6.25×10^{18}
Explanation: $n = \frac{q}{e} = \frac{1C}{1.6 \times 10^{-19}C}$
$= 6.25 \times 10^{18}$

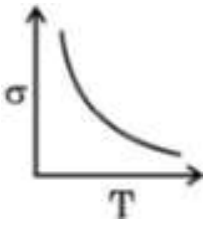
4.
(b) decreases
Explanation: With temperature rise, the dielectric constant of liquid decreases.

5.
(c) both phenomenon of corona discharge and charge always resides on the outer surface of a hollow conductor
Explanation: It is based on
i. the phenomenon of corona discharge
ii. The charge always resides on the outer surface of a hollow conductor.

6.
(d) 90°
Explanation: An electric line of force is perpendicular to the equipotential surface at every point.

7.
(b) 8 : 9
Explanation: Prior to closing the key, the circuit consists of two resistors connected in parallel each having a value of 3R. The effective resistance will be 1.5R. Hence, ammeter reading is $(\frac{12}{1.5R})$ or $(\frac{8}{R})$ amperes. When the key is closed, the circuit is equivalent to two sections connected in parallel. The effective resistance is $\frac{2R}{3} + \frac{2R}{3} = \frac{4R}{3}$. The ammeter reading will be $\frac{12}{\frac{4R}{3}} = \frac{9}{R}$
Therefore, Ratio of ammeter readings is 8 : 9

8.
(d) 

Explanation: 

9.

(c) $\frac{2}{3}A$

Explanation: As it is balanced wheat stone bridge, so total resistance of the closed loop is

$\frac{1}{R} = \frac{1}{10} + \frac{1}{10} = \frac{2}{10}$

$R = 5\ \Omega$

$Total\ Circuit\ resis\tan ce = 10 + 5 = 15\ \Omega$

$Current\ in\ circuit = \frac{10}{15} = \frac{2}{3}A$

10.

(d) moving in the perpendicular direction

Explanation: Force, F = qvB sin 90° = qvB

In all other cases, F = 0

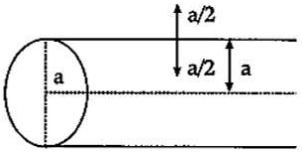
11.

(c) The rate of heating

Explanation: Since, the current remains constant, the rate of heating will not increase.

12.

(b) 4 : 3

Explanation: 

Magnetic field, $B = \frac{\mu_0}{2\pi} \times \frac{I}{r}$ (for r > a)

And $B = \frac{\mu_0}{2\pi} \times \frac{Ir}{a^2}$ (for r < a)

For point P, r > a

So, $B_p = \frac{\mu_0}{2\pi} \times \frac{I}{r_1}\ \left[r_1 = \frac{3a}{2}\right]$

For point Q, r < a

So, $B_Q = \frac{\mu_0}{2\pi} \times \frac{Ir_2}{a^2}\ \left[r_2 = \frac{a}{2}\right]$

So, the ratio $\frac{B_P}{B_Q} = \frac{\frac{I}{r_1}}{\frac{Ir_2}{a^2}}$

$= \frac{I}{r_1} \times \frac{a^2}{Ir_2}$

$= \frac{a^2}{\frac{3a}{2} \times \frac{a}{2}}$

$= \frac{a^2}{\frac{3a^2}{4}} = 4 : 3$

13.

(c) $3.2 \times 10^{-4}\ \mathrm{N/m}$

Explanation: $F = \frac{\mu_0 i_1 i_2}{2\pi r}$

$\frac{4\pi\times10^{-7}\times4\times10}{2\pi\times2.5\times10^{-2}}$

$= 3.2 \times 10^{-4}$ N/m

14. **(c)** 60°

Explanation: $cos\delta = \frac{B_H}{B} = \frac{3\times10^{-5}}{6\times10^{-5}} = 0.5$

Hence angle of dip = 60°

15. **(c)** 0 and 0

Explanation: Torque = τ = MBsin θ

Since, M and B are parallel, then θ = 0 and hence,

τ = 0

Torque is 0. So, in this case force is also zero since the distance is not equal to zero.

16. **(c)** 0°

Explanation: Vertical component = B sinθ [V = vertical component of earth 's magnetic field; B = earth's magnetic field at a place; θ = angle of dip]

So, vertical component of earth magnetic field becomes zero when angle of dip becomes zero, i.e. at the magnetic equator.

17. **(d)** $T = 2\pi\sqrt{\frac{I}{MB}}$

Explanation: Time period of oscillation of a magnetic needle is $T = 2\pi\sqrt{\frac{I}{MB}}$

18. **(a)** Magnetic dipole

Explanation: Magnetic dipole

19. **(a)** $\frac{\sqrt{3}}{1}$

Explanation: For a tangent galvanometer,

$\frac{\mu_0 NI}{2R}$ = B_H tan θ

For same I and B_H, N $\times$ tan θ

$\therefore \frac{N_1}{N_2} = \frac{\tan 60^\circ}{\tan 45^\circ} = \frac{\sqrt{3}}{1}$

20. **(d)** 6 J

Explanation: W = $mB\left(\cos\theta_1 - \cos\theta_2\right)$

$= 2 \times 10^4 \times 6 \times 10^{-4}$ (cos 0° - cos 60°) = 6J

21. **(d)** 2T

Explanation: T = $2\pi\sqrt{\frac{I}{mB_H}}$

When mass is quadrupled,

I' = 4I

$\therefore$ T' = $2\pi\sqrt{\frac{T}{mB_H}} = 2\pi\sqrt{\frac{4I}{mB_H}}$ = 2T

22.

(d) 6.3 C

Explanation: $q = \frac{\text{Net change in magnetic flux}}{R}$

$= \frac{BA(\cos 0^\circ - \cos 90^\circ)}{R} = \frac{B \times \pi r^2 (1-0)}{R} = \frac{B\pi r^2}{R}$

$= \frac{2 \times 3.14 \times (0.1)^2}{0.01}$C = 6.28C = 6.3 C

23.

(b) become double

Explanation: Induced emf $\propto$ speed of rotation of the dynamo.

24. **(a)** energy

Explanation: energy

25.

(d) is tripled

Explanation: $\phi = NBA\cos\theta$

i.e., $\phi \propto N$

26.

(c) Zero

Explanation: Power = $V_{rms} \times I_{rms} \times \cos\phi$

Here

$\phi = \frac{\pi}{2}$ So,

Power = 0

27.

(b) $\frac{1}{4}$

Explanation: $E = \frac{1}{2}Li^2$

$\frac{E_1}{E_2} = \left(\frac{i_1}{i_2}\right)^2$

Now, $i_2 = \frac{i_1}{2}$

So, $\frac{E_1}{E_2} = \left(\frac{i_1}{\frac{i_1}{2}}\right)^2 = 4$

Thus, $E_2 = \frac{E_1}{4}$ thus the energy is 1/4 th of previous ones.

28.

(c) 10 W

Explanation: Let P = actual power used

W = power specified = 40 W

V_A = Applied voltage = 100 V

V_S = Specified voltage = 200 V

Now,

$P = \left(\frac{V_A}{V_S}\right)^2 W$

$P = \left(\frac{100}{200}\right)^2 \times 40 = 10W$

29. **(a)** $\frac{10}{\sqrt{2}}$ V

Explanation: $V_R = V_L = V_C = 10V$

$\Rightarrow R = X_L = X_C$ and $Z = R$

$V = IR = 10$ V

When the capacitance is short-circuited,

$Z' = \sqrt{R^2 + X_L^2} = \sqrt{R^2 + R^2} = \sqrt{2}R$

New current, $I' = \frac{V}{Z'} = \frac{V}{\sqrt{2}R} = \frac{10}{\sqrt{2}R}$

$V_L' = I'X_L = \frac{10}{\sqrt{2}R} \times R = \frac{10}{\sqrt{2}}V$

30.

(b) Visible rays

Explanation: 5890 $\overset{0}{A}$ - 5896 $\overset{0}{A}$ [double lines of sodium] belongs to visible region of em-spectrum

31.

(d) Radio

Explanation: Wavelength range of radio waves is 0.1 m to 600 m. So ,this radiation belongs to radio waves.

32.

(b) Photoelectric effect

Explanation: Photoelectric effect allows us to perceive the quantum nature of light and ultimately electromagnetic radiation.

33.

(b) 10 s

Explanation: Exposure time, $t \propto d^2$

$\therefore t_2 = \frac{d_2^2}{d_1^2}t_1 = \frac{120^2}{60^2} \times 2.5 = 10s$

34.

(b) $\delta_1 < \delta_2$

Explanation: Now, $\delta_1 = A(\mu_r - 1)$ = A(1 · 520 - 1) = 0 · 520A

and $\delta_2 = A(\mu_b - 1)$ = A(1 · 525 - 1) = 0 · 525A

$\therefore \delta_1 < \delta_2$

35. **(a)** 90°

Explanation: Number of images, $n = \frac{360^o}{\theta} - 1$

$\theta = \frac{360}{(n+1)} = \frac{360}{4} = 90^\circ$

36.

(d) (i) Between F and C, (ii) Between P and F

Explanation: When the object is placed between C and F in front of a concave mirror, the imager is formed beyond C. Image is magnified, real and inverted.

When the object is placed between P and F in front of a concave mirror, the image is formed behind the mirror. Image is magnified, virtual and erect.

37.

(d) Diffraction

Explanation: When the light bends round an obstacle it enters into an area of geometrical shadow. This phenomenon is called as diffraction of light.

38.

(b) cylindrical wavefront

Explanation: cylindrical wavefront

39.

(c) λ is smaller than or equal to 2d

Explanation: For Bragg's diffraction,

$2d \sin\theta = n\lambda$

$\Rightarrow \lambda = \frac{2d \sin\theta}{n}$

$\theta \leq \sin\theta \leq 1 \Rightarrow \lambda \leq 2d$

40.

(c) Pt > Al > K

Explanation: As $W_0 = h\nu_0$ i.e., $W_0 \propto \nu_0$

$\therefore \nu_0(\mathrm{Pt}) > \nu_0(\mathrm{Al}) > \nu_0(\mathrm{K})$

41.

(c) 1.76×10^{11} C/kg

Explanation: $\frac{e}{m} = \frac{1.6\times10^{-19}\mathrm{C}}{9.1\times10^{-31}\ \mathrm{kg}} = 1.76 \times 10^{11}$ C/kg^{-1}

42.

(c) intensity of light

Explanation: Photocurrent is proportional to incident light intensity.

43.

(d) 6557 $\mathring{A}$

Explanation: For longest wavelength in Balmer series, $n_1 = 2$ and $n_2 = 3$.

$\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] = 1098 \times 10^7 \left[\frac{1}{2^2} - \frac{1}{3^2}\right]$

$\lambda = \frac{36\times10^{-7}}{5\times1.098}$ m

$= 6577 \times 10^{-10}$ m

$= 6577\ \mathring{A}$

44. **(a)** Second line of Balmer series

Explanation: In line spectra, the Balmer formula corresponds to $n_f = 2$ and $n_i = 3, 4, 5,$ etc.

45.

(c) in general to any of the states with lower energy

Explanation: A set of atoms in an excited state decays in general to any of the states with lower energy.

46.

(d) No. of photons

Explanation: In a photon-electron collision, a photon may be absorbed or a new photon

may be released. Here number of photons is not conserved but linear momentum, total energy and no. of electrons are conserved.

47. **(d)** first increases and then decreases with mass number

Explanation: B.E. per nucleon first increases, becomes maximum for ^{56}Fe and then decreases with the increase in mass number.

48. **(a)** binding energy per nucleon increases

Explanation: for light nucleus we know that binding energy per nucleon will increase while the two nuclei fuse together to form a stable heavier nucleus, the heavier nucleus will be more stable than the two nuclei.

49. **(d)** emitter and base

Explanation: In a bipolar junction transistor, the emitter is heavily doped, the base is lightly doped and the collector is moderately doped.

50. **(d)** a force transducer

Explanation: A force transducer is also known as a force sensor this converts an input mechanical force into output electrical signal.Hence a force transducer is used in digital weighing balance.