Question Bank

Council of Higher Secondary Education, Odisha

PHYSICS

Fill in the blanks

Electrostatics

1. One coulomb of charge is equal to the charge on ____ electrons.
2. The charge on a particle or body can be only ____ multiple of least possible value of charge.
3. The least possible value of charge on a body can be ____.
4. When electrons are removed from a body, it becomes ____ charged.
5. Glass rod becomes ____ charged on rubbing with silk.
6. If charges q_1 and q_2 have the same magnitudes and opposite signs, $q_1 + q_2 =$ ____.
7. Like charges ____ each other and unlike charges _____ each other.
8. The electric force between two charges is a _____ force.
9. If $q_1 q_2 > 0$, the nature of electrostatic force between the charges is _____.
10. If $q_1 q_2 < 0$, the nature of electrostatic force between the charges is _____.
11. SI unit of electric permittivity is ____.
12. Dimensional formula for electric permittivity is ____.
13. The ratio of forces between two charges separated by a certain distance in air and by the same distance in the medium is called ______.
14. The charge (in coulomb) of a $_7N^{14}$ nucleus is _____.
15. The SI unit of electric field intensity is ______.
16. Electric field intensity inside a charged conductor is _____.
17. A force of 2·25 N acts on a charge of 15×10^{-4} C. The intensity of electric field at that point is ___ .
18. The magnitude of electric dipole moment is equal to the product of one of the charges and ___of the dipole.
19. The direction of electric dipole moment is from ________ charge.
20. In stable equilibrium of an electric dipole in an electric field, the angle between the electric field intensity and the dipole moment is ____ .
21. In unstable equilibrium of an electric dipole in an electric field, the angle between the electric field intensity and the dipole moment is ___.
22. The SI unit of electric flux is ____.
23. The dimensional formula of electric flux is _____.
24. A sphere of radius 1m encloses a charge of 3μC. Another charge –3μC is placed inside the sphere. The net flux through the sphere is _____.

25. An electric dipole of dipole moment 20×10^{-6} Cm is enclosed by a closed surface. The net electric flux coming out of the surface is _____.
26. Electrostatic potential energy stored in a dipole of moment **p** placed in an external uniform electric field of intensity **E** is ______ .
27. Torque acting on a dipole of moment **p** placed in an external uniform electric field of intensity **E** is ______ .

Answers:

1. $6 \cdot 25 \times 10^{18}$	10. Attractive	19. – ve to + ve
2. Integral	11. $C^2N^{-1}m^{-2}$	20. 0°
3. $\pm 1 \cdot 6 \times 10^{-19}$ C	12. $M^{-1}L^{-3}T^4A^2$	21. 180°
4. Positively	13. relative permittivity	22. $Nm^2 C^{-1}$ or JmC^{-1}
5. Positively	14. $11 \cdot 2 \times 10^{-19}$ C	23. $ML^3 T^{-3} A^{-1}$
6. Zero	15. NC^{-1} or Vm^{-1}	24. Zero
7. Repel, attract	16. Zero	25. Zero
8. Central	17. 1500 N/C	26. $\mathbf{p} \cdot \mathbf{E}$
9. Repulsive	18. Length	27. $\mathbf{p} \times \mathbf{E}$

CHAPTER-2

1. The work done in moving a charge in an electrostatic field is path _____.
2. The SI unit of electric potential is ____.
3. The dimensional formula of electric potential or electric potential difference is _____.
4. The work done in moving a charge of 4C from one point to another point having a potential difference of 5V is __ .
5. 1eV = ______J.
6. 1MeV = ______J.
7. At a point mid-way between two equal and opposite charges, electric potential is ____.
8. The relation between electric field intensity and potential gradient at a point is ____.
9. The electric potential is constant in a region. There, the electric field is _____.
10. For a point charge, the equipotential surfaces are _____.
11. The equipotential surfaces are at ____ angles to the direction of electric field.
12. SI unit of capacitance is _____.
13. 1F = ___ pF.
14. The dimensional formula of capacitance is _____.
15. A parallel plate capacitor has a capacitance of 5 μF in air and 50 μF when a dielectric medium is introduced. The dielectric constant of the medium is____.
16. Three capacitors, each of capacitance 2 μF are connected in series. The resultant capacitance in farad is __ .

17. Work done to charge a 24 μF capacitor when potential difference between the plates is 500V is ___.
18. The dipole moment of non-polar molecule is ____.
19. Water has dielectric constant _____.
20. Mica has dielectric constant ______.

Answers

1. independent
2. JC^{-1} or volt
3. $ML^2 T^{-3}A^{-1}$
4. 20J
5. $1{\cdot}6 \times 10^{-19}$
6. $1{\cdot}6 \times 10^{-13}$
7. Zero
8. $E = \vec{E} = -\vec{\nabla} V$
9. Zero
10. concentric spheres
11. right
12. CV^{-1} or farad
13. 10^{12}
14. $M^{-1}L^{-2}A^2T^4$
15. 10
16. $0{\cdot}67\ 10^{-6}$ F
17. 3J
18. Zero
19. 80
20. 6

Multiple Choice Questions

UNIT-I

1. The SI unit of electric field strength is

   (a) NC^{-1}

   (b) Coulomb

   (c) ab coulomb

   (d) newton

2. Three small spheres each carrying a positive charge 'q' are placed on circumference of a circle of radius 'r' to form an equilateral triangle. The electric field intensity at the centre of the circle will be

   (a) $\frac{3Q}{r}$

   (b) $\frac{3Q}{r^2}$

   (c) $\frac{Q}{\sqrt{2}r^2}$

   (d) zero

3. Two similar conducting spheres A and B are brought in contact and inshlated from with. A negatively charged ebonite rod is brought near A now.

   (a) A will have +ve and B will have –ve charge

   (b) A will have –ve charge and B will have +ve charge

   (c) Both will acquire negative charge

   (d) both will remain uncharged

4. Two identical metallic sphere A and B have exactly equal masses A is given a +ve charge q coulomb and B is given an equal negative charge. Then after charging.

   (a) Masses of A and B are equal

   (b) mass of B s greater than A.

   (c) Mass of A is greater than B

   (d) None of these

5. The magnitude of electric intensity E is such that an electron placed on it would experience an electrical force equal to its weight. E is given by

(a) mg e

(b) $\frac{e}{mg}$

(c) $\frac{mg}{e}$

(d) $\frac{e^2 g}{m^2}$

6. A charge q_1 exerts some force on a second charge q_2. It a third charge q_3 is brought near, then the force of q_1 exerted on q_2

(a) will increase in magnitude

(b) will decrease in magnitude

(c) will remain unchanged.

(d) will increase if q_3 is of the same sign as q_1 and will decrease if q_3 is of opposite sign.

7. Five balls numbered q to 5 are suspended using separate threads pairs (1,2), (2,4) and (4,1) show electrostatic attraction, while pairs (2,3) (4,5) show repulsim, therefore ball q to be zero.

(a) neutral

(b) made of metal

(c) positively changed

(d) negatively charged

8. Three charges 4q, Q and q are placed in a straight line of length l at points o, $l/2$ and l respectively. What should be Q in order to make the net force on q to be zero

(a) $-q$

(b) $-\frac{1}{2}q$

(c) 1 : 5

(d) 5 : 1

9. There are two changes 1 μc and 5 μc the ratio of the forces acting on them will be

(a) 1 : 1

(b) 1 : 25

(c) 1 : 5

(d) 5 : 1

10. A large isolated metal sphere of radius r carries a fixed charge. A small charge is placed at a distance d from its surface. It experiences a force which is

(a) independent of r and d

(b) proportional to $r^2 + d^2$

(c) proportional to r^2

(d) inversely proportional to $(r+d)^2$

11. A charge q is placed at the centre of line joining two equal charges Q . The system of the three chrges will be in equilibrium if q is equal to

(a) $\frac{-Q}{2}$

(b) $\frac{-Q}{4}$

(c) $\frac{+Q}{4}$

(d) $\frac{+Q}{2}$

12. Charge is placed at each of two opposite corners a square. A charge q is placed at each othe other corners. Given that resultant electric force on is zero. The Q is equal to

(a) $\frac{2\sqrt{2}}{9}$

(b) $\frac{-9}{2\sqrt{2}}$

(c) $2\sqrt{2}q$

(d) $-2\sqrt{2}q$

13. A point Q lies on perpendicular bisector of an elective pole of moment P. if the distance of Q from the dipole is r much larger than size of dipole, then the electric field at Q is proportional to

(a) P^{-1} *and* r^{-2}

(b) P *and* r^{-2}

(c) P^2 *and* r^{-3}

(d) P *and* r^{-3}

14. A hollow insulated conducting sphere is given a positive charge of 10 μc. What will be the electric field at the under of the use if its radius is 2m.

(a) Zero

(b) 5 μ cm^{-2}

(c) 20 5 μ cm^{-2}

(d) 325 μ cm^{-2}

15. Equal charge are given to two spheres of different radii; potential will be

(a) more on smaller sphere

(b) more on bigger sphere

(c) equal on both spheres

(d) dependant on nature of material of the spheres

16. Fight dipoles of charges of magnitude $\pm e$ are placed side a cabe . The total electric this coming out of the tube will be.

(a) $\frac{8e}{\varepsilon_0}$

(b) $\frac{8e}{\varepsilon_0}$

(c) $\frac{e}{\varepsilon_0}$

(d) zero

17. Two charges -10° C + 10 C are placed 10 cm apart tential at the centre of the line joining the two charges.

(a) zero

(b) 2V

(c) -2V

(d) none of these

18. Coulomb's law is given by F=k q_1 q_2 r where n is

(a) $\frac{1}{2}$ (b) -2 (c) 2 (d) $-\frac{1}{2}$

19. Work done in moving a unit positive charge through ω distance of x meter on an equipotential surface is

(a) x *joule*

(b) $\frac{1}{x}$ joule

(c) zero

(d) x^2joule

20. Potential diff between two parallel plate separate by 1 cm apart is 10 volt. The electric field is

(a) 10 N/C (b) 500 N/C (c) 10^3 N/C (d) 250 N/C

21. If the surface densim of charge be r, electric field near the surface would be

(a) $\frac{2r}{\varepsilon_0}$ (b) $\frac{r}{\varepsilon_0}$ (c) $\frac{3r}{\varepsilon_0}$ (d) $\frac{3r}{\varepsilon_0}$

22. A hollow metal sphere of radii 10 cm is charged such that the potential on its surface is 80 volt. The potential at the centre of the sphere is

(a) zero

(b) 80 volt

(c) 800 volt

(d) 8 volt

24. Two metallic sphere of radii 1 cm and 2 cm are given charge of 10^{-1} and 5×10^{-2} C respectively. If these are connected by a conducting wire, the final charge on the smalles sphere is

(a) 3×10^{-2} C

(b) 1×10^{-2} C

(c) 4×10^{-2} C

(d) 2×10^{-2} C

25. Three different capacitors are connected in series. Then

(a) they will have equal charges.

(b) they will have same potential

(c) both (a) & (b)

(d) none of these

26. A sheet of Aluminium is inserted in the air gap of a parallel plate capacitor without touching any of the plates of the capacitors the capacitance of the capacitor is

(a) invariant for all positions of sheet

(b) maximum when the sheet is midway between 2 plate

(c) maximum when the sheet is never to +ve plate

(d) maximum when the sheet is never to –ve plate

27. Which of the following is a volt?

(a) erg per cm

(b) joule per coulomb

(c) erg per ampere

(d) newton/coulomb × m^2

28. Two sphere each carrying a charge Q placed r meters apart repel each other with a force F. If one of the spheres is taken around the other one in a circular path of radius r the work done will be

(a) F × r

(b) F × 2πr

(c) $\frac{F}{2\pi r}$

(d) Zero

29. If one penetrates a uniformly charged spherical shell, the electric field strength E.

(a) increases

(b) decreases

(c) remains same as surface

(d) is zero at all points

30. Two condensers of capacity 0.3 μF and 0.6 μF respectively are connected in series. The combination is connected across a potential of 6 volt. The ratio of energies stored by condenser will be

(a) ½ (b) 2 (c) ¼ (d) 4

31. SI unit of permittivity is

(a) N m^2 c^{-2}

(b) A m^{-1}

(c) N C^{-1}

(d) C^2 N^{-1} m^{-2}

32. Two point changes at a certain distance experience a force of 5 N. Each change is doubled in magnitude and distance between the two is halved. The interacting force would be

(a) 16 N (b) 80 N (c) 5 N (d) 20 N

33. When an electric dipole is placed in a uniform electric field it expliences.

(a) a force as well as torque

(b) a torque but no force

(c) a force but no torque

(d) neither a force nor a torque

34. Torque on a dipole in an electric field in maximum when angle between $\vec{P}$ *and* $\vec{E}$ is

(a) 0^0 (b) 90^0 (c) 45^0 (d) 180^0

35. Potential energy of two equal negative point charges 2μC each held 1m apart in air is

(a) 2 J (b) 2 eV (c) 4 J (d) 0.036 J

36. The dielectric const of a metal is

(a) 1 (b) 0 (c) ∞ (d) Indefinite

37. A work of 100 joule is performed in carrying a charge of 5 coulomb from infinity to a particular point in an electrostatic field. The potential of this point is

(a) 100 V (b) 5 V (c) – 20 V (d) 20 V

38. When a charge q is moved once a circle of radius R with charge Q at the centre of circle work done is

(a) Zero

(b) $\frac{Qq}{4\pi\varepsilon_0 R}$

(c) $\frac{Qq}{4\pi\varepsilon_0 R^2}$

(d) $\frac{Qq}{R}$

39. When a capacitor is connected to a battery

(a) an althnating current flows in the CC+

(b) no current flows at all

(c) a current flows for some time and finally decreases to zero

(d) current keeps in increasing and reaches maximum alter some time

40. A parallel plate capacitor has capacitance of 50 pF in air and 105 pF when immersed in a oil. The dielectric constant of the oil is

(a) $\frac{50}{100}$

(b) 1

(c) 2 : 1

(d) ∞

41. A parallel plate capacitors is made by stocking n equally spaced plates connected alternately. If capacitance between any two plates is x. Then total capacitance is

(a) nx

(b) $\frac{n}{x}$

(c) x

(d) (n – 1)x

42. Three capacitors of capacitance 4μF, 6μF and 12μF are connected first in series and then in parallel. What is the ratio of equivalent capacitance in the two cases?

(a) 2 : 3 (b) 1 : 11 (c) 11 : 1 (d) 1 : 3

43. The Gaussian surface for calculating the electric field due to a change distribution is

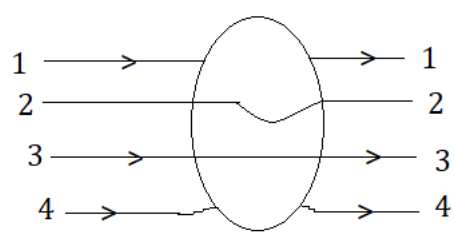
(a) any closed surface around the charge distribution

(b) any surface near the charge distribution

(c) a spherical surface

(d) a symmetrical closed surface at every point of which electric field has a single fixed value.

44. A metallic solid is placed in a uniform electric field. The lines of force follow the path (s) shown in the figure as



(a) 1 (b) 2 (c) 3 (d) 4

45. A comb run through ore's dry hair attracts small bits of paper. This is due to

(a) comb is a good conductor

(b) paper is a good conductor

(c) the atoms in the paper get polarized by charged comb

(d) the comb possesses magnetic properties

46. For a given surface the Gausis law is stated as $\int \vec{E} \cdot \vec{ds} = 0$ from this we can conclude that

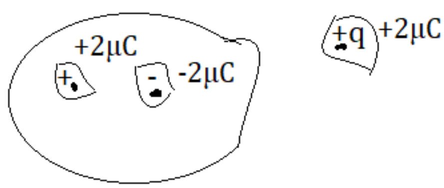
(a) E is necessarily zero on the surface

(b) E is perpendicular to the surface at every point

(c) the total flux through the surface is zero

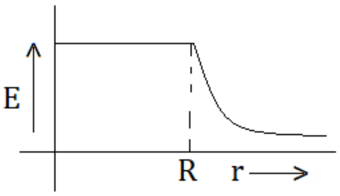
(d) the flux is only going out of the surface

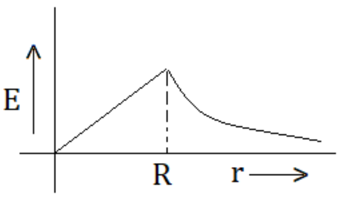
47. Shown below is a distribution of charge. The flux of electric field due to these charges. The flux of electric field due to these charges through the surface S is

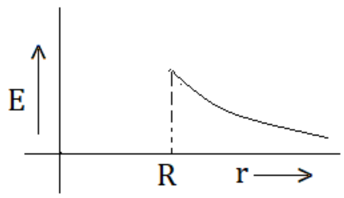


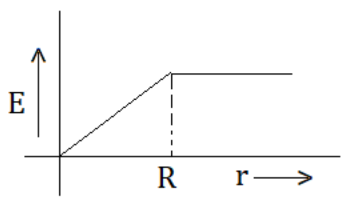
(a) $\frac{3q}{\varepsilon_0}$	(a) $\frac{6\mu C}{\varepsilon_0}$
(b) $\frac{2q}{\varepsilon_0}$	(b) $\frac{4\mu C}{\varepsilon_0}$
(c) $\frac{q}{\varepsilon_0}$	(c) $\frac{2\mu C}{\varepsilon_0}$
(d) zero	(d) 0

48. The electric field due to a uniformly charged sphere of radius R as a function of the distance from its centre is represented by

(a) 

(b) 

(c) 

(d) 

49. Gausis Law is valid for

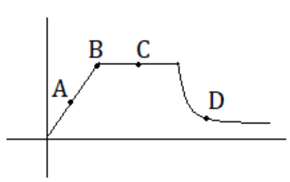
(a) Any closed surface

(b) Only regular closed surface

(c) Any open surface

(d) Only irregular open surface

50. Figure shows variation of electrostatic potential with distance for a charge distribution. At which point electric field is zero.



(a) A (b) B (c) C (d) D

51. When a bar is placed near a strong magnetic field and is repelled, then the material of bar is

(a) diamagnetic

(b) ferromagnetic

(c) paramagnetic

(d) anti-ferromagnetic

52. The permeability of a paramagnetic substance is

(a) slightly more than vacuum

(b) slightly less than vacuum

(c) much more than vacuum

(d) none of these

53. A magnet can be completely demagnetized by

(a) breaking the magnet into small pieces

(b) heating it slightly

(c) dropping it into ice cold water

(d) a reverse field of appropriate strength

54. Susceptibilty of a diamagnetic substance is

(a) zero

(b) negative

(c) < 1

(d) >1

55. For a paramagnetic material the dependence of the magnetic susceptibility X on the absolute temp is given as

(a) $X \ \alpha \ T$

(b) $X \ \alpha \ \frac{1}{T^2}$

(c) $X \alpha \frac{1}{T}$

(d) Independent

ANSWERS

1.	(a)	20.	(c)	39.	(c)
2.	(d)	21.	(c)	40.	(c)
3.	(a)	22.	(b)	41.	(d)
4.	(b)	23.	(d)	42.	(b)
5.	(c)	24.	(d)	43.	(d)
6.	(c)	25.	(a)	44.	(d)
7.	(a)	26.	(a)	45.	(c)
8.	(a)	27.	(b)	46.	(c)
9.	(a)	28.	(d)	47.	(d)
10.	(d)	29.	(c)	48.	(b)
11.	(b)	30.	(b)	49.	(a)
12.	(d)	31.	(d)	50.	(c)
13.	(d)	32.	(b)	51.	(a)
14.	(a)	33.	(b)	52.	(a)
15.	(a)	34.	(b)	53.	(d)
16.	(d)	35.	(b)	54.	(b)
17.	(a)	36.	(c)	55.	(c)
18.	(b)	37.	(c)		
19.	(c)	38.	(a)		

Electromagnetic Wave

1. Maxwell introduced displacement current to make necessary correction in which law?

   a. Faraday's law
   b. Gauss's Law
   c. Biot-Savart's Law
   d. Ampere's circuital Law

2. Electromagnetic wave is generated by

   a. Static charge
   b. Charge moving with uniform velocity
   c. Accelerated charge
   d. All of the above

3. Velocity of electromagnetic wave in free space is

   a. $\sqrt{(\mu_o \varepsilon_o)}$
   b. $1/\sqrt{(\mu_o \varepsilon_o)}$
   c. μ_o/ε_o
   d. $\mu_o \varepsilon_o$

4. What is the wavelength of light waves if their frequency is $6.0 X 10^{14}$ Hz?

   a. 0.50 m
   b. 5.0 mm
   c. 0.050 mm
   d.0.50 micro-m

5. How long does it take light to travel 1.0 m?

   a. 3.3 ns
   b. 3.3 micro-s
   c. 3.3 ms
   d. 3.3 s

6. What is the wavelength of a 30 MHz radio wave?

a. 10 mm

b. 10 cm

c. 10 m

d. 1.0 m

7. Ratio of amplitude of electric field (E) and amplitude of magnetic field (B) in an electromagnetic wave is

a. c

b. c^2

c. 1/c

d. √c

where ‘c’ is the velocity of light.

8. The angle between electric field (E) and magnetic field (B) in an electromagnetic wave is

a. π/2

b. π

c. π/4

d. 0

9. Which scientist experimentally proved the existence of electromagnetic wave?

a. Einstein

b. Maxwell

c. Hertz

d. Ampere

10. Which of the following electromagnetic waves has highest penetrating power?

a. infrared waves

b. gamma rays

c. ultraviolet rays

d. radio waves

11. Which one is the correct order of increasing wavelength?

a. X-rays, gamma rays, visible rays, gamma ray

b. gamma rays, X-rays, Ultraviolet rays, Visible rays

c. Ultraviolet rays, Visible rays, gamma rays, X-rays

d. Visible rays, gamma rays, Ultraviolet rays, X- rays

12. Which one is the correct order of increasing frequency?

a. X-rays, Ultraviolet rays, Visible rays, infrared rays

b. infrared rays, Visible rays, Ultraviolet rays, X- rays

c. Ultraviolet rays, Visible rays, infrared rays, X-rays

d. Visible rays, infrared rays, Ultraviolet rays, X- rays

Answers:

1. (d)	5. (a	9. (c)
2. (c)	6. (c)	10. (b)
3. (b)	7. (a)	11. (b)
4. (d)	8. (a)	12. (b)

MODERN PHYSICS

1. As the quantum number increases, the difference of energy between consecutive energy levels
(a) remain the same
(b) increases
(c) decreases
(d) sometimes increases and sometimes decreases.

2. Which of the following in a hydrogen atom is independent of the principal quantum number n? (Where, v & E are the velocity & energy of the electron in n^{th} orbit respectively; r is the radius of the n^{th} orbit)
(a) $v \times n$
(b) $E \times r$
(c) $E \times n$
(d) $v \times r$

3. According to the Bohr theory of H-atom, the speed of the electron, its energy and the radius of its orbit varies with the principal quantum number n, respectively, as

(a) $1/n$, n^2, $1/n^2$
(b) n, $1/n^2$, n^2
(c) n, $1/n^2$, $1/n^2$
(d) $1/n$, $1/n^2$, $1/n^2$

4. When an atomic gas or vapour is excited at low pressure, by applying external electric field, then
(a) emission spectrum is observed
(b) absorption spectrum is observed
(c) band spectrum is observed
(d) both (b) and (c)

5. As an electron makes a transition from an excited state to the ground state of a hydrogen – like atom/ion
(a) kinetic energy decreases, potential energy increases but total energy remains same
(b) kinetic energy and total energy decrease but potential energy increases
(c) kinetic energy increases but potential energy and total energy decrease
(d) kinetic energy, potential energy and total energy decrease

6. Which one of the following supports the results of the Rutherford's α-particles gold foil experiment?
(a) The nucleus of an atom is held together by forces which are much stronger than electrical or gravitational forces.
(b) The force of repulsion between an atomic nucleus and an α-particle varies with distance according to inverse square law.
(c) α-particles are nuclei of Helium atoms.
(d) Atoms can exist with a series of discrete energy levels

7. According to the Rutherford's atomic model, the electrons inside an atom are
(a) stationary
(b) not stationary
(c) centralized
(d) None of these

8. Rutherford's α-particle experiment showed that the atoms have
(a) Proton
(b) Nucleus
(c) Neutron
(d) Electrons

9. The Rutherford α-particle experiment shows that most of the α-particles pass un-scattered, while some are scattered through large angles. What information does it give?

(a) Atom is hollow.
(b) The whole mass of the atom is concentrated in a small centre called nucleus
(c) Nucleus is positively charged
(d) All of the above

10. The significant result deduced from the Rutherford's scattering experiment is that
(a) whole of the positive charge is concentrated at the centre of atom
(b) there are neutrons inside the nucleus
(c) α-particles are helium nuclei
(d) electrons are embedded in the atom

11. Rutherford's atomic model was unstable because
(a) nuclei will break down
(b) electrons do not remain in orbit
(c) orbiting electrons radiate energy
(d) electrons are repelled by the nucleus

12. According to Rutherford's atomic model, electrons would be expected to lose energy because, they
(a) move randomly
(b) jump on nucleus
(c) accelerate towards the nucleus
(d) escape from the atom

13. Bohr's atomic model is the modification of Rutherford's model by the application of
(a) Newton's theory
(b) Huygen's theory
(c) Maxwell's theory
(d) Planck's quantum theory

14. According to Planck's quantum theory any electromagnetic radiation is
(a) continuously emitted
(b) continuously absorbed
(c) emitted or absorbed in discrete units
(d) None of these

15. In the uranium radioactive series, the initial nucleus is $_{92}U^{238}$ and that the final nucleus is $_{82}Pb^{206}$. When uranium nucleus decays to lead, the number of α particles and β particles emitted are
(a) 8α, 6β
(b) 6α, 7β
(c) 6α, 8β
(d) 4α, 3β

16. The nuclear radius is of the order of
(a) 10^{-10} m
(b) 10^{-6} m

(c) 10^{-15} m
(d) 10^{-14} m

17. The radius of a nucleus is
(a) directly proportional to its mass number
(b) inversely proportional to its atomic weight
(c) directly proportional to the cube root of its mass number
(d) None of these

18. The electrons cannot exist inside the nucleus because
(a) de-Broglie wavelength of an electron is much less than the size of nucleus
(b) de-Broglie wavelength of an electron is much greater than the size of nucleus
(c) de-Broglie wavelength of an electron is equal to the size of nucleus
(d) negative charge cannot exist in the nucleus

19. A nuclei having same number of neutrons but different number of protons are called
(a) isobars
(b) isomers
(c) isotones
(d) isotopes

20. Nuclei having same number of protons but different number of neutrons are called
(a) isobars
(b) isomers
(c) isotones
(d) isotopes

21 Nuclei having same number of nucleons but different number of protons are called
(a) isobars
(b) isomers
(c) isotones
(d) isotopes

22. When the number of nucleons in nuclei increases, the binding energy per nucleon
(a) increases continuously with mass number
(b) decreases continuously with mass number
(c) remains constant with mass number
(d) first increases and then decreases with increase of mass number

23. M_p denotes the mass of a proton and M_n that of a neutron. A given nucleus, of binding energy B, contains Z protons and N neutrons. The mass M(N, Z) of the

nucleus is given
by (c is the velocity of light)
(a) $M(N, Z) = NM_n + ZM_p + B/c^2$
(b) $M(N, Z) = NM_n + ZM_p - Bc_2$
(c) $M(N, Z) = NM_n + ZM_p + Bc^2$
(d) $M(N, Z) = NM_n + ZM_p - B/c^2$

24. The mass of an atomic nucleus is less than the sum of the masses of its constituents. This mass defect is converted into
(a) heat energy
(b) light energy
(c) electrical energy
(d) energy which binds nucleons together

25. Which of the following statement is not true regarding Einstein's mass energy relation?
(a) Mass disappears to reappear as energy.
(b) Energy disappears to reappear as mass.
(c) Mass and energy are two different forms of the same entity.
(d) Mass and energy can never be related to each other.

26. The curve of binding energy per nucleon as a function of atomic mass number has a sharp peak for helium nucleus. This implies that helium
(a) can easily be broken up
(b) is very stable
(c) can be used as fissionable material
(d) is radioactive

27. Nuclear forces are
(a) spin dependent and have no non-central part
(b) spin dependent and have a non-central part
(c) spin independent and have no non-central part
(d) spin independent and have a non-central part

28. Nuclear forces exists between
(a) neutron – neutron
(b) proton – proton
(c) neutron – proton
(d) all of these

29. Neutron decay in free space is given as ${}_0n^1 \rightarrow {}_1H^1 + {}_{-1}e^0 + X$; X represents a
(a) neutrino
(b) photon
(c) antineutrino
(d) graviton

30. In a semiconductor
(a) there are no free electrons at 0 K
(b) there are no free electrons at any temperature
(c) the number of free electrons increases with pressure
(d) the number of free electrons is more than that in a conductor

31. Let n_h and n_e be the number of holes and conduction electrons in an extrinsic semiconductor. Then
(a) $n_h > n_e$ (b) $n_h = n_e$ (c) $n_h < n_e$ (d) $n_h \neq n_e$

32. A p-type semiconductor is
(a) positively charged
(b) negatively charged
(c) uncharged
(d) uncharged at 0K but charged at higher temperatures

33. Electric conduction in a semiconductor takes place due to
(a) electrons only
(b) holes only
(c) both electrons and holes
(d) neither electrons nor holes

34. The impurity atoms with which pure silicon may be doped to make it a p-type semiconductor are those of
(a) phosphorus (b) boron (c) antimony (d) nitrogen

35. The electrical conductivity of pure germanium can be increased by
(a) increasing the temperature
(b) doping acceptor impurities
(c) doping donor impurities
(d) All of the above

36. The resistivity of a semiconductor at room temperature is in between
(a) 10^{-2} to 10^{-5} Ω cm (b) 10^{-3} to 10^{6} Ω cm (c) 10^{6} to 10^{8} Ω cm (d) 10^{10} to 10^{12} Ω cm

37. In a semiconductor, the forbidden energy gap between the valence band and the conduction band is of the order is
(a) 1 MeV (b) 0.1 Mev (c) 1 eV (d) 5 Ev

38. The forbidden energy gap for germanium crystal at 0 K is
(a) 0.071 eV (b) 0.71 eV (c) 2.57 eV (d) 6.57 eV

39. In an insulator, the forbidden energy gap between the valence band and conduction band is of the order of
(a) 1 MeV (b) 0.1 MeV (c) 1 eV (d) 5 eV

40. Temperature coefficient of resistance of semiconductor is
(a) zero (b) constant (c) positive (d) negative

41. In a p-type semiconductor, the acceptor level valence band is
(a) close to the valence band of the host crystal
(b) close to conduction band of the host crystal
(c) below the conduction band of the host crystal
(d) above the conduction band of the host crystal

42. In an n-type semiconductor, donor valence band is
(a) above the conduction band of the host crystal
(b) close to the valence band of the host crystal
(c) close to the conduction band of the host crystal
(d) below the valence band of the host crystal

43. The mobility of free electrons is greater than that of free holes because
(a) they are light
(b) they carry negative charge
(c) they mutually collide less
(d) they require low energy to continue their motion

44. In semiconductors, at room temperature
(a) the conduction band is completely empty
(b) the valence band is partially empty and the conduction band is partially filled
(c) the valence band is completely filled and the conduction band is partially filled
(d) the valence band is completely filled

45. At Absolute Zero, Si acts as
(a) non-metal (b) metal (c) insulator (d) None of these

46. A strip of copper and another of germanium are cooled from room temperature to 80K. The resistance of
(a) each of these decreases
(b) copper strip increases and that of germanium decreases
(c) copper strip decreases and that of germanium increases
(d) each of these increases

47. Carbon, Silicon and Germanium atoms have four valence electrons each. Their valence and conduction bands are separated by energy band gaps represented by $(Eg)_C$, $(Eg)_{Si}$ and $(Eg)_{Ge}$ respectively. Which one of the following relationship is true in their case?
(a) $(Eg)_C > (Eg)_{Si}$ (b) $(Eg)_C < (Eg)_{Si}$ (c) $(Eg)_C = (Eg)_{Si}$ (d) $(Eg)_C < (Eg)_{Ge}$

48. If the two ends of a p-n junction are joined by a wire
(a) there will not be a steady current in the circuit
(b) there will be a steady current from the n-side to the p side
(c) there will be a steady current from the p-side to the n side

(d) there may or may not be a current depending upon the resistance of the connecting wire

49. The diffusion current in a p-n junction is from the
(a) n-side to the p-side
(b) p-side to the n-side
(c) n-side to the p-side if the junction is forward-biased and in the opposite direction if it is reverse-biased
(d) p-side to the n-side if the junction is forward-biased and in the opposite direction if it is reverse-biased

50. The drift current in a p-n junction is from the
(a) n-side to the p-side
(b) p-side to the n-side
(c) n-side to the p-side if the junction is forward-biased and in the opposite direction if it is reverse biased
(d) p-side to the n-side if the junction is forward-biased and in the opposite direction if it is reverse-biased

51. Diffusion current in a p-n junction is greater than the drift current in magnitude
(a) if the junction is forward-biased
(b) if the junction is reverse-biased
(c) if the junction is unbiased
(d) in no case

52. Forward biasing is that in which applied voltage
(a) increases potential barrier
(b) decreases the potential barrier
(c) is equal to 1.5 volt
(d) None of these

53. In V-I characteristic of a p-n junction, reverse biasing results in
(a) leakage current
(b) the current barrier across junction increases
(c) no flow of current
(d) large current

54. In a half wave rectifier, the r.m.s. value of the a.c. component of the wave is
(a) equal to d.c. value (b) more than d.c. value
(c) less than d.c. value (d) zero

55.The current flow is ----- in diodes

a.unidirectional b.bidirectional c.multidirectional d. none

56.Efficiency of half wave and full wave rectifiers are

a. 50% and 100 % b. 40.6% and 81 % c. 81% and 40.6 % d. none

57. The emitter-base junction of a transistor is ………. Biased while the collector-base junction is …………

a. Reverse, Forward
b. Reverse, Reverse
c. Forward, forward
d. Forward, reverse

58. Which of the following is true

a. Common base transistor is commonly used because the current gain is maximum
b. Common emitter is commonly used because the current gain is maximum
c. Common collector is commonly used because the current gain is maximum
d. Common emitter is the least used transistor

59. For a common base configuration of PNP transistor $I_c/I_E = 0.98$ then the maximum current gain in common emitter configuration will be

a. 12
b. 24
c. 6
d. 5

60. Which is the least doped region in a transistor?

a. Either emitter or collector
b. Base
c. Emitter
d. Collector

61. In a PNP transistor the base is the N-region. Its width relative to the P-region is

a. Smaller
b. Larger
c. Same
d. Not related

62. Which gate is known as the universal gate?

a.NAND b.OR c.AND d.None

63. Which of the following is not a logic gate?

a.NAND b.OR c.AND d.IF

64. Which of the following gates can function on a single input?

a.NAND b.OR c.AND d.NOT

65. The following truth table represents

A	B	output
1	1	0
0	0	1
1	0	1
0	1	1

a.NAND b.OR c.AND d.NOT

66. The following truth table represents

A	B	output
1	1	0
0	0	1
1	0	0
0	1	0

a.NAND b.NOR c.AND d.NOT

Answers:

1. (c)
2. (a)
3. (b)
4. (a)
5. (c)
6. (b)
7. (b)
8. (b)
9. (d)
10. (a)
11. (b)
12. (c)
13. (d)
14. (c)
15. (a) (c)
16. (a)
17. (a)
18. (b)
19.
20. (c)
21. (a)
22. (b)
23. (c)
24. (d)
25. (a)
26. (d)
27. (d)
28. (d)
29. (d)
30. (b)
31. (b)
32. (d)
33. (c)
34. (a)
35. (d)
36. (c)
37. (c)
38. (b)
39. (d)
40. (b)
41. (c)
42. (b)
43. (d)
44. (d)
45. (a)
46. (c)
47. (a)
48. (a)
49. (b)
50. (a)
51. (a)
52. (b)
53. (a)
54. (b)
55. (a)
56. (b)
57. (d)
58. (b)
59. (b)
60. (b)
61. (a)
62. (a)
63. (d)
64. (d)
65. (a)
66. (b)

Electromagnetic Wave

State true or false

1. Microwaves are produced by special vacuum tubes called Klystrons.

2. Electromagnetic waves carry both energy and momentum.

3. Infrared waves are often called heat waves.

4. Cellular phones use _____________ waves to transmit voice communication.

5. _______________wave is used in microwave oven.

6._________________ wave is trapped by greenhouse gases.

7.Ozone layer in the atmosphere saves us from the harmful effects of __________wave.

8. Name of the electromagnetic wave which is produced by bombarding a metal target by high energy electrons is ________________.

Answers

[Ans: 1.True 2. True 3. True 4. radio wave 5. Microwave 6. Infrared 7. Ultraviolet 8. X-rays

Give one-word answer:

1. State the SI unit of magnetic flux.

2. What is the SI unit of electrical conductivity?

3. Write down a relation between current and current density vector?

4. What happens to resistivity of material of a conductor on heating?

5. Out of two bulbs marked 25W – 220 V and 100W – 220V, Which has the higher resistance?

6. Write down the relation between current and drift velocity.

7. Two copper wires A and B have their lengths in the ratio 1 : 2 . What is the ratio of their (i) resistances and (ii) resistivities ?

8. Name the physical quantity whose $S.I.$unit is A m^{-2}?

9. What happens to resistance of a conductor if potential difference across its ends are doubled?

10. What do you mean by a steady current?

11. What happens to condition of balance of a Wheatstone bridge, if the position of cell and galvanometer are interchanged?

12. What is board of Trade unit ?

13. When is a Wheatstone bridge most sensitive?

14. Write down a relation between electrical conductivity and mobility.

15. What does slope of T – E graph represent?

Single formula numerical:

1. Three resistances, each of 5 Ω, are connected to form a triangle. Calculate the resistance between two ends of any arm.

2. What is the resistance of a 100W-220V electric bulb?

3. An electric bulb marked 100W-220V is connected across a 110V supply. Calculate the electric power consumed by the bulb.

4. The slope of $I - V$ characteristic of a conductor wire is 1mA/volt. What is the resistance of the wire?

5. What are the limitations of Ohm's law?

6. Define resistivity of material of a conductor and write down its $S.I$ unit.

7. Five identical cells each of emf 2V and internal resistance 0.3 Ω are connected in series. Calculate the current through an external resistance of 3.5 Ω due to this combination.

8. Deduce the relation,

$$r = \left(\frac{E - V}{V}\right)R$$

Where, the symbols have their usual meaning

9. A wire of resistance 10 Ω is doubled on itself. What is the new resistance?

10. What is the time required by a 50 Hz. AC to attain its peak value?

11. What are the characteristic features of a material to be used as a fuse wire?

12. A wire is stretched so that its length increased by 10% . Calculate the percentage increase in length of the wire.

13. The change flowing through a circuit varies with time as per relation,

$$q = 2t^2 + t + 1$$

Where q is in μc and t is in second. Calculate instantaneous value of current at the end of 2 sec.

14. The magnitude of current flowing through a circuit varies with time as, $I = 3t^2 + 2t + 1$, where I is in μA and T is in second. Calculate the amount of charge transferred between 2 sec to 5 sec.

15. Two cells marked ($2V$, 0.2 Ω) and ($3V$, 0.4 Ω) are connect in parallel. Calculate effective emf of the combination

16. A current of 2 A flows through a resistance of 10 Ω for 5 minutes. Calculate heat energy generated in joule.

17. What is the nature of filament of a zero watt electric bulb?

18. You are given two electric bulbs marked 60W-220 V and 100 W – 220 V . Which of them glows brighter when connected (i) in series and (ii) in parallel.

Electromagnetic Wave

Correct the statements:

1. Light is a longitudinal wave.

2. The basic difference between various types of electromagnetic waves lies in their velocities.

3. Electromagnetic wave of frequency of the order giga hertz are called radio waves.

4. Electromagnetic waves does not exert pressure.

5. Electromagnetic waves need medium for their propagation.

6. The self inductance of a coil is **inversely** proportional to the number of turns in it.

(Correct the sentence by changing he underlined word, if necessary.

[Ans: 1. transverse wave 2. in their frequencies or wavelengths 3. Microwaves 4. they exert pressure called radiation pressure. 5. do not need medium 6. directly)

Definitions / Statements /Laws

1. Why the classical Rutherford model for an atom of electron orbiting around nucleus is not able to explain the atomic structure

2. Define ionization energy

3. Write the expression for Bohr's radius in hydrogen atom.

4. State Rohr's quantisation condition for defining stationary orbits.

5. In the Rutherford scattering experiment .how the distance of closest approach for an α particle is related to Kinetic energy.

6. How the distance of closest approach in Rutherford scattering experiment is changed when the α particle is replaced by protons.

7. Express De-Broglie wavelength associated with electrons, when they are accelerated by voltage V_d.

8. What is the stopping potential applied to a photoelectric cell when the maximum kinetic energy is 5 eV.

9. The wavelength of a photon is 400nm. Find its energy is eV.

10. Find the energy of a photon having wavelength 6000 A° in Joules.

11. An electron and proton are having same momentum. Compare their DE-Broglie wavelength.

12. What is the trajectory of α-particle in Rutherford scattering experiment?

13. How density of a nucleus is dependent upon the mass number?

14. Why nuclear force is a short range force?

15. An electron and alpha particle have same de-Broglie wavelength associated with them. How are their kinetic energy related to each other?

16. State two characteristic properties of nuclear force.

17. Two nuclei have mass number in the ratio 1 : 2. What is the ratio of their nuclear densities?

18. Two nuclei have mass number in the ratio 1 : 8. What is the ratio of their nuclear radix?

19. Can photoelectric effect be explained by wave theory of light?

20. Write the mathematical form of Bohr's postulate regarding emission of photon.

21. Write down the laws of radioactivity.

22. Write the mathematical expression for packing fraction.

23. What is the mass of proton in amu?

24. What is the speed of $\gamma - rays$ in vacuum?

25. Why $\gamma - rays$ are not deflected by magnetic fields?

26. What is the energy equivalent of 1 kg of matter?

27. Explain why nuclear fusion reaction can't take place in laboratory.

28. What is the nuclear radius of X^{125} If that of Al^{27} is 3.4 fm?

29. Which process is responsible for the source of stellar energy?

30. The minimum number of diodes used in full wave rectifier.

31. What is forbidden gap?

32. Draw a circuit diagram of P-N junction in reverse bias.

33. State the laws of electromagnetic induction.

34. State and explain Ohm's law.

35. The current in a circuit with a cell of emf 6V and internal resistance 0.1 Ω is 2A. Find the value of the external resistance in it.

36. State Lens's law of electromagnetic induction and mention its significance.

37. State faraday's laws of electromagnetic induction.

38. State Joule's law of heating.

39. Define electric dipole moment.

40. Define terminal velocity.

41. State Kirchhoff's Voltage Law.

42. Define critical angle in refraction.

43. Write down the relationship between the refractive index and critical angle?

44. State faraday's Laws of electromagnetic induction.

45. Define self inductance of a coil.

Small Derivations:

1. What is self induction? Find an expression for the self – inductance of a circular coil of N turns.

2. Derive an expression for the electrical conductivity of a metal in terms of the drift velocity of the electron.

4. State and explain Biot-Savart law.

6. Write the expression for impedance in a series LCR circuit connected to an ac source and identify the symbols used. Write the expression for resonance frequency.

9. Write down the relation between current and drift velocity. Express different terms used in he expression.

10. Deduce Ohm's law from the concept of drift velocity

11. Define internal resistance of a cell. What are the factors on which it depends?

12. What should be the value of series resistance to be connected across an electric bulb marked 100W – 200 V when connected across a 300V electric supply?

13. State and explain maximum power transfer theorem.

14. The effective resistance of two resistors when connected in series is 25 Ω but 4 Ω when connected in parallel. Calculated the individual resistances.

15. Discuss the principle of working of meter – Bridge.

16. Discuss the principle of working of a potentiometer for comparing emfs two cells.

Explanations:

1. Mention four properties of electromagnetic wave.

2. Explain displacement current.

3. If the relative permeability and relative permittivity of the medium is 1·0 and 2·25, respectively. Find the speed of the electromagnetic wave in this medium.

4. If the total energy of an electromagnetic wave falling on a surface is 6×10^5J, then calculate total momentum delivered by the wave on the surface.

5. Why do we prefer a potentiometer to measure emf of a cell rather than voltmeter?

6. Distinguish between emf and terminal potential difference.

Long Questions:

1. State Kirchhoff's laws for an electrical network. Use them with a neat circuit diagram to obtain the condition of balance for a Wheatstone's bridge. (2023,2019)

2. An AC emf. $E = E_0 \sin\omega t$ is applied to a circuit containing pure inductance (L) only. Obtain an expression for current (I) in the circuit . Explain the phase relationship between E and I, and show it graphically.

3. An AC emf $e = e_0 \sin \omega t$ is applied to a circuit containing resistance R, inductance L and capacitance C in series. Write the expression for currecnt in the circuit. Obtain the condition of resonance. In a series L-C-R Circuit, R = 60 Ω, L = 40 mH and C = 400 μF. Determine the resonant frequency.

4. State Biot and Savart law. Derive the expression for the magnetic field at any point on the axis of a circular current carrying loop. Find its value at the center of this loop.

5. Define drift velocity. Derive an expression for drift velocity of electros in a metal when subjected to a potential difference V.

6. Deduce an expression for emf induced in a coil as it rotates in a uniform magnetic field 'B' with a constant angular velocity 'w' . Also discuss the nature of emf and current

7. State Biot-Savart's law. Apply it to calculate magnetic field induction at a point on the axis of a circular current carrying coil.

8. State Amp[ere's circuital law. Apply it to determine magnetic field induction at a point due to a long straight current carrying cinductor.

9. Two cells A & B having emfs E_1 and E_2 and internal resistances r_1 and r_2 are connected in parallel Deduce he expression for current flowing through a resistance 'R' connected across the combination.

10. Deduce an expression for effective resistance of combination of resistances (i) in series and (ii) in parallel.