

# Sub – Physics

## Class – XII

*(The figures in the margin indicate full marks for the questions)*

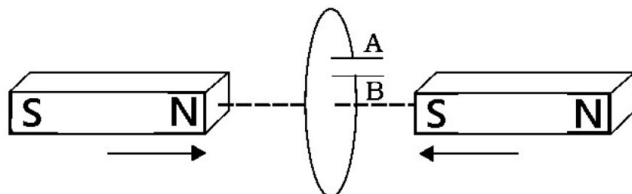
Time – 3 hours

Full marks-70

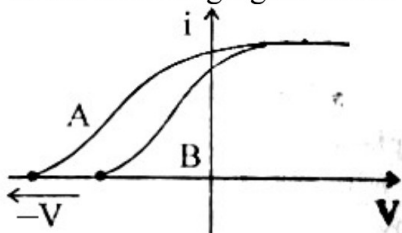
I. Answer following questions :

1x8=8

- (a) Give the dimensional formula of energy flux .
- (b) How mobility depends on mean relaxation time ( $\tau$ ) of the free electrons ?
- (c) Write down Biot-Savart's law in vector form .
- (d) Predict the polarity of the capacitor as shown in the following diagram



- (e) In the following figure which radiation, A or B has higher frequency?



- (f) The half life of a radio active sample is \_\_\_\_\_ % of its mean life

- (i) 36.7                      (ii) 50                      (iii) 69.3                      (iv) 86.7.

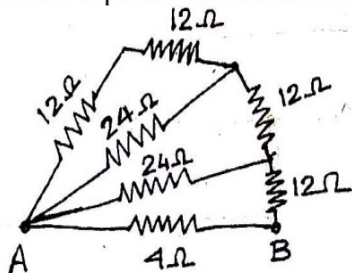
- (g) What is the  $H_{\alpha}$  line in the hydrogen spectrum ?

**(h) What is rectification and a rectifier ?**

2. Find an expression for the capacitance of a parallel plate capacitor 2

3. Find an expression for internal resistance of a cell . 2

4. Find the equivalent resistance between A and B.



2

5. A galvanometer coil has a resistance of  $12\ \Omega$  and shows full scale deflection for a current of  $3\ \text{mA}$ . How will you convert it into a voltmeter of range  $0$  to  $18\ \text{V}$ ?

2

6. Find an expression for motional emf induced across the two ends of a rod moving perpendicularly to a magnetic field.

2

7. In an LCR series circuit, the voltage drop across the capacitor, the inductor and the resistor are  $120\ \text{V}$ ,  $60\ \text{V}$  and  $80\ \text{V}$  respectively. Find the total voltage across the combination.

2

8. Prove that mean value of an AC for the full cycle is zero.

2

9. What is  $1\ \text{amu}$ ? Convert it into energy.

2

10. Give the failure of Bohr's postulates.

2

11. The work function for the following metals is given :

Na :  $2.75\ \text{eV}$  and Mo :  $4.175\ \text{eV}$

(i) Which of these will not give photoelectron emission from a radiation of wavelength  $3300\ \text{\AA}$  from a laser beam?

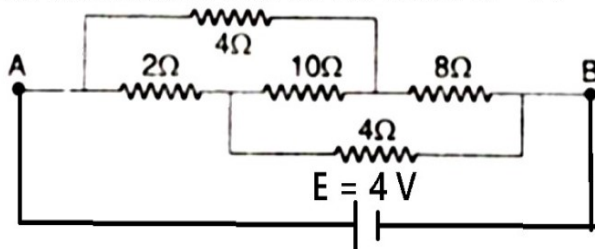
(ii) What happens if the source of laser beam is brought closer?

2

12. Applying Kirchhoff's laws of current electricity, establish the principle of a balanced Wheatstone's bridge. 3

Or

Find the current drawn from the cell of emf  $E = 4\text{ V}$



13. If an alternating voltage is applied across an ideal inductor, then prove that power consumed in full cycle is zero. 3

Or

What is RMS value of alternating current? Obtain its relation with peak value. 3

14. Write down limitations of Ohm's law. 3

Or

Using to the concept of drift velocity, prove Ohm's law. 3

15. Distinguish among paramagnetic, ferromagnetic and diamagnetic materials qualitatively. 3

Or

Find the expression for the magnetic moment of a revolving electron. 3

What is Bohr magneton? 3

16. Obtain the relation between the kinetic energy of the photo electrons and the frequency of the incident photon in the photoelectric effect. 3

Or

The photoelectric threshold frequency for a certain metal surface is  $330\text{ \AA}$ . What is the maximum kinetic energy of the photoelectrons released, if radiations of wavelength  $100\text{ \AA}$  are incident on the cathode plate? 3

17. Obtain the binding energy per nucleon of  ${}_{26}\text{Fe}^{56}$

Given  $m({}_{26}\text{Fe}^{56}) = 55.934939$  amu

$m_p = 1.007825$  amu

$m_n = 1.008665$  amu

3

Or

Explain how energy is produced in the Sun by the process of fusion

3

18. State the laws of photo electric effect .

3

Or

Monochromatic light of frequency  $6.0 \times 10^{14}$  Hz is produced by a laser. The power emitted is  $2.0 \times 10^{-3}$  W. (a) What is the energy of a photon in the light beam?

(b) How many photons per second, on an average, are emitted by the source?

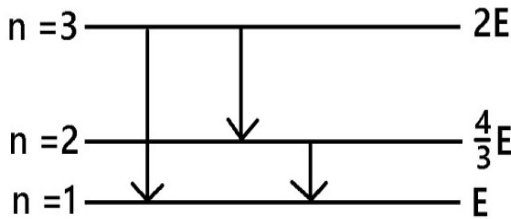
3

19. Find the expression the energy of an electron in ground state of hydrogen atom.

3

Or

The energy levels of a certain atom for first, second and third levels are  $E$ ,  $4E/3$  and  $2E$  respectively. A photon of wavelength  $\lambda$  is emitted for a transition  $3 \rightarrow 1$ . What will be the wavelength of emission for transition  $2 \rightarrow 1$  and for transition  $3 \rightarrow 2$



3

20. Distinguish between Coulomb's law and Biot Savart's law.

Give one example of each.

1 + 1 + 1 = 3

21. Find an expression for electric field at any position on the axial line of an electric dipole.

What is the magnitude of a point charge so that the electric field 0.5m away has the magnitude of 2 N/C ?

3 + 2 = 5

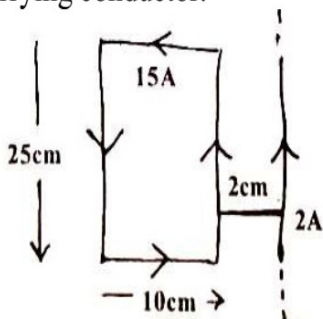
Or

Find an expression for electric field due to a straight conductor of uniform line charge density  $\lambda$ , of infinite extend using Gauss's law .

A charge 1 micro coulomb is at a distance 10 cm from another charge of 2 micro coulomb . At what point on the line joining the two charges is the electric field strength is zero? 3 + 2 = 5

22. Find an expression for the time period of oscillation of a magnetic dipole placed in a uniform magnetic field.

Figure shows a rectangular current carrying loop placed 2cm away from a long straight current carrying conductor.



What is the direction and magnitude of the net force acting on the loop? 3 + 2 = 5

Or

Using Ampere's circuital law , find an expression for magnetic field due to a solenoid.

A horizontal overhead power line carries a current of 90A from east to west direction.

What is the magnitude and direction of the magnetic field due to current 1.5m below the line? 3 + 2 = 5

23. Find the expression for the mutual inductance of a pair of co-axial solenoids .

Current in a circuit falls from 5.0 A to 3.0 A in 0.2 s . If an average emf of 200 V induced, give an estimate of the self-inductance of the circuit. 3+2=5

Or

Find the expression for the energy stored in an inductor .

Find the expression for the energy density of the inductor .

Give the dimensional formula of the mutual inductance of a pair of coil . 2+2+1=5