Mock Test - 1

Time : 3 hrs **M.M : 70**

General Instructions

- There are 37 questions in all. All questions are compulsory.
- This question paper has four sections: Section A, Section B, Section C, and Section D.
- Section A contain twenty questions of 1 mark each, Section B contain seven questions of 2 marks each, Section C contains seven questions of 3 marks each and Section D contains three questions of 5 marks each.
- There is no overall choice. However, an internal choice has been provided in two questions of one mark, two questions of two marks, one question of three marks and all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
- You may use the following values of physical constants wherever necessary.
  $C = 3 \times 10^8$ m/s, $h = 6.63 \times 10^{-34}$ J-s, $e = 1.6 \times 10^{19}$C, $\mu_0 = 4\pi \times 10^{-7}$TmA^{-1}, $\varepsilon_0 = 8.854 \times 10^{-12}$ C^{2}N^{-1}m^{-2}, $1/4\pi\varepsilon_0 = 9 \times 10^9$ N-m$_2$C^{-2}, $m_e = 9.1 \times 10^{-31}$ kg, mass of neutron $= 1.675 \times 10^{-27}$ kg, mass of proton $= 1.673 \times 10^{-27}$ kg,

SECTION A (Objective Questions, 1M)

Directions (Q. Nos. 1-10)

Select the most appropriate option from those given below each question.

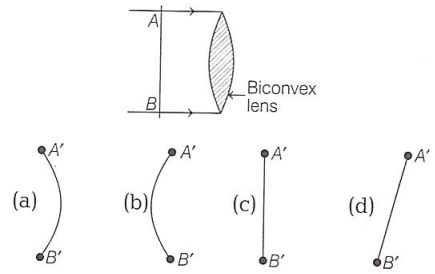
1. The current in a circuit containing a capacitor is 0.20 A Then, the displacement current is
(a) 0.15 A (b) 0.10 A (c) 0.20 A (d) 0.40 A

2. If the critical angle for light going from medium A to B is θ, then the speed of light in medium B, if the speed of light in medium A is v, is
(a) v(1 – cos θ) (b) $\frac{v}{cos\theta}$ (c) $\frac{v}{sin\theta}$ (d) v(1 – sin θ)

3. Which of the following statement is correct for n-type semiconductor?
(a) The donor level lies below the bottom of the conduction band
(b) The donor level lies closely above the top of the valence band
(c) The donor level lies at the halfway mark of the forbidden energy gap
(d) None of the above

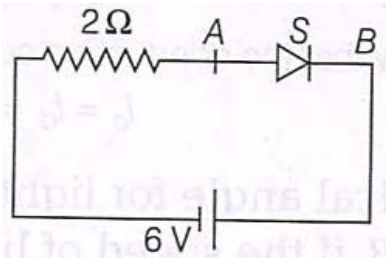
4. Amongst the following statements which is true for a photosensitive material?
(a) All materials show photosensitivity to some or more extent
(b) Different Photosensitive materials have same sensitivity
(c) Same photosensitive substances give different response to light of different wavelengths
(d) All photosensitive materials give response to green light

5. If AB is incident wavefront, then refracted wavefront is



6. If the peak value of magnetic field of a beam is 12×10^{-8} T. Then, its average energy density is
(a) 12×10^{-10} W/m^2 (b) 5.73×10^{-9} W/m^2
(c) 4.2×10^{-9} W/m^2 (d) 1.8×10^{-6} W/m^2

7. The diode shown in the circuit is a silicon diode. The potential difference between the points A and B will be



(a) 6 v (b) 0.6 v (c) 0.7 v (d) 0 v

8. Magnetic potential energy of a needle is minimum when the angle between the magnetic moment and magnetic field is

(a) 90^o (b) 30^o (c) 60^o (d) 0^o

9. In a non – uniform magnetic field, which substances move from stronger to weaker magnetic field?

(a) Ferromagnetic (b) Diamagnetic

(c) Paramagnetic (d) None of the above

10. A mirror is turned through 17^o. Then, the reflected ray is turned by

(a) 17^o (b) 34^o (c)85^o (d) 0^o

Directions (Q. Nos. 11-15)

Answer the following

11. State Bohr's postulate of quantisation of angular momentum of an electron orbiting in the hydrogen atom.

12. Write the following radiations in ascending order with respect to their frequencies : X – rays, microwaves, UV – rays and radio waves

13. A 10 m long horizontal straight wire extending from East to West is falling with a speed of 5 m/s at right angles to the horizontal component of the Earth's magnetic field of 0.30×10^{-4} Wbm^{-2} . What is the instantaneous value of the emf induced in the wire?

Or

An alternating current in a circuit is given by, $I = 20 \sin (100 \pi t + 0.05 \pi)$
What is the rms value of current?

14. What will be the effect on image formed by a concave mirror, if its lower half is blackened?

15. Define drift velocity and write its expression in terms of electric field (E) and relaxation time (τ).

Directions (Q. Nos. 16-20)

Fill in the blanks with appropriate answer.

16. ……. Radiations are detected by using a thermopile and used in physical therapy.

17. Width of the depletion layer ……... with doping

18. Time taken by a radioactive nuclei having a half life of T years, to reduce to 3.125% of its original value is ……

19. Direction of electric field is the one along which potential …. is the steepest.

20. An α – particle and a proton are accelerated through the same potential. The ratio of their de – Broglie wavelength is …….

SECTION B

(Short Answer Type Questions , 2 M)

21. Calculate the binding energy per nucleon of nucleus $_{20}Ca^{40}$. Given m_n and m_p are 1.008665 u and 1.007825 u respectively and m ($_{20}Ca^{40}$) = 39.962589 u.

OR

Using the Bohr's model calculate the speed of the electron in a H-atom in the n = 1 and 2 levels.

22. A ball of superconducting material is dipped in liquid nitrogen and placed near a bar magnet.
(i) In which direction will it move?
(ii) what will be the direction of its magnetic moment?

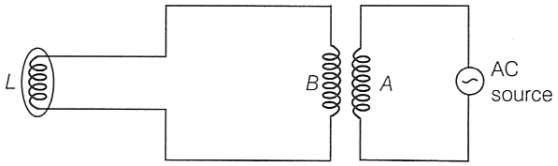
23. Semiconductors obey Ohm's law at only low fields. Why ?

24. Name the device which is used in cellphones which produces light in its display. Write and explain the principle on which this device is based.

25. A silver wire has a resistance of 2.1Ω at 27.55° C and a resistance of 2.7 Ω at 100^0 C. Determine the temperature coefficient of resistance of silver.

26. Define magnifying power of a telescope. Also, write its expression.

27. In the figure given below, a coil B is connected to low voltage bulb L and placed parallel to another coil A as shown. Explain the following observations.
(i) Bulb lights up and
(ii) Bulb gets dimmer if the coil B is moved upwards.



OR

When AC circuit with L,C and R in series is brought into resonance, the current has large value. Why? If the capacitance C is increased, will the current increase or decrease? Explain with a suitable relation.

SECTION C

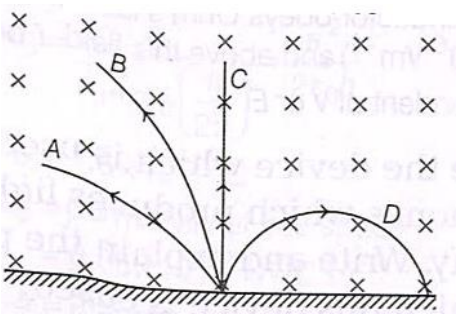
(Long Answer Type Questions , 3 M)

28. Electromagnetic waves with wavelength
(i) λ_1 is used in satellite communication.
(ii) λ_2 is used to kill germs in water purifiers.
(iii) λ_3 is used to detect leakage of oil in underground pipelines.
(iv) λ_4 is used to improve visibility in runways, during fog and mist conditions.
(a) Identify and name the part of electromagnetic spectrum to which these radiations belong.
(b) Arrange the wavelengths in ascending order of their magnitude.

29. Ragini was worried about her grand-mother who stays all alone in her residence in a crowded area of Varanasi. To ensure safety of her grand-mother, she installed a device known as Burglar's

alarm under the guidance of her Physics teacher. While doing the experiment, she recorded the following observations.
When radiations of frequency 10^{15} Hz are incident on two photosensitive surfaces A and B, in Burglas's alarm,
For surface A No photoemission took place.
For surface B Photoemission took place but photoelectrons have zero velocity. From the above passage explain her observations on the basic of Eintein's photoelectric equation.

30. A neutron, a proton, an electron and an α- particle enter in a region of uniform magnetic field with equal velocities. The magnetic field is directed to the plane of paper. The tracks of the pariticles are shown in figure. Relate the tracks to particles.



31. Obtain the first Bohr's radius and the ground state energy of a muonic H-atom [i.e. an atom in which a negatively charged muon (μ) of mass about 207 m_e orbits around a proton]

32. In Young's double slit experiment, using light of wavelength 400nm, interference fringes of width X are obtained. The wavelength of light is increased to 600 nm and the separation between the slits is halved. If we want the observed fringe width on the screen to be the same in two cases. Then find the ratio of the distance between the screen and the plane of the interfering sources in the two arrangements.

33. Two cells of emfs, 2E and E and internal resistances, 2r and r respectively, are connected in parallel to each other and with an external resistance R.
Obtain expression for
(i) equvailent internal resistance (ii) equivalent emf
(iii) current through the external resistance

34. (i) Why are Si and GaAs preferred materials for solar cells?
(ii) Describe briefly with the help of a necessary circuit diagram, the working principle of a solar cell.

OR

Explain briefly, with the help of circuit diagram, how V-I characteristics of a p-n junction diodes are obtained in
(i) forward bias
(ii) reverse bias?

SECTION:D (Long Answer Type Question, 5 M)

35. (i) How does a transverse wave is said to be plane polarised?
Describe briefly with the help of necessary diagram, the polarisation of light by reflection from a transparent medium.
(ii) Two polaroids A and B are kept in crossed position. How should a third polaroid C be placed between them, so that the intensity of polarised light transmitted by polarised polaroid B reduces to $1/8^{th}$ of the intensity of unpolarised light incident on A?

OR

A compound microscope consists of an objective lens of focal length 2.0 cm and ab eye piece of focal length 6.25 cm separated by a distance of 15 cm. How far from the objectives lens should an object be placed in order to obtain the final image placed in order to obtain the final image
(i) At least distance of distinct vision, (D=25 cm)
(ii) At infinity?

36. Draw a schematic diagram of a step up transformer. Explain the working principle. Deduce the expression for the secondary to primary voltage in terms of ideal transformer, how is this ratio related the transformer and distribution of electrical energy over long distances?

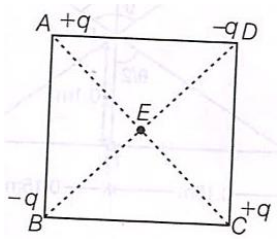
OR

In an AC circuit containing a prime inductor, show that the voltage is ahead of current by $\frac{\pi}{2}$ in phase. Draw the phasor V and I versus ωt.

37. Two spheres carrying charges 1.5μC and 2.5 μC are located 30 cm apart. Find the potential and electric field
(i) at mid-point of the line joining the two charges.
(ii) at a point 10 cm from this mid-point in a plane normal to the line passing through the mid-point.
Hence, calculate the angle ($\propto$) subtended by the result intensity of electric field in case (ii).

OR

Four charges are arranged at the corners of a square ABCD of side d as shown in the figure.



(i) Find the work required to put together this arrangement.
(ii) A charge q_0 is brought to the centre E of the square, the four charges being held fixed at its corners. How much extra work is needed to do this?
(iii) Compute the work done by the charges in rearranging this arrangement to another similar square arrangement of the charges such that the side of the square now becomes 2d.