INTERNATIONAL INDIAN SCHOOL DAMMAM
II TERM EXAMINATION NOV-2014
PHYSICS (SET A)
Class: XII

Max. Time: 3 hours. Max. Marks: 70

General Instructions:

i. All questions are compulsory.
ii. Question numbers 1 to 5 are very short answer questions, each carrying 1 mark. These are to be answered in one or two sentences.
iii. Question numbers 6 to 10 are short answer questions, each carrying 2 mark. Answer to these questions should be of around 30 words.
iv. Question numbers 11 to 22 are also short answer questions, each carrying 3 mark. Answer to these questions should be of around 50 words.
v. Question number 23 is value based and is of 4 marks.
vi. Questions numbers 24 to 26 are long answer questions, each carrying 5 marks. Answer to these questions should be of around 150 words each.
vii. Use log tables if necessary.
viii. You may use the following physical constants wherever necessary :

$c = 3 \times 10^8\ ms^{-1}$
$h = 6.626 \times 10^{-34}\ Js$
$e = 1.602 \times 10^{-19}\ C$
$\frac{1}{4\pi\varepsilon_0} = 9\times10^9\ Nm^2C^{-2}$
$\mu_0 = 4\pi \times 10^{-7}\ TmA^{-1}$

1. Write relationship of de Broglie wavelength λ associated with a particle of mass 'm' in terms of its kinetic energy E.
2. A magnetic needle free to rotate in a vertical plane orients itself vertically at a certain place on earth. What are the values of (i) horizontal component of earth's magnetic field (ii) angle of dip at that place?
3. Two material Ge and Al are cooled from 300K to 60K. What will be the effect on their resistivity?
4. Show the variation of photocurrent with collector plate potential for different frequencies but same intensity of incident radiation.
5. Write two factors by which voltage sensitivity of a galvanometer can be increased.
6. Define the resolving power of a microscope. How is this affected when (i) wavelength of illuminating radiation is decreased. (ii) diameter of objective lens is decreased.
7. Define ionic mobility. Write its relationship with relaxation time.

OR

Define drift velocity. Write its relationship with relaxation time in terms of the electric field $\vec{E}$ applied to a conductor.

8. Draw a ray diagram of an astronomical telescope in the normal adjustment positions.
9. State Malus' law. Draw a graph to show variation of intensity of light emerging from analyzer with angle between polarizer and analyzer.
10. Using the lens formula, show that a concave lens produces a virtual and diminished image independent of the location of object.
11. An electron and a proton are accelerated through the same potential. Which one of the two has (i) greater value of de Broglie wavelength associated with it and (ii) less momentum? Justify your answer.
12. A short bar magnet of magnetic moment $5.25 \times 10^{-2} JT^{-1}$ is placed with its axis perpendicular to the earth's field direction. At what distance from the centre of the magnet the resultant field is inclined at 45° with the earth's field on (a) its normal bisector and (b) its axis. Magnitude of the earth's field at the place is given to be $4.2 \times 10^{-5} T$. Ignore the length of the magnet in comparison to the distances involved.
13. Two heating elements of resistances R_1 and R_2 when operated at a constant supply voltage V consume powers P_1 and P_2 respectively. Deduce the expressions for the power of their combination when they are in turn connected in (i) series (ii) parallel across the same voltage supply.
14. Derive an expression for resulting intensity when two light waves of same frequency and having phase difference 'ϕ' are superposed. Draw a graph to show resulting intensity against position on screen if the waves are non- coherent.
15. Derive the expression for force per unit length between two long straight parallel current carrying conductors. Hence define one ampere.
16. Write two characteristic features observed in photoelectric effect which support the photon picture of electromagnetic radiation. Draw a graph between the frequency of incident radiation (ν) and the maximum kinetic energy of the electron emitted from the surface of a photosensitive material. State clearly how this graph can be used to determine (i) Planck's constant and (ii) work function of the material.
17. With the help of suitable ray diagram, derive a relation between the object distance (u), image distance (v) and radius of curvature (R) for a convex spherical surface, when a ray of light travels from rarer to denser medium.

18. A galvanometer gives deflection of 10 divisions for a current of 1 mA. The galvanometer has a resistance of 78 Ω and there are 75 divisions on its scale. If a shunt resistor of 2Ω is connected to the galvanometer, how much maximum current can be measured with it?

19. A beam of light consisting of two wavelengths 560 nm and 700 nm is used to obtain interference fringes in a Young's double slit experiment. What is the least distance from the central maximum where the bright fringes due to both the wavelength coincide? Given that the screen is at 1m from the slits and separation between the slits is 2 mm.

OR

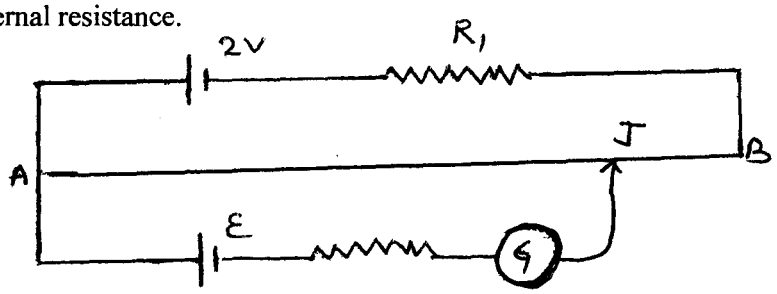
A parallel beam of monochromatic light of wavelength 500 nm falls normally on a narrow slit and the resulting diffraction pattern is obtained on a screen 1 m away. It is observed that the first minimum is at a distance of 2.5 mm from the centre of the screen Find (a) width of the slit. (b) The distance of the second maximum from the centre of the screen. (c) The width of the central maximum.

20. Write a general expression for force experienced by a charged particle moving in a uniform magnetic field. Using this expression explain what is the nature of its path if its (i) velocity is perpendicular to magnetic field. (ii) parallel to magnetic field.

21. With the help of a ray diagram explain the phenomenon of total internal reflection. Obtain the relation between critical angle and the refractive index of the denser medium.

22. State the principle of working of potentiometer.

Figure show the circuit diagram of a potentiometer for determining the e.m.f. 'ε' of a cell of negligible internal resistance.



(i) How does the position of balance point (J) change when the resistance R_1 is decreased?

(ii) Why can not the balance point be obtained when e.m.f. . 'ε' is greater than 2 V.

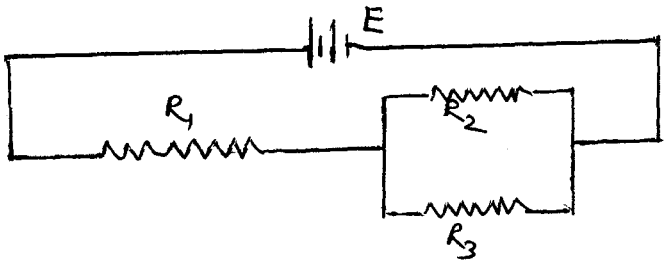
23. Sujeet was making an electric bell. For that he was looking for an appropriate material. Sumeet suggested him to use soft iron for this purpose and helped him in making electromagnet.

(a) What quality do you think is there in Sumeet?

(b) Why Sumeet suggested for soft iron?

24. (a) With the help of neat circuit diagram obtain the condition for balanced Wheat Stones network.

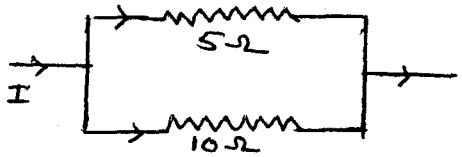
(b) Three identical resistors R_1, R_2 and R_3 are connected to a battery as shown in figure. What will be the ratio of voltages across R_1 and R_2?



OR

24. (a) With the help of neat diagram explain how Meter Bridge can be used to find an unknown resistance.

(b) In the arrangement of resistors shown here, what fraction of I will pass through 5Ω resistor?



25. (a) With the help of neat ray diagram derive a formula for refractive index of material of a prism in terms of angle of prism and angle of minimum deviation.

(b) A screen is placed 80 cm from an object. The image of the object on the screen is formed by a convex lens for two different positions of the lens, separated by 10 cm. Calculate the focal length of the lens used.

OR

25. (a) With the help of neat ray diagram derive formula for magnifying power of simple microscope.

(b) A ray of light, incident on an equilateral glass prism $\mu_g=\sqrt{3}$ moves parallel to the base. Find the angle of incidence for this ray.

26. (a) Derive a formula for fringe width in Young's double slit experiment.

(b) In a single slit diffraction experiment first minima for red light (wavelength 660 nm) coincides with first maxima of some other wavelength λ'. Find the value of λ'.

OR

26. (a) Derive a formula for width of central bright band in case of single slit diffraction pattern.

(b) In a double – slit experiment, the angular width of a fringe is found to be 0.2° on a screen placed 1 m away. The wavelength of light used is 600 nm. What will be the angular width of the fringe if the entire experimental apparatus is immersed in water? Take refractive index of water to be 4/3.