Pre Board Examination 2015
Std. 12
07-01-2015

Set 2

PHYSICS

Max. Marks : 70
Time : 3 hrs.

INSTRUCTIONS*:*

i) Q. Nos. 1 to 5 carry 1 mark each.
ii) Q. Nos. 6 to 10 carry 2 marks each.
iii) Q. Nos. 11 to 22 carry 3 marks each.
iv) Q. No. 23 carries 4 marks.
v) Q. Nos. 24 to 26 carry 5 marks each.
vi) Use pencil for the diagrams and graphs.
vii) Answers should be to the point.
viii) Use log tables if necessary.

K = 9×10^9 Nm ^{2}/C ^{2}, $\in_0 = 8.85\times10^{-12}$ C ^{2}/N m ^{2}, c = 3×10^8 m/s, $\mu_0 = 4\pi\times10^{-7}$ Tm/A
Mass of electron = 9.1×10^{-31} Kg, mass of proton =1.67×10^{-27} Kg, h = 6.6×10^{-34} J s,
Mass of alpha particle = 6.6×10^{-27} Kg, Mass of neutron = 6.65×10^{-27} Kg, 1 a.m.u. $\equiv$ 931 MeV,
k = 1.38×10^{-23} J/mole K, e = 1.6×10^{-19} C.

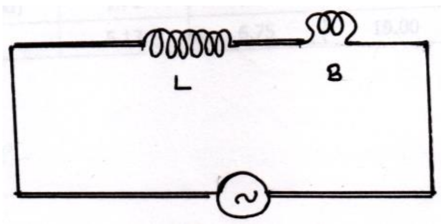
1. A given logic gate gives high state of output when any one of the input is at high state. Identify this gate and give its logic symbol. (1)

2. If the radius of the Gaussian surface enclosing a point charge is doubled, how does the electric flux through the Gaussian surface change? (1)

3. Draw the graph of resistivity against absolute temperature T for a semiconductor. (1)

4. What is the condition in terms of angle of diffraction for observing first secondary maxima in case of diffraction due to a single slit? (1)

5. An air core coil 'L' and a bulb 'B ' are connected in series in the ac mains as shown in the figure. The bulb glows with some brightness. How will the glow of the bulb change if the frequency of the ac source is changed? Give reason in support of your answer. (1)



6. A metal has threshold wavelength of 600nm. Calculate (i) Threshold frequency (ii) Work function of metal in eV. (2)

7. An electric dipole with electric dipole moment 4×10^{-9}Cm oriented at 60^o with the direction of a uniform electric field of magnitude 5×10^4N/C. Calculate the magnitude of the torque acting on the dipole. (2)

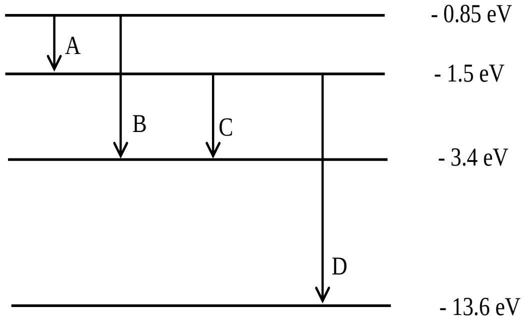
8. Identify the following electromagnetic radiation as per wavelength given below. Write one application of each. a) 1mm b) 10^{-12}m c) 10^{-8}m (2)

9. Distinguish between point to point communication and broadcasting mode. Give one example of each. (2)

10. The ratio between the de-Broglie wavelengths associated with protons accelerated though a potential of 512V and alpha particles accelerated through a potential of 'x' is found to be same. Find the value of x. (2)

11. Explain why high frequency carrier waves are used for effective transmission of signals. A message signal of 10 kHz and peak voltage 20V is used to modulate a carrier wave frequency 10MHz and peak voltage 30V. Calculate the (i) modulation index (ii) side band frequencies. (3)

12. The energy level diagram of an element is shown below. Identify by doing necessary calculations, which transition corresponds to the emission of a spectral line of wavelength 102.7nm. (3)



13. Three point charges q, 2q and Q are placed at the vertices of an equilateral triangle. Find the value of q in terms of Q so that electric potential energy of the system is zero. (3)

14. Derive an expression for the energy stored in a parallel plate capacitor. On charging a parallel plate capacitor to a potential 'V', the space between the plates is halved and a dielectric medium of K=10 is introduced between the plates without disconnecting DC source. Explain, using suitable expression how energy stored in the capacitor changes. (3)

15. A compass needle is placed on the magnetic of pole of earth. How does it behave? If a dip needle is placed at the same place then what will be its behavior? The horizontal component earth's magnetic field at a place is 0.2G and total magnetic field intensity is 0.4G. Find the angle of dip. (3)

16. When a circuit element 'X' is connected across an ac source of emf 220V, a current of 2A flows through it and this current is in phase with the applied voltage. When another element 'Y' is connected across the same ac source the same current flows in the circuit, but it lags the voltage by $\pi/2$ radians. Name the circuit elements X and Y. Find the current in the circuit when the series combination of X and Y is connected across the same ac source. (3)

17. A beam of light consisting of two wavelengths 560nm and 420nm is used to obtain interference fringes in Young's double slit experiment. Find the least distance from the central maximum where the bright fringes due to both the wavelengths coincide. The distance between the slits is 4.0mm and the screen is at a distance of 1.0m from the slits. (3)

18. State conditions for the diffraction to occur. Draw the graph showing variation of intensity with angle of diffraction. Write two changes that occur in diffraction pattern of monochromatic source is replaced by a source of white light. (3)

19. An object is placed 30 cm from a convex lens 'P' of focal length 10 cm. Calculate the position and magnification of image. A concave lens 'Q' of focal length 10 cm is now to be placed behind 'P' to make final rays parallel to the principal axis. Locate the position of Q with respect to P. (3)

20. Draw the labeled circuit diagram of a common emitter transistor amplifier. Explain clearly how the input and output signal are in out of phase. (3)

21. What is a light emitting diode (LED)? Draw a circuit diagram and explain its action. (3)

22. State the law of radioactive disintegration. What is half life period of radioactive substance? Derive an expression for it.

(OR)

The half life time of a radioactive substance is100 years. Calculate in how many years the activity will decay to $(1/10)^{th}$ of its initial value.

23. One day Gautam was celebrating his birthday along with some of his friends at home. All of sudden the ceiling fan of the room stopped working. Out of shear enthusiasm, Gautam first switched off the power supply of the fan then opened the cap of the fan to look for the problem. His friend Tushar tried to stop him but he did not pay any attention. As soon as he touched upon the interior parts of the fan, he received a severe electric shock and fell down. All his friends were scared as to what had happened because the power supply had been already switched off ?

a) What negative trait has been shown by Gautam?

b) What could be the possible cause of electric shock?

c) Write expressions for current and emf of the component used in the fan with proper phase difference.

24. a) Use Kirchoff's laws to obtain the balanced condition in a Wheatstone's bridge

b) Draw a circuit diagram for determining the unknown resistance 'X' using meter bridge. Explain briefly its working giving necessary formula used.

(OR)

a) A cell with a finite internal resistance 'r' is connected across two external resistances R_1 and R_2 ($R_1 < R_2$) one by one. In which case would the terminal potential difference of the cell be more? Justify your answer.

b) Write the underlying principal of a potentiometer. Draw the circuit diagram of the experimental set up used for determining the internal resistance of a cell by potentiometer. Derive the necessary formula. (5)

25. Draw a ray diagram to show refraction of a ray of monochromatic light passing through a glass prism. Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation.

(OR)

Explain briefly how the phenomenon of total internal reflection is used in fibre optics.

a) Obtained lens makers formula using the expression $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$. Here the ray of light propagating from a rarer medium of refractive index (n_1) to a denser medium of refractive index (n_2) is incident on the convex side of spherical refracting surface of radius of curvature R.

b) Draw a ray diagram to show the image formation by a concave mirror then the object is kept between its focus and the pole. Using this diagram, derive the magnification formula for the image formed. (5)

26. State Biot-Savart law, giving the mathematical expression for it. Use this law to derive the expression for the magnetic field due to a circular coil carrying current at a point along its axis. How does a circular loop carrying current behave as a magnet?

(OR)

With the help of a labelled diagram, state the underlying principle of a cyclotron. Explain clearly how it works to accelerate the charged particles .Show that cyclotron frequency is independent of energy of the particle. Is there an upper limit on the energy acquired by the particle? Give reason. (5)

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