GURUKUL ACADEMY

FOR – XIth , XIIth & Competitive Exam.

Time – 3hr. **Test – Full Syllabus.** **M.M – 70.**

Question no 1 to 8 – [1 Marks each]. *Question no 9 to 16 – [2 Marks each].*
Question no 17 to 25 – [3 Marks each]. *Question no 27 to 29 – [5 Marks each].*
Question no 26 – [4 Marks, Value based question]

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General Instructions:

- All questions are compulsory.
- There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all questions of five marks. You have to attempt only one the choices in such questions.
- Question numbers 1 to 8 are very short answer type questions, carrying one mark each.
- Questions numbers 9 to 16 are short answer type questions carrying two marks each.
- Question numbers 17 to 25 are also short answer type questions, carrying 3 marks each.
- Question numbers 26 value based type question, carrying four marks each.
- Question numbers 27 to 29 are long answer type questions, carrying five marks each.
- Use of calculators is not permitted. However, you may use log tables, if necessary.
  You may use the following physical constants wherever necessary.
  $c = 3 \times 10^{8}$ ms^{-1}
  $h = 6.6 \times 10^{-34}$ Js
  $e = 1.6 \times 10^{-19}$C
  $\mu_o = 4\pi \times 10^{-7}$ TmA^{-1}
  $1/4\pi\varepsilon_o = 9 \times 10^{9}$ N m^{2}C^{-2}
  Avogadro number $N_A = 6.023 \times 10^{23}$ mol^{-1}
  Mass of the neutron = 1.675×10^{-27} kg
  Boltzmann constant, $k = 1.38 \times 10^{23}$ J K^{-1}

Q.1 An electron moving through a magnetic field does not experiences a force. Under what condition is this possible?

Q.2 The instantaneous value of voltage from an a.c. Source is given by E=300 Sin 314t. What is the r.m.s. voltage of the source?

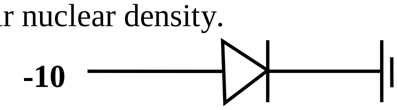
Q.3 A bulb and a capacitor are connected in series to an a.c. source of variable frequency. How will the brightness of the bulb change on increasing the frequency of the a.c. source.

Q.4 Name the part of electromagnetic spectrum that has largest penetrating power.

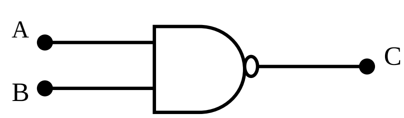
Q.5 When light undergoes refraction. What happens to its frequency.

Q.6 Two nuclei have mass number in the ratio 1:2. What is the ratio of their nuclear density.

Q.7 In the given diagram, is the diode D forward or reversed biased?

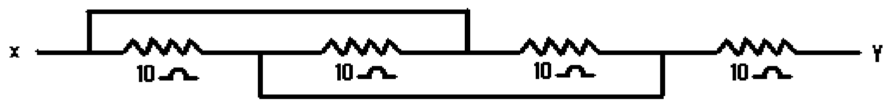


Q.8 Write the truth table for the gate shown below.



Q.9 Two point charges 4μc and —2μc are separated by a distance of 1m in air. At what point on the line joining the two charges is the electric potential is zero.

Q.10 Four resistors of resistance each of 10Ω is connected as given below.



Calculate the equivalent resistance between points X and Y.

Q.11 A battery of emf 10V and internal resistance 3 Ω connected to a resistor R.

(i) If the current in the circuit is 0.5A. Calculate the value of R.

(ii) What is the terminal voltage of the battery when the circuit is closed.

Q.12 The electric field of e.m wave in vacuum is given:-

$$\vec{E} = \{3.1 \tfrac{N}{C}[(\cos 1.8\ rad/m)\, y + (5.4 \times 10^6 rad/sec)t]\}\,\hat{i}$$

a. What is the direction of propagation of the wave.

b. What is its wave length?

c. What is the frequency?

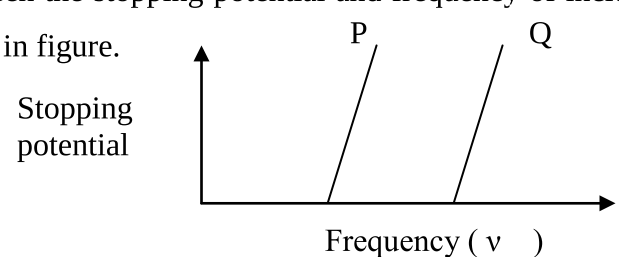
d. What is the direction of magnetic field?

Q.13 A concave lens has the same radii of curvature for both sides and has a refractive index 1.6 in air. In the second case it is immersed inside a liquid of refractive index 1.4. Calculate the ratio of focal length of the lens in the two cases.

Q.14 In the photo electric experiment, the graph between the stopping potential and frequency of incident radiations on two metal plates P and Q are shown in figure.

a) Which has greater work function?

b) What does the slope of the line depict?



Q.15 Explain the laws of photo electric emission on the basis of Einstein's photo electric equation.

Q.16 The values of ground state energy of hydrogen atom is -13.6 eV.
a) What does the negative sign signify?
b) How much energy required to take an electron in this atom from the ground state to the first excited state?

OR

Write any two properties of Nuclear force and prove nuclear density is independent from mass no.

Q.17 Define magnetic susceptibility of a material. Name two elements one having positive susceptibility and other having negative susceptibility.

Q.18 Define capacitance of a capacitor. Prove that the total electrostatic energy stored in a parallel plate capacitor is ½ CV^2.

Q.19 Using Gauss theorem, deduce an expression for the electric field intensity at any point due to a thin infinity long wire of charge per unit length is λ .

Q.20 With the help of circuit diagram explain in brief the use of potentiometer for comparision of emf of two cells.

Q.21 A metallic rod of length 'l' and resistance 'R' is moving normal to a uniform magnetic field 'B' with a velocity 'V' . Deduce expressions for (i) the emf induced (n) the induced current in the metallic rod.

Q.22 Explain with help of a neat and labeled diagram, the principle and working of a transformer.

Q.23 Draw a labeled ray diagram shown the formation of image of a distant object using as astronomical telescope in normal adjustment position. Also write the expression for magnifying power of telescope for normal adjustment.

Q.24 Define polarizing angle. Derive the relation connecting polarising angle and the refractive index of a medium.

Q.25 (a) The activity of a radioactive element drops to $1/16^{th}$ of its initial value in 32 years. Find the mean life of the sample.

(b) Write the nuclear equations for α decay of ${}^{242}_{94}Pu$.

Q.26 Kumaran wanted to pay electricity bill that day. He realized that the consumption shown by the meter was unbelievably low. He thought that the meter must have been faulty. He wanted to check the meter. But unfortunately he did not have any idea as to how to do this. There came his friend Subhash to help him. He told Kumaran to run only the electric heater rated 1kW in his house for some time keeping other appliances switched off. He also calculated the power consumed in kilowatt hour and compared the value with the meter. . Kumaran was happy and thanked Subhash for his timely help and the knowledge.

(1) What are the values displayed by the friends?

(2) Express kWh in joules. Find the resistance of the heater.

Q.27 Draw a neat and labelled diagram of a cyclotron. State the underlying principle and explain how a positively charged particle gets accelerated in a cyclotron. Show mathematically that the cyclotron frequency does not depend on speed of the particle.

OR

State the Biot-savart law for the magnetic field due to a current carrying element. Using this law obtain a formula for magnetic field at the centre of circular loop of radius R carrying a steady current

Q.28 What is interference of light? In Young's double slit experiment deduce the conditions for

(i) constructive and (ii) destructive interference.

Draw a graph showing the variation of resultant intensity in the intereference pattern against position 'x' on the screen.

OR

(i) Explain the phenomenon of diffraction of light at a single slit to show the formation of diffraction fringes.

(ii) A slit of width 'd' is illuminated by light of wave length $6500A^0$. For what value of 'd' will the first minimum fall at an angle of diffraction of $30^{0.}$

Q.29 (a) With the help of a circuit diagram explain the working of transistor as oscillation.

(b) If a change of 100μA in the base current of an n-p-n transistor causes a change of 10mA in its collector current. What is it's a.c. current gain.

OR

Explain the formation of p-n junction. With the help of circuit diagram, explain the working of a p-n junction diode as half wave & full wave rectifier. Show the input and output wave forms.