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ERNAKULAM REGION**

**SAMPLE QUESTION PAPER -01**

**PHYSICS (042) 2012-13**

**CLASS :XII**

**Max Marks : 70**

**Max Time: 3 Hrs**

**GENERAL INSTRUCTIONS:**

- (a) All questions are compulsory.
- (b) There are 29 questions in total. Question 1 to 8 carry one mark each, questions 9 to 16 carry two marks each, questions 17 to 25 carry three marks each, question 26 is a value based question which carries 4 marks and questions 27 to 29 carry five marks each.
- (c) 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 three questions of five marks each.
- (d) Use of calculators is not permitted.
- (e) You may use the following physical constants wherever necessary:

$$c = 3 \times 10^8 \text{ m/s ,}$$

$$h = 6.63 \times 10^{-34} \text{ Js}$$

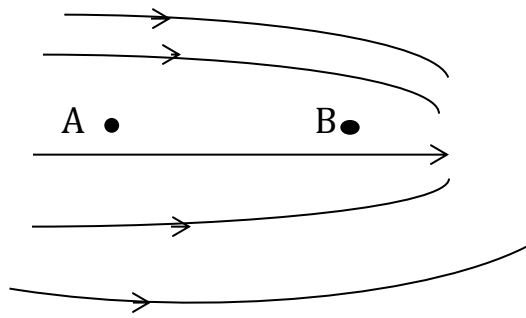
$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ Tm/A}$$

$$1/4\pi\epsilon_0 = 9 \times 10^9 \text{ Nm}^2 / \text{C}^2$$

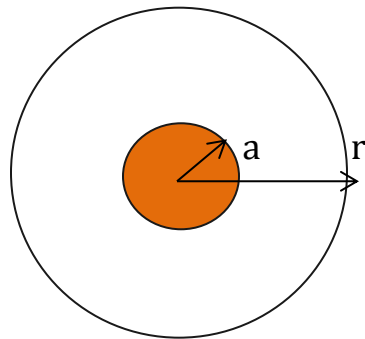
$$m_e = 9.1 \times 10^{-31} \text{ Kg}$$

1



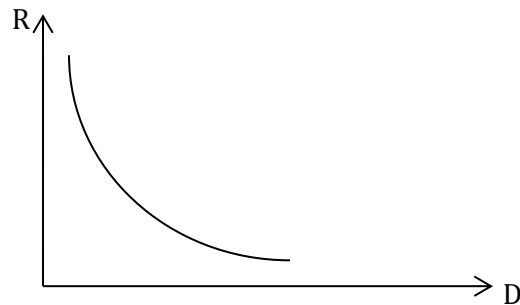
The electric field lines in a region are shown in the figure. A and B are two points in the region. At which point a charge '+q' experiences minimum force?

- 2 A distorted signal is received by a receiver set. Suggest a method to rectify this while doing the modulation process? 1
- 3 A current  $I$  flows through a wire of radius ' $r$ ' and the drift velocity ' $v_d$ '. What is the drift velocity of electrons through a wire of same material but having double the radius, when a current ' $2I$ ' flows through it? 1
- 4 The figure shows a long straight conducting wire of circular cross section of radius ' $a$ ' (shaded portion) carrying a current  $I$ . Assume the current is uniformly distributed across this cross section. Draw the shape of the graph between magnetic field versus distance ' $r$ ' in the region between ' $a$ ' and ' $r$ ' if  $r > a$ . 1



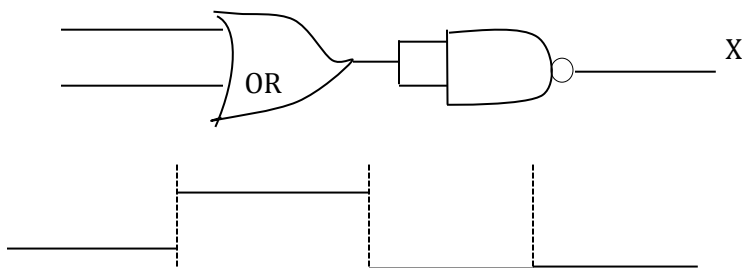
- 5 In India domestic power supply is 220V, 50Hz; while in USA it is 110V, 50Hz. Give one advantage and one disadvantage of 220V supply over 110 V supply. 1

- 6 The graph of variation of resistance  $R$  of a metal wire as a function of its diameter  $D$  is as follows. Give the reason for the shape of the graph. **1**



- 7 An audio signal is not transmitted directly by converting it into an electromagnetic wave of same frequency. Give two reasons. **1**
- 8 A magician during a show makes a concave glass lens with refractive index 1.47 changes into convex lens while dipping it in another medium. What will be the ratio of refractive index of glass with that of the medium? **1**
- 9 A solenoid has a core of a material with relative permeability 400. The windings of the solenoid are insulated from the core and carry a current of 2A. If the number of turns is 1000 per metre, Calculate the magnetic intensity 'H' and the magnetic field 'B'. **2**
- 10 The magnetic susceptibility for a specimen has a small negative value. To which class of the magnetic substances, does the specimen belong? What is Meissner effect? **2**
- 11 Three resistors of resistance 'r' each are connected to get maximum possible resistance. Then they are connected differently to get minimum possible resistance. Find the ratio between minimum and maximum resistance so obtained. **2**
- 12 A circular loop and a rectangular loop of wire are moving towards a uniform magnetic field region from a field free space with a constant velocity 'v' with their plane perpendicular to the magnetic field. In which loop the induced emf is constant during the time of motion? What about the emf induced in the other one? **2**

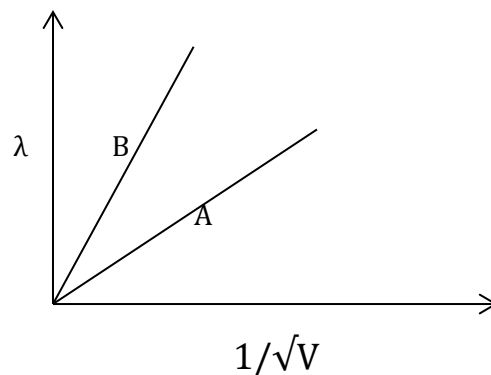
- 13** A beam of light coming out of a convex lens when a point source is placed at its focus is incident on an equilateral prism. Draw the shape of wave fronts coming out of the convex lens and the prism. **2**
- 14** A monochromatic source, emitting light of wave length, 600 nm, has a power output of 66W. Calculate the number of photons emitted by this source in 10 seconds. **2**
- 15** Draw the input waveforms for three different inputs if the output waveform from the given logic Gate is as follows. **2**



Or

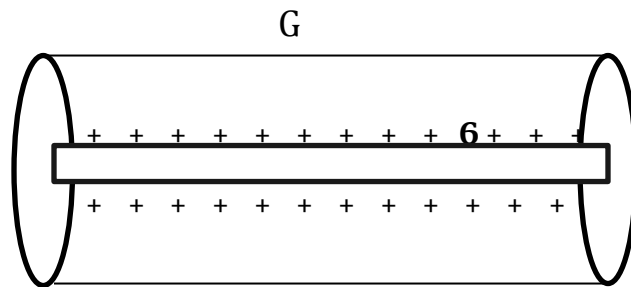
Two car garages have a common gate which needs to open automatically when a car enters either of the garages or car enters both. Design a truth table, logic symbol and hence Boolean expression for a circuit that resembles this situation using diodes.

- 16** Two lines A and B shown in the graph represent the de-Broglie wavelength ' $\lambda$ ' as a function of  $1/\sqrt{V}$  ( $V$  is the accelerating potential) for two particles having the same charge. Which of the two represents the particle of smaller mass? **2**



- 17 (a) An electron revolves around a nucleus in circular orbit. Draw the three equipotential surfaces around the nucleus. 3

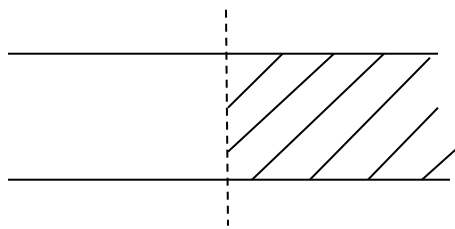
(b) Figure below shows a cylindrical Gaussian surface 'G' for an infinitely long thin straight wire of uniform charge density ' $\sigma$ '



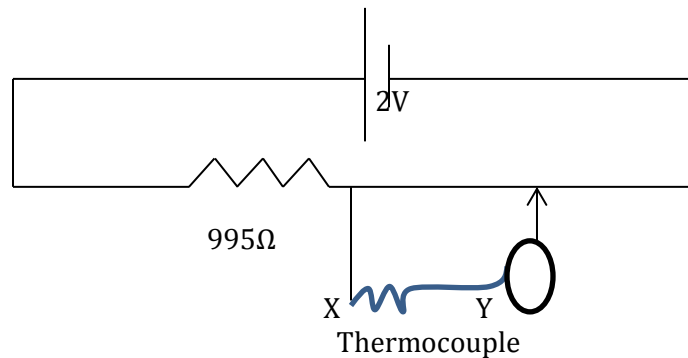
- (i) For which surface is the electric flux zero?  
 (ii) Over which surface is the electric field constant?

OR

Define the SI unit of capacitance. As shown in the figure given below, a dielectric material of dielectric constant 19 is inserted in half portion between the plates of a parallel-plate capacitor. If its initial capacitance is  $40 \mu\text{F}$ , what will be the new capacitance?



- 18 State the principle behind working of a potentiometer? The circuit diagram shows the use of a potentiometer to measure a small emf produced by a thermocouple connected between X and Y. A cell of emf 2V has negligible internal resistance. The potentiometer wire PQ is 1 m long and has resistance  $5\Omega$ . The balance point S is found to be 40cm from P. Calculate the value of emf generated by the thermocouple. 3

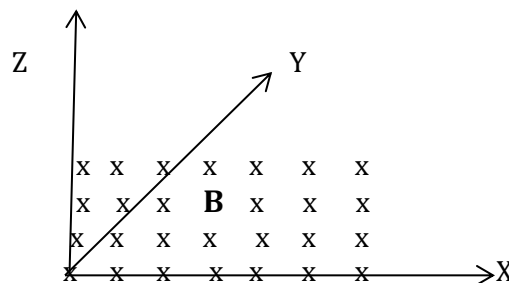


**19** A charged particle moves along the positive X-axis in a uniform magnetic 'B' which is directed parallel to the positive Y-axis. **3**

(i) In which direction would the Lorentz force act for an electron?

(ii) What will be the path of the charged particle?

(iii) Draw the path of the charged particle if it has a velocity component along 'B'.



**20** Which part of the electromagnetic spectrum is suitable for RADAR systems used in aircraft navigation? **3**

A parallel plate capacitor of capacitance  $2 \mu\text{F}$  produces an instantaneous displacement current of  $1 \text{ mA}$  in the space between its plates. What should be the rate of change of potential difference required?

- 21 State the condition for diffraction of light to occur. 3  
The following table gives data about the single slit diffraction experiment:

Wave length of Light	Half Angular width of the principal maxima
$\Lambda$	$\theta$
P $\lambda$	Q $\theta$

Find the ratio of the width of the slits used in the two cases. Would the ratio of the half angular width of the first secondary maxima, in the two cases, be also equal to Q?

- 22 Two slits in Young's experiment are illuminated by a monochromatic lamp. With a neat sketch, get an expression for fringe width of the interference pattern so obtained. 3

How will the fringe width change when the region between coherent sources and the screen is filled with another medium of refractive index ' $\mu$ '.

- 23 An electron revolves around the nucleus of a Hydrogen atom. Relate the energy of the electron to Principal quantum number. 3

Two Hydrogen atoms are in the excited state. Is it possible for the electrons to have different energies but the same orbital angular momentum according to the Bohr model?

- 24 From the following data given 3  
 ${}_{92}\text{U}^{238} = 238.05079 \text{ u}$ ,  ${}_{2}\text{He}^4 = 4.00260 \text{ u}$ ,  ${}_{90}\text{Th}^{234} = 234.04363 \text{ u}$ ,  
 ${}_{1}\text{H}^1 = 1.00783 \text{ u}$ ,  ${}_{91}\text{Pa}^{237} = 237.05121 \text{ u}$

(a) Calculate the energy released during the alpha decay of  ${}_{92}\text{U}^{238}$

(b) Show that  ${}_{92}\text{U}^{238}$  cannot spontaneously emit a proton.

- 25 A company would like to transmit message signal as amplitude modulated wave. Suggest a simple method in the form of block diagram to produce A M wave. What are the functions of the blocks (devices) used? With a block diagram show how this AM wave will be transmitted? 3

**26** Mr. Kishan is a farmer who was staying happily in a hut made of hey and leafy roof. It is easy for him to renovate his home with new leaves every year as the good quality palm leaves he get free of cost and it is environment friendly. Most of the village people are satisfied with the same type of huts there. **4**

But one day during heavy lightning, many of the huts were burnt to ashes and people were sad and disappointed. Mr. Sekhar works in electricity department and has good knowledge of current affairs. He soon reached the spot along with his friends and pacified them and made arrangements for their comfortable stay. The very next day the team could erect many lightning conductors and few cavities of metal conductors and made awareness to the villagers about lightning and the use of things installed there. (a) What according to you, are the values displayed by Mr. Sekhar and his friends to help Mr. Kishan and the village people? (2)

What is the principle behind working of a lightning conductor? Also by applying Gauss theorem show that net electric field inside the metallic cavity is zero. (2)

**27** (a) Why Si and Ga As are preferred materials for solar cells? Draw V-I Characteristics of Zener diode. How a Zener diode can act as voltage regulator? **5**

(b) In a p-n junction diode, the current  $I$  can be expressed as  $I = I_0 \exp\{ (eV/2K_B T) - 1 \}$  where  $I_0$  is called reverse saturation current,  $V$  is the voltage across the diode and is positive for forward bias and negative for reverse bias,  $I$  is current through the diode,  $K_B$  is Boltzmann constant ( $8.6 \times 10^{-5}$  eV/K) and  $T$  is the absolute temperature. If for a given diode  $I_0 = 5 \times 10^{-12}$  A and  $T = 300$ K, then  
(i) What will be the forward current at a forward voltage of 0.6 V?  
(ii) What will be the dynamic resistance if forward current at 0.7 V is  $14.3 \times 10^{-7}$  A

OR

(a) Define trans- conductance of a transistor.  
(b) Show by circuit diagram, how a transistor work as a feed back oscillator. Also give collector and emitter current variation graph due to inductive coupling

(c) Two amplifiers are connected one after the other in series (cascaded)



The first amplifier has a voltage gain of 10 and second has a voltage-gain of 20. If the input signal is 0.01V, calculate the output voltage of the ac signal.

**28** Trace the path of three rays from a distant object through an astronomical telescope in normal adjustment. **5**

(a) The far point of a myopic person is 80 cm in front of the eye. What is the power of the lens required to enable him to see very distant objects clearly?

(b) In what way does the corrective lens help the above person?

(c) The above person prefers to remove his spectacles while reading a book. Why?

OR

(a) A ray of light is normally incident on one face of an equilateral prism. Trace the course of the ray through the prism and emerging from it.

(b) The critical angle for glass-air interface is ' $i_c$ '. Will the critical angle for glass-water interface be greater than or less than ' $i_c$ '? Why?

(c) How does the angle of minimum deviation of a glass prism change if the incident violet light is replaced by red light?

**29** (a) A simple A C generator having a constant magnetic field is connected to a resistive load. Mention the reason for the effect of doubling the speed of rotation on the following. **5**

(a) Frequency of rotation (b) the generated emf.

(b) Obtain the frequency of a series L C circuit at resonance.

(c) A person while walking through the doorway of a metal detector, it emits a sound. What does it indicate? What is the underlying principle of metal detector?

**OR**

- (a) Show diagrammatically two different arrangements used for winding the primary and secondary coils in a transformer.
- (b) Assuming the transformer to be an ideal one, write the expressions for the ratio of its output voltage to input voltage.
- (c) The core of transformer is made of magnetic material. Give any two properties of such materials used.
- (d) Write any four types of energy losses in transformer.