

Roll Number

Code Number 42/2/2



INDIAN SCHOOL MUSCAT  
FIRST PRELIMINARY EXAMINATION 2017  
PHYSICS

CLASS: XII  
10.12.2017

Sub. Code: 042

Time Allotted: 3 Hrs  
Max. Marks: 70

**General Instructions:**

1. All questions are compulsory. There are 26 questions in all.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. Section A contains five questions of one mark each, Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each.
4. 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 the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
5. You may use the following values of physical constants wherever necessary.

$$c = 3 \times 10^8 \text{ ms}^{-1}$$

$$h = 6.626 \times 10^{-34} \text{ Js}$$

$$e = 1.602 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

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

$$1\text{eV} = 1.6 \times 10^{-19} \text{ J}$$

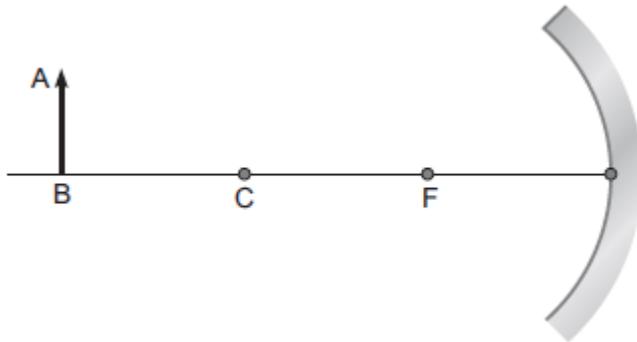
**SECTION A**

- 1 Name the phenomenon which shows the quantum nature of electromagnetic radiation. 1
- 2 At a place, the horizontal component of earth's magnetic field is B and angle of dip is  $60^\circ$ . What is the value of horizontal component of the earth's magnetic field at equator? 1
- 3 A closed loop moves normal to the constant electric field between the plates of a large capacitor. Is a current induced in the loop 1  
(i) when it is wholly inside the region between the capacitor plates  
(ii) when it is partially outside the plates of the capacitor? The electric field is normal to the plane of the loop.
- 4 Write the expression for speed of electromagnetic waves in a medium of electrical permittivity  $\epsilon$  and magnetic permeability  $\mu$ . 1

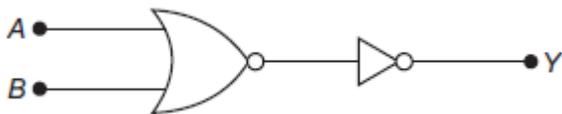
- 5 Draw the shape of the wavefront coming out of a convex lens when a plane wavefront is incident on it. 1

### SECTION B

- 6 (i) The angle of dip at a location in southern India is about  $18^\circ$ . Would you expect a greater or smaller dip angle in Britain? 2  
(ii) Magnetic field lines can be entirely confined within the core of a toroid, but not within a straight solenoid. Why?
- 7 An object  $AB$  is kept in front of a concave mirror as shown in the figure. 2



- (i) Complete the ray diagram showing the image formation of the object.  
(ii) How will the position and intensity of the image be affected if the lower half of the mirror's reflecting surface is painted black?
- 8 (i) Draw a plot of potential energy of a pair of nucleons as a function of their separation. 2  
(ii) Write two important conclusions which you can draw regarding the nature of nuclear forces.
- 9 Write the truth table for the following circuit. Name the equivalent gate that this circuit represents. 2



- 10 Write the function of (i) Transducer and (ii) Repeater in the context of communication system. 2

### OR

Write two factors justifying the need of modulation for transmission of a signal.

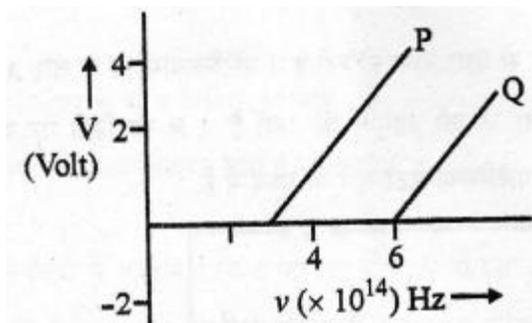
### SECTION C

- 11 (i) Draw the magnetic field lines distinguishing between diamagnetic and paramagnetic materials. 3  
(ii) Give a simple explanation to account for the difference in the magnetic behaviour of these materials.
- 12 Define mutual inductance between a pair of coils. Derive an expression for the mutual inductance of two long coaxial solenoids of same length wound one over the other. 3

OR

Define self-inductance of a coil. Obtain the expression for the energy stored in an inductor  $L$  connected across a source of emf.

- 13 A metallic rod of length ' $l$ ' is rotated with a frequency  $\nu$  with one end hinged at the centre and the other end at the circumference of a circular metallic ring of radius  $r$ , about an axis passing through the centre and perpendicular to the plane of the ring. A constant uniform magnetic field  $B$  parallel to the axis is present everywhere. Using Lorentz force, explain how emf is induced between the centre and the metallic ring and hence obtain the expression for it. 3
- 14 (i) Why do we not encounter diffraction effects of light in everyday observations? 3  
(ii) In the observed diffraction pattern due to a single slit, how will the width of central maximum be affected if  
(a) the width of the slit is doubled;  
(b) the wavelength of the light used is increased?
- 15 Draw a labelled ray diagram of a reflecting telescope. Mention its two advantages over the refracting telescope. 3
- 16 i) State Law of Malus. 3  
ii) Draw a graph showing the variation of intensity ( $I$ ) of polarized light transmitted by an analyser with angle ( $\theta$ ) between polarizer and analyser.  
iii) What is the value of refractive index of a medium of polarizing angle  $60^\circ$ ?
- 17 Describe Young's double slit experiment to produce interference pattern due to a monochromatic source of light. Deduce the expression for the fringe width. 3
- 18 (a) How are electromagnetic waves produced? Explain. 3  
(b) A plane electromagnetic wave is travelling through a medium along the +ve  $z$ -direction. Depict the electromagnetic wave showing the directions of the oscillating electric and magnetic fields.
- 19 In the study of a photoelectric effect the graph between the stopping potential  $V$  and frequency  $\nu$  of the incident radiation on two different metals P and Q is shown below: 3



- (i) Which one of the two metals has higher threshold frequency?  
(ii) Determine the work function of the metal which has greater value?  
(iii) Find the maximum kinetic energy of electron emitted by light of frequency  $8 \times 10^{14} \text{ Hz}$  for this metal.
- 20 (i) In a Geiger–Marsden experiment, calculate the distance of closest approach to the nucleus of  $Z=80$ , when an  $\alpha$ -particle of 8 MeV energy impinges on it before it comes momentarily to rest and reverses its direction. 3  
(ii) How will the distance of closest approach be affected when the kinetic energy of the  $\alpha$ -particle is doubled?
- 21 (a) Using de Broglie’s hypothesis, explain with the help of a suitable diagram, Bohr’s second postulate of quantization of energy levels in a hydrogen atom. 3  
(b) The ground state energy of hydrogen atom is  $-13.6 \text{ eV}$ . What are the kinetic and potential energies of the electron in this state?
- 22 (i) What is space wave propagation? Give two examples of communication system which use space wave mode. 3  
(ii) Frequencies higher than 10MHz are not reflected by the ionosphere on a particular day at a place. Calculate the maximum electron density of the ionosphere.

#### SECTION D

- 23 Some people living in a building were facing radiation problem. They did not know the basic cause of it. When Sudhir learned their problem, he explained them that many rocks contain small amount of Uranium, as do building materials made from them, such as bricks and concrete blocks, that Uranium decay produces a radioactive gas, Radon. Radon can accumulate and become a health hazard in well insulated houses and buildings. As per his suggestion, they took needful action to prevent such radiation. 4  
(i) What are the values displayed by Sudhir?  
(ii) A radioactive isotope has a half life of  $T$  years. After how much time is its activity reduced to 6.25% of its original activity?

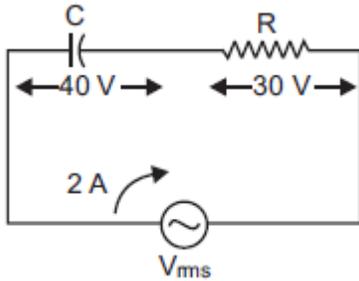
#### SECTION E

- 24 (i) Draw a circuit diagram to study the input and output characteristics of an  $n-p-n$  transistor in its common emitter configuration. Draw the typical input and output characteristics. 5  
(ii) Explain, with the help of a circuit diagram, the working of  $n-p-n$  transistor as a common emitter amplifier.

#### OR

- (i) How is a zener diode fabricated so as to make it a special purpose diode?  
(ii) Draw I-V characteristics of zener diode and explain the significance of breakdown voltage.  
(iii) Explain briefly, with the help of a circuit diagram, how a  $p-n$  junction diode works as a half wave rectifier.

- 25 (a) State the condition for resonance to occur in a series  $LCR$  a.c. circuit and derive an expression for the resonant frequency. 5  
 (b) Draw a plot showing the variation of the peak current ( $i_m$ ) with frequency of the a.c. source used.  
 (c) Define the quality factor,  $Q$  of the circuit.  
 (d) Calculate the impedance of the given a.c. circuit.



**OR**

- (a) Draw a labelled circuit arrangement showing the windings of primary and secondary coil in a transformer.  
 (b) Explain the underlying principle and working of a step-up transformer. Write any two major sources of energy loss in this device.  
 (c) How much current is drawn by the primary coil of a transformer which steps down 220 V to 22 V to operate device with an impedance of 220 ohm ?
- 26 (a) Draw the ray diagram showing refraction of light through a glass prism and hence obtain the relation between the refractive index  $\mu$  of the prism, angle of prism and angle of minimum deviation. 5  
 (b) Determine the value of the angle of incidence for a ray of light travelling from a medium of refractive index  $\mu_1 = \sqrt{2}$  into the medium of refractive index  $\mu_2 = 1$ , so that it just grazes along the surface of separation.

**OR**

- (a) A point object is placed on the principal axis of a convex spherical surface of radius of curvature  $n_1$  and  $n_2$  ( $n_2 > n_1$ ). Draw the ray diagram and deduce the relation between the object distance ( $u$ ), image distance ( $v$ ) and the radius of curvature ( $R$ ) for refraction to take place at the convex spherical surface from rarer to denser medium.  
 (b) A converging lens has a focal length of 20cm in air. It is made up of a material of refractive index 1.6. If it is immersed in a liquid of refractive index 1.3, find its new focal length.

**End of the Question Paper**