Series SSO

Code No. 55/1/B

Roll No. | | | | | | | |

Candidates must write the code on the title page of the answer book

General Instructions:

- Please check that this question paper contains 6 printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer book by the candidate.
- Please check that this question paper contains 26 questions.
- **Please write down the serial number of the question before attempting it.**
- 15 minutes' time has been allotted to read this question paper. The student will read the question paper only and will not write any answer on the answer script during this period.

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First Pre-Board Examination, 2017-2018

Physics

Grade: 12 **Time: 3 hours**

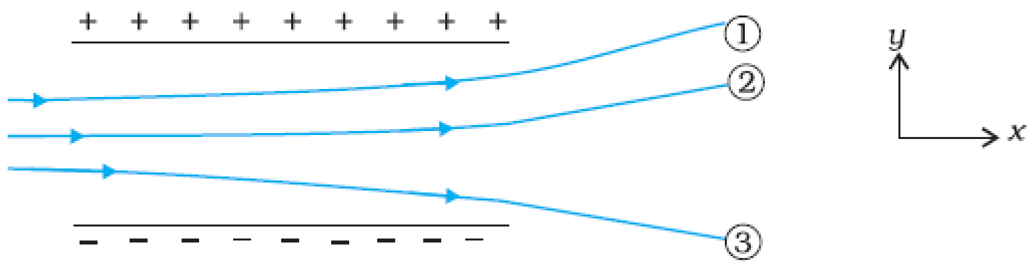
Date: 00.00.0000 **Max. Marks: 70**

General Instructions:

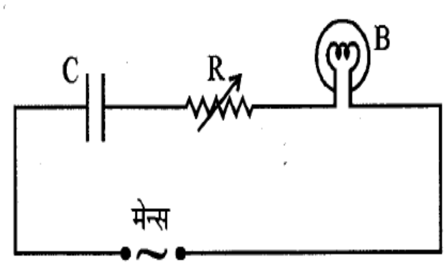
- All questions are compulsory
- Marks for each question are indicated against it.
- Question number 1 to 5 are very short-answer questions and carry 1 mark each.
- Question numbers 6 to10 are short-answer questions and carry 2 marks each.
- Question numbers 11 to 22 are also short-answer questions and carry 3 marks each.
- Question number 23 is a value based question and carries 4 marks.
- Question numbers 24 to 26 are long answer questions and carry 5 marks each.
- Use Log Tables, if necessary. Use of calculators is not allowed
- You may use the following values o f physical constants wherever necessary:

$c = 3 \times 10^{8}$ m/s	$h = 6{\cdot}63 \times 10^{-34}$ Js
e $1{\cdot}6 \times 10^{-19}$ C	$\mu_o = 4\pi \times 10^{-7}$ T m A^{-1}
$\varepsilon_o = 8{\cdot}854 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$	$m_e = 9{\cdot}1 \times 10^{-31}$ kg
Mass of neutron = $1{\cdot}675 \times 10^{-27}$ kg	Mass of proton = $1{\cdot}673 \times 10^{-27}$ kg
$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 Nm^2C^{-2}$	Boltzmann constant = $1{\cdot}38 \times 10^{-23}$ JK^{-1}

1. Figure shows tracks of three charged particles in a uniform electrostatic field. Give the signs of the three charges. Which particle has the highest charge to mass ratio? (1)



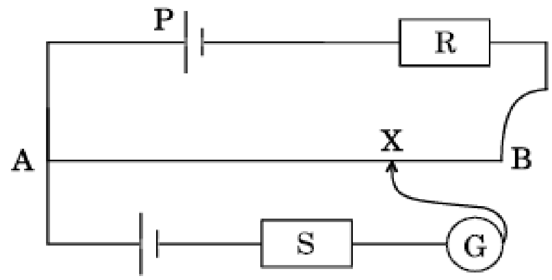
2. A magnetic field that varies in magnitude from point to point but has a constant direction (East to west) is set up in a chamber. A charged particle enters the chamber and travels undeflected along a straight path with constant speed. What can you say about the initial velocity of the particle? (1)
3. A planar loop of rectangular shape is moved within the region of a uniform magnetic field acting perpendicular to its plane. What is the direction and magnitude of the current induced in it? (1)
4. What is the function of a band pass filter used in a modulator for obtaining AM signal? (1)
5. When light travels from an optically denser medium to a rarer medium, why does the critical angle of incidence depends on the color of light? (1)
6. The amplitude of the magnetic field part of a harmonic electromagnetic wave in vacuum is B_0=510nT. What is the electromagnetic wave produced by the oscillator? (2)
7. Given a uniform electric field B: 5 x 10^3 i N/C, find the flux of this field through a square of l0 cm on a side whose plane is parallel to the y-z plane. What would be the flux through the same square if the plane makes a 30" angle with the x-axis? (2)
8. A capacitor 'C', a variable resistor 'R' and a bulb 'B' are connected in series to the ac mains in circuit as shown. The bulb glows with some brightness. How will the glow of the bulb changes if (i) a dielectric slab is introduced between the plates of the capacitor, keeping resistance R to be the same; (ii) the resistance R is increased keeping the same capacitance? (2)



9. In the potentiometer circuit shown, the null point is at X. State with reason, where the balance point will be shifted when (2)

a) Resistance R is increased, keeping all other parameters uncharged;

b) (b) Resistance S is increased, keeping R constant.



10. Define a wave front. Using Huygens' principle, draw the shape of a refracted wave front, when a plane wave is incident on a convex lens. (2)

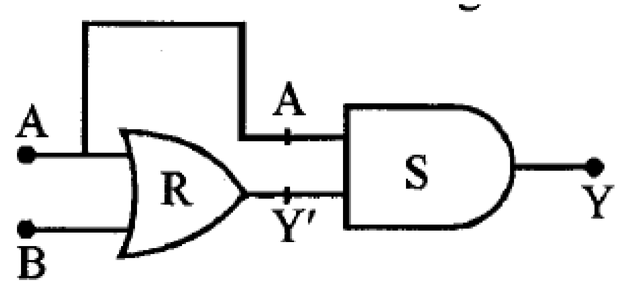
OR

(a) When a wave is propagating from a rarer to a denser medium, which characteristic of the wave does not change and why?

(b) What is the ratio of the velocity of the wave in the two media of refractive indices μ_1 and μ_2?

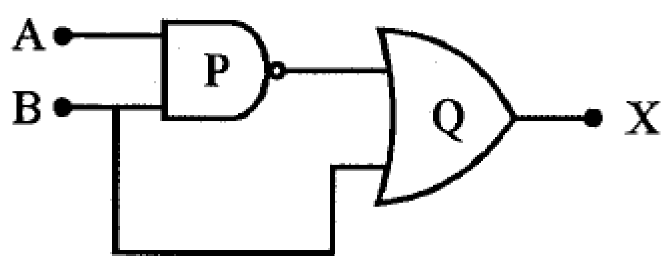
11. Distinguish between 'sky wave' and 'space wave' modes of propagation. Why is the sky wave mode of propagation restricted to frequencies up to 40 MHz? (3)

12. Write the truth table for the combination of the gates shown. Name the gates used. (3)



OR

Identify the logic gates marked 'P' and 'Q' in the given circuit. Write the truth table for the combination.



13. In a plane electromagnetic wave, the electric field oscillates sinusoidal at a frequency of 2.0×10^{10} Hz and amplitude 48V/m. (3)

a) What is the amplitude of the oscillating magnetic field?

b) Show that the average energy density of the E field equals the average energy density of the magnetic field. (3×10^8 m/s)

14. A proton and an α- particle enters enter at right angles into a uniform magnetic field of intensity B. Calculate the ratio of their radii when they enter the field with the: (3)

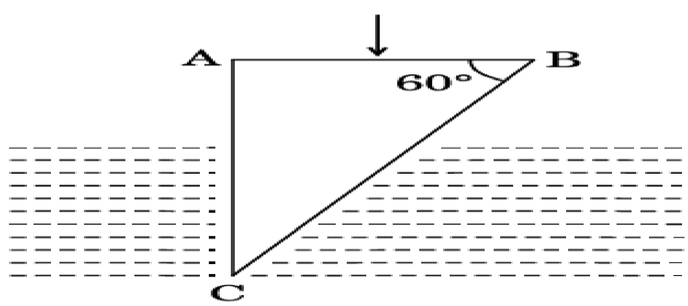
a) Same momentum

b) Same kinetic energy

15. a) A bar magnet falls from a height h through a metal ring. Will its acceleration be equal to g? Give reason for your answer. (3)

b) What happens if the metal ring in the above case is cut so as not to form a complete loop?

16. (a) A ray of light is incident normally on the face AB of a right-angled glass prism of refractive index ${}_a\mu_g$=1.5. The prism is partly immersed in a liquid of unknown refractive index. Find the value of refractive index of the liquid so that the ray grazes along the face BC after refraction through the prism.



(b) Trace the path of the rays if it were incident normally on the face AC (3)

17. Explain, with the help of suitable diagram, the two important processes that occur during the formation of p-n junction. Hence define the terms: depletion region and barrier potential.

OR

A potential difference V is applied across a conductor of length L and diameter D. How is the drift velocity, vd, of charge carriers in the conductor affected when (i) V is halved, (ii) L is doubled and (iii) D is halved? Justify your answer in each case. (3)

18. Define the activity of a radioactive sample. Write its S.I. unit. A radioactive sample has activity of 10,000 disintegrations per second (dps) after 20 hours. After next 10 hours its activity reduces to 5,000 dps. Find out its half-life and initial activity. (3)

19. a) Show that the average power consumed in an inductor L connected to an a.c. source is zero. (3)

(b) In a series LR circuit, $X_L = R$ and the power factor of the circuit is P_1. When a capacitor with capacitance C such that $X_C = X_L$ is put in series, the power factor becomes P_2. Find out P_1 / P_2.

20. A radio can tune over the frequency range of a portion of MW broadcast band: (800KHz to 1200 KHz). If its LC circuit has an effective inductance of 200μH, what must be the range of its variable capacitor? (3)

21. (i) A giant refracting telescope has an objective lens of focal length 15 m. If an eye piece of focal length 1.0 cm is used, what is the angular magnification of the telescope?

(ii) If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens? The diameter of the moon is 3.48×10^6 m and the radius of lunar orbit is 3.8×10^8 m. (3)

22. Draw a block diagram of simple modulator for obtaining amplitude modulated signal. (3)
A carrier wave of peak voltage 12 V is used to transmit a message signal. What should be the peak voltage of the modulating signal in order to have a modulation index of 75%?

23. Suresh was facing some disturbance in the network while using his internet connection. He checked the connections as well as the device, but could not find a fault. Then he discussed the problem with his friend Lakshay. Lakshay checked the connecting wire and found a fault. He explained that metallic mesh on the wire was removed due to which signals were distorted. (4)

a) Why are the wires wrapped with metallic mesh?
b) Why copper wire is laminated with a dielectric?
c) What values are displayed by Lakshay?

24. a) Draw a labeled ray diagram of an astronomical telescope to show the image formation of a distant object. Write the main considerations required in selecting the objective and eyepiece lenses in order to have large magnifying power and high resolution of the telescope.

b) A compound microscope has an objective of focal length 1.25 cm and eyepiece of focal length 5 cm. A small object is kept at 2.5 cm from the objective. If the final image formed is at infinity, find the distance between the objective and the eyepiece.

OR

a) Write three characteristic features to distinguish between the interference fringes in Young's double slit experiment and the diffraction pattern obtained due to a narrow single slit.

(b) A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is a distance of 2.5 mm away from the centre. Find the width of the slit. (5)

25. (a) Deduce an expression for the frequency of revolution of a charged particle in a magnetic field and show that it is independent of velocity or energy of the particle.

(b) Draw a schematic sketch of a cyclotron. Explain, giving the essential details of its construction, how it is used to accelerate the charged particles.

OR

(a) Draw a labeled diagram of a moving coil galvanometer. Describe briefly its principle and working.

(b) Answer the following:

(i) Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer?

(ii) Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity. Explain, giving reason. (5)

26.(a)Using Bohr's postulates, derive the expression for the total energy of the electron in the stationary states of the hydrogen atom.

(b) Using Rydberg formula, calculate the wavelengths of the spectral lines of the first member of the Lyman series and of the Balmer series.

OR

(a) Define the terms (i) half-life (T1/2) and (ii) average life (λ). Find out their relationships with the decay constant.

(b) A radioactive nucleus has a decay constant λ= 0.3465 (day)–1. How long would it take the nucleus to decay to 75% of its initial amount ? (5)
