Class: XII
SESSION : 2022-2023
SAMPLE QUESTION PAPER (THEORY)
SUBJECT: PHYSICS

Maximum Marks: 70 Marks Time Allowed: 3 hours.

General Instructions:

(1) There are 35 questions in all. All questions are compulsory

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.

(3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study-based questions of 4 marks each.

(4) There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.

5. Use of calculators is not allowed.

SECTION A

Q1. Which of the following is NOT the property of equipotential surface?

(i) They do not cross each other.

(ii) The rate of change of potential with distance on them is zero.

(iii) For a uniform electric field they are concentric spheres.

(iv) They can be imaginary spheres.

Q2. Two point charges +8q and -2q are located at x=0 and x=L respectively. The point on x axis at which net electric field is zero due to these charges is-

(i) 8L

(ii) 4L

(iii) 2 L

(iv) L

Q3. The best instrument for accurate measurement of EMF of a cell is-

(i) Potentiometer

(ii) metre bridge

(iii) Voltmeter

(iv) ammeter and voltmeter

Q4 An electric current is passed through a circuit containing two wires of same material, connected in parallel. If the lengths and radii of the wires are in the ratio of 3:2 and 2:3, then the ratio of the current passing through the wire will be

(i) 2:3
ii) 3:2
iii) 8:27
(iv) 27:8

Q5. The SI unit of magnetic field intensity is

(i) AmN^{-1}
(ii) $NA^{-1}m^{-1}$
(iii) $NA^{-2}m^{-2}$
(iv) $NA^{-1}m^{-2}$

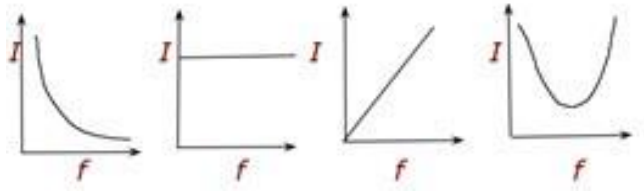
Q6. The coil of a moving coil galvanometer is wound over a metal frame in order to

(i) reduce hysteresis
(ii) increase sensitivity
(iii) increase moment of inertia
iv) provide electromagnetic damping

Q7. Nuclear force is a _____ and _____ force.

(A) Strong, long-range
(B) Strong, short range
(C) Weak, long-range
(D) Weak, short-range

Q8. Which of the following graphs represent the variation of current(I) with frequency (f) in an AC circuit containing a pure capacitor?



A B C D

Q 9. A car is moving with at a constant speed of 60 km h^{-1} on a straight road. Looking at the rear-view mirror, the driver finds that the car following him is at a distance of 100 m and is approaching with a speed of 5 km h^{-1}. In order to keep track of the car in the rear, the driver begins to glance alternatively at the rear and side mirror of his car after every 2 s till the other car overtakes. Which of the following statement(s) is/are correct?

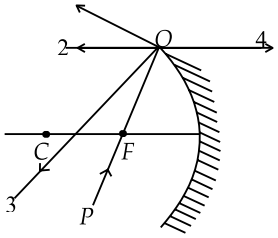
(A) The speed of the car in the rear is 65 km/h.

(B) In the side mirror the car in the rear would appear to approach with a speed of 5 km h^{-1} to the driver of the leading car.

(C) In the rear view mirror the speed of the approaching car would appear to decrease as the distance between the cars decreases.

(D) In the side mirror, the speed of the approaching car would appear to increase as the distance between the cars decreases.

Q10. The direction of ray of light incident on a concave mirror is shown by PQ while directions in which the ray would travel after reflection is shown by four rays marked 1, 2, 3 and 4 (Figure). Which of the four rays correctly shows the direction of reflected ray?



A) 1
(B) 2
(C) 3
(D) 4

Q11. In a concave mirror, an object is placed at a distance x_1 from the focus. Image if formed at a distance x_2 from the focus. The focal length of the mirror is

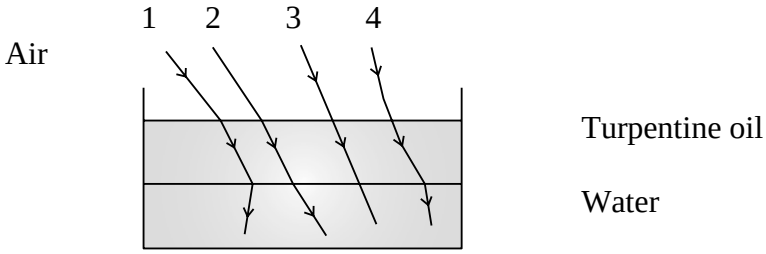
(A) x_1x_2.

(B) $x_1 + x_2$.

(C) x_1/x_2.

(D) None of these

Q12. The optical density of turpentine is higher than that of water while its mass density is lower. Figure shows a layer of turpentine floating over water in a container. For which one of the four rays incident on turpentine in Figure, the path shown is correct?



(A) 1

(B) 2

(C) 3

(D) 4

Q13. Threshold wavelength of a photoelectric emission from a material is 600 nm. Which of the following illuminating source will emit photoelectrons?

(A) 400 W, infrared lamp

(B) 10 W, ultraviolet lamp

(C) 100 W, ultraviolet lamp

(D) Both (B) & (C)

Q14. Consider a beam of electrons (each electron with energy E_0) incident on a metal surface kept in an evacuated chamber. Then,

(A) no electrons will be emitted as only photons can emit electrons.

(B) electrons can be emitted but all with an energy, E_0.

(C) electrons can be emitted with any energy, with a maximum of $E_0 – Ø$ (Ø is the work function).

(D) electron can be emitted with energy, with a maximum of E_0.

Q15. Two H atoms in the ground state collide inelastically. The maximum amount by which their combined kinetic energy is reduced, is

(A) 10.20 eV. (B) 20.40 eV.

(C) 13.6 eV. (D) 27.2 eV.

Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

a) Both A and R are true and R is the correct explanation of A

b) b Both A and R are true and R is NOT the correct explanation of A

c) c) A is true but R is false

d) d) A is false and R is also false

Q16. Assertion (A): Resolving power of electron microscope increases as electron is accelerated through higher voltage.

Reason (R): de-Broglie wavelength of electron decreases as accelerating voltage of electron increases.

Q17. Assertion (A): Silicon is preferred over Germanium for making semiconductor devices.
Reason (R): The energy gap of Germanium is more than the energy gap of Silicon.

Q18. Assertion (A): Semiconductors do not obey Ohm's law.
Reason (R): V-I characteristic of semiconductors is linear.

SECTION B

Q19. A point charge is placed at the centre of spherical Gaussian surface. How will electric flux ϕ_E change if

(i) The sphere is replaced by a cube of same or different volume,

(ii) A second charge is placed near, and outside, the original sphere,

(iii) A second charge is placed inside the sphere, and

(iv) The original charge is replaced by an electric dipole?

Q20. . Explain how electron mobility changes for a good conductor when (i) the temp of the conductor is decreased at constant potential difference, and (ii) applied potential difference is doubled at constant temp?

Q21. Cosmic rays are charged particles that bombard earth's atmosphere from outer space. Why do the north and south magnetic poles of earth receive more low energy cosmic rays than the magnetic equator?

Q22. Consider interference between waves from two sources of intensities I and 4I . Find the intensities at points where the phase difference is (a) 0 (b) π /2 and (c) π .

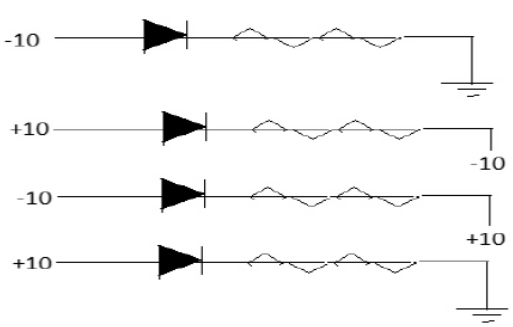
Q23. What is the effect on the velocity of the photoelectrons if the wavelength of incident light is decreased?

Q24. A radioactive nucleus 'A' undergoes a series of decays according to the following scheme:

$$A \xrightarrow{\alpha} A_1 \xrightarrow{\beta} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{\gamma} A_4$$

The mass no. and atomic no. of A are 180 and 72 respectively. What are these numbers for A_4?

Q25. In the following diagrams, write which of the diodes are forward biased and which are reverse biased.



SECTION C

Q26. . What is a rectifier? With the help of a labelled circuit diagram, explain the working of a full wave rectifier. Draw the input and output wave forms.

Q27. A neutron is absorbed by a $_3Li^6$ nucleus with subsequent emission of an alpha particle, write the corresponding nuclear reaction. Calculate the energy released in this reaction.
Given that m ($_3Li^6$) = 6.015126 a.m.u. ; m ($_2He^4$)=4.002604 a.m.u.; m($_on^1$) = 1.008665 a.m.u. , m($_1H^3$) = 3.016049 a.m.u.

Q28. What do electromagnetic waves consists of? Explain as what factors does its velocity in vacuum depend? Suppose that the electric field part of an electromagnetic wave in vacuum is

$$E = [(3.1 \times 10^4 \text{ N/C}) \cos \{(1.8 \text{ rad/m}) y + (5.4 \times 10^6 \text{ rad/s}) t\}]\hat{i}.$$

(i) What is the frequency?

(ii) What is the wavelength?

(iii) Write an expression for the magnetic field part of the wave.

(iv) In which direction is the wave travelling?

Q29. Classify the material as per the properties given below:-

i) Induced Dipole Moment (M) is a large + ve value.

ii) Intensity of Magnetisation (I) has a small – ve value.

iii) They obey Curie's Law. They lose their magnetic properties with rise in temperature.

iv) rod is freely suspended in a uniform magnetic field, it aligns itself in a direction perpendicular to the field.

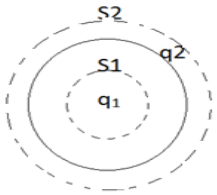
v) Alkaline earth metals, Nickel, Gold, Silver

vi) B>H, B<H

Q30. A 10 m long potentiometer wire of resistance 20Ω is connected in series with 5V battery & external resistance of 480Ω. If an unknown emf E is balanced at 600cm of this wire find (a)potential gradient (b)value of unknown emf E

SECTION D

Q31. (i) If + 5 μC charges are placed at the center of a sphere of radius 5 cm. Calculate:
(a) Flux through the sphere,
(b) If the radius of the sphere is doubled, finds new flux through the sphere.
(ii) Find the ratio of flux passing through sphere S_1 and S_2 in respect of given figure.



OR

State Gauss' law in electrostatics. Find electric field due to infinitely charged long straight uniformly charged wire of linear charge density λ at a given point using Gauss' law. Draw 'E' vs distance.

Q32. State the Biot - Savart law for the magnetic field due to a current carrying element. Use this law to obtain a formula for magnetic field at the centre of a circular loop of radius R carrying a steady current I. Sketch the magnetic field lines for a current loop clearly indicating the direction of the field

OR

a) Obtain the expression for the deflecting torque acting on the current carrying rectangular coil of a galvanometer in a uniform magnetic field. Why is a radial magnetic field employed in the moving coil galvanometer ?

(b) Particles of mass 1·6 × 10–27 kg and charge 1·6 × 10–19 C are accelerated in a cyclotron of dee radius 40 cm. It employs a magnetic field 0·4 T. Find the kinetic energy (in MeV) of the particle beam imparted by the accelerator.

Q33. (a) Derive the expression for fringe width in Young's double slit experiment.
(b) Explain the effect on fringe width when:

(i) The separation between the slits is increased
(ii) The screen is moved away from the slits
(ii) The monochromatic source is replaced by the monochromatic source of smaller wavelength
(iv) The monochromatic source is replaced by white light.

OR

(a) State and explain Huygen's principle.
(b) Draw the wave front that corresponds to a beam of light; (i) coming from a very far off source(ii) diverging radically from a point.
Deduce the law of refraction on the basis of Huygen's principle.

SECTION E

Q34. Bottle Dynamo:

A bottle dynamo is a small generator to generate electricity to power the bicycle light.

It is not a dynamo. Dynamo generates *DC* but a bottle dynamo generates *AC*. Newer models are now available with a rectifier. The available *DC* can power the light and small electronic gadgets. This is also known as sidewall generator since it operates using a roller placed on the sidewall of bicycle tyre. When the bicycle is in motion, the dynamo roller is engaged and electricity is generated as the tyre spins the roller. When engaged, a dynamo requires the bicycle rider to exert more effort to maintain a given speed than would otherwise be necessary when the dynamo is not present or disengaged.

Bottle dynamos can be completely disengaged during day time when cycle light is not in use. In wet conditions, the roller on a bottle dynamo can slip against the surface of the tyre, which interrupts the electricity generated. This cause the lights to go out intermittently.

1) Can you recharge the battery of your mobile phone with the help of bottle dynamo ?
2) State the principle of dynamo.
3) Write down two advantages of newer model of bottle dynamo ?

Or

Derive an expression for induced emf in a dynamo if N be the no. of turns, B be the magnetic field and A be area of coil.

Q35. Optical Fibre:

Optical fiber works on the principle of total internal reflection. Light rays can be used to transmit a huge amount of data, but there is a problem here – the light rays travel in straight lines. So unless we have a long straight wire without any bends at all, harnessing this advantage will be very tedious. Instead, the optical cables are designed such that they bend all the light rays' inwards (using TIR). Light rays travel continuously, bouncing off the optical fibre walls and transmitting end to end data. It is usually made of plastic or glass.

Modes of transmission: Single-mode fibre is used for long-distance transmission, while multi-mode fiber is used for shorter distances. The outer cladding of these fibres needs better protection than metal wires. Although light signals do degrade over progressing distances due to absorption and scattering. Then, optical Regenerator system is necessary to boost the signal.

Types of Optical Fibres: The types of optical fibers depend on the refractive index, materials used, and mode of propagation of light. The classification based on the refractive index is as follows:

- Step Index Fibres: It consists of a core surrounded by the cladding, which has a single uniform index of refraction.
- Graded Index Fibres: The refractive index of the optical fibre decreases as the radial distance from the fibre axis increases.

i) State the working principle of Optical fiber.

ii) What type of fibre is used for long distance transmission.

iii) Write down the essential conditions for total internal reflection.

Or

On the basis of TIR explain sparkling of diamond.