GATEWAY
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Delhi-NCR, Sonipat

- Mock Test
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- How to Select Perfect Course/College after 12th?

MOCK TEST-1

Class XII

PHYSICS

Programs at Gateway: B.Tech CSE | B.Tech CSE (AI & ML) | B.Pharm | B.Arch
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Class - XIITH

PHYSICS

MOCK EXAMS

Serial Number: 1

Time: 3 Hours

Maximum Marks: 70

Exam Date: _____

General Instructions:

(1) There are 33 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.

(3) All the sections are compulsory.

(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.

(5) There is no overall choice However, an internal choice has been provided in one question in Section B, one question in Section C, and all three questions in Section E. You have to attempt only one of the choices in such questions.

(6) Use of calculators is not allowed.

Section -A **(16x1=16)**

Q1. A particle of mass 10-3 kg and charge 5μC is thrown at a speed of 20m/s against a uniform electric field of strength $2x10^5$N/C. The distance travelled by particle before coming to rest is:

(a) 0.1 m (b)0.2 m (c)0.3 m (d) 0.4 m

Q2. Electric flux will be maximum when:

(a) electric field and area are perpendicular to each other

(b) electric field and area are parallel to each other

(c) electric field and area are at an angle other than 0° and 90°

(d) None of the above

Q3. In the current against voltage curve in Ohm's law, the slope gives

(a) resistance (b) conductance (c) resistivity (d) conductivity

Q4. A charged particle is released from a rest in a region having steady and uniform electric and magnetic fields. the two fields are parallel to each other, then the path of the particle will be:

(a)ellipse (b) circle (c)helix . (d) straight line

Q5. A series LCR circuit with R = 20Ω L = 1.5H and C = 35μF is connected to a variable frequency 200 V AC supply. When the frequency of the supply equals the natural frequency of the circuit, the average power transferred to the circuit in one complete cycle is:

(a) 200 W (b) 2000 W (c)100 W (d) 4000 W

Q6. The incorrect statement is.

(a) Electromagnetic waves are transverse

(b) Electromagnetic waves travel in vacuum with the speed of light

(c)The speed of electromagnetic waves in same in all the media

(d) Electromagnetic waves are emitted by an accelerated charge.

Q7. Choose the correct statement

C-I (waves)	C-II (Production)
(1) Infra-red	P . Rapid vibration of electrons in aerials
(2) Radio	Q . Electrons in atoms emit light when they move from higher to lower energy level.
(3) Light	R . Klystron valve
(4) Microwave	S . Vibration of atoms and molecules

(A) 1-P, 2-R, 3-S, 4-Q (B) 1-S, 2-P, 3-O, 4-R

(C) 1-Q, 2-P, 3-S, 4-R (D) 1-S. 2-R, 3-P, 4-Q

Q8. Given $_{a}n_{g} = 3/2$, $_{a}n_{w} = 4/3$ If a convex lens of focal length 10 cm is placed in water, then its focal length is water is

(a) 40cm (b) 20 (c) 10cm (d) none of these

Q9. The velocity of light in a medium is 120000 km/s. If the velocity of light in air is $3x10^{8}$m/s the refractive index of the medium is

(a)1.5 (b) 2.0 (c)2.5 (d) 3.0

Q10. Two wave with amplitudes in the ratio 1:2 interfere. The ratio of the maximum and minimum. Intensities of the bright and dark fringes is

(a)1:2 (b) 2:1 (c) 3:1 (d) 9:1

Q11. If the electron in the hydrogen atom jumps from second excited state to second orbit, the wavelength of radiations emitted in terms of Rydberg constant will be

(a)5R/36 (b) 5/36R (c)36/5R (d) none of these

Q12. For semiconductor, temperature coefficient of resistance is

(a) positive and finite (b)negative and finite (c) zero d. infinity

Questions number 13 to 16 are Assertion (A) & Reason (R) type questions. Two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (a), (b), (c) and (d) as given below.

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

(b) Both (A) & (R) are true, but (R) is not the correct explanation of (A).

(c) (A) is true, but (R) is false.

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

Q13. Assertion(A): To increase the range of an ammeter, we must connect a suitable high resistance in series to it.

Reason(R): The ammeter with increased range should have high resistance.

Q14. Assertion(A): The central fringe is bright or dark is depend upon the initial phase difference between the two coherence sources.

Reason(R): The pattern and position of fringes always remain same even after the introduction of transparent medium in a path of one of the slit.

Q15. Assertion (A): Paschen series lies in the infrared region.

Reason(R): Paschen series corresponds to the wavelength given by $1/\lambda = R[1/(3^2) - 1/(n^2)]$ where n = 4, 5, 6 …,infinity

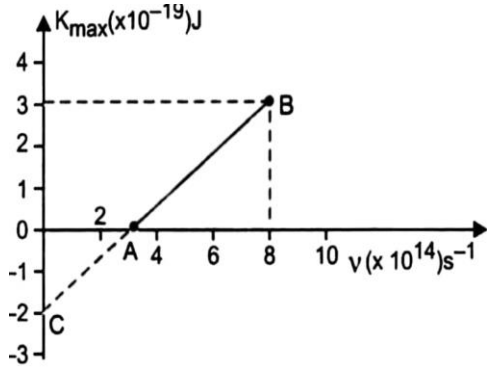
Q16. Assertion(A): Neutrons penetrate matter more readily as compared to proton.

Reason(R): Neutrons are slightly more massive than protons.

Section -B **(5x2=10)**

Q17. Suppose a pure Si-crystal has 5×10^{28} atoms m^{-3}. It is doped by 1ppm concentration of pentavalent As. Calculate the number of electrons and holes. Given that $n_i = 1.5 \times 10^{16}$ m^{-3}.

Q18.In an experiment on photo electric effect, the graph between maximum kinetic energy and frequency v of emitted photoelectron from metal surface is found to be a straight line as shown in Fig.



Calculate (a) threshold frequency

(b) work function of metal in electron volt

Q19. Double-convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 20cm?

OR

Find the ratio of intensities at two points in a screen in Young's double slit experiment, when waves from the two slits have path difference of (i) 0 and (ii) λ/4.

Q20. A storage battery of emf 8.0 V and internal resistance of 0.5 is being charged by a 120 V d.c. supply using a series resistor of 15.5 Ω What is the terminal voltage of the battery during charging?

Q21. Two long straight parallel conductors carry steady current I_1, and I_2, separated by a distance d. If the currents are flowing in the same direction, show how the magnetic field set up in one produces an attractive force on the other. Obtain the expression for this force.

Section -C (7X3=21)

Q22.Obtain an expression for the capacitance of a parallel plate capacitor, whose plates are partially filled by a dielectric medium. (3)

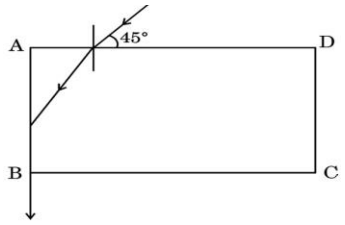
Q23. An infinitely long positively charged straight wire has a linear charge density λ. An electron is revolving in a circle with a constant speed such that the wire passes through the centre, and is perpendicular to the plane, of the circle. Find the kinetic energy of the electron in terms of magnitudes of its charge and linear charge density on the wire. Draw a graph of kinetic energy as a function of linear charge density λ.(3)

OR

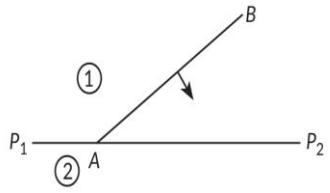
A molecule of a substance has a permanent electric dipole moment of magnitude 10^{-29} C m. A mole of this substance is polarised (at low temperature) by applying a strong electrostatic field of magnitude 10^6 V/ m. The direction of the field is suddenly changed by an angle of 60º. Estimate the heat released by the substance in aligning its dipoles along the new direction of the field. For simplicity, assume 100% polarisation of the sample. (3)

Q24.A small compass needle of magnetic moment 'M' is free to turn about an axis perpendicular to the direction of uniform magnetic field 'B'. The moment of inertia of the needle about the axis is 'I'. The needle is slightly disturbed from its stable position and then released. Prove that it executes simple harmonic motion. Hence deduce the expression for its time period. (3)

Q25. In the figure, a ray of light is incident on a transparent liquid contained in a thin glass box at an angle of 45° with its one face. The emergent ray passes along the face AB. Find the refractive index of the liquid. (3)

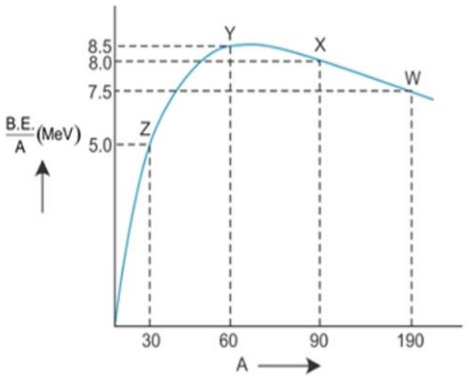


Q26. Define the term 'wavefront of light'. A plane wave front AB propagating from denser medium (1) into a rarer medium (2) is incident on the surface P_1P_2 separating the two media as shown in figure. Using Huygens' principle, draw the secondary wavelets and obtain the refracted wavefront in the diagram. (3)



Q27(a). The radius of innermost electron orbit of a hydrogen atom is 5.1×10^{-11} m. What is the radius of orbit in the second excited state? (1)

(b). Binding energy per nucleon vs mass number curve for nuclei is shown in the figure. W, X, Y and Z are four nuclei indicated on the curve. Identify which of the following nuclei is most likely to undergo (i) Nuclear Fission (ii) Nuclear Fusion. Justify your answer.



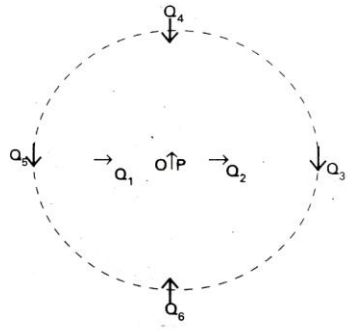
Q28. Draw the circuit diagram of a full wave rectifier and explain its working. Also give the input and output waveforms. (3)

Section -D **(2x4=8)**

Case Study based Questions: -

Q29. Read the following paragraph and answer the questions that follow: -

Figure shows a small magnetised needle P placed at a point O. The arrow shows the direction of its magnetic moment. The other arrows show different positions (and orientations of the magnetic moment) of another identical magnetised needle Q.



(i).In which configuration the system is not in equilibrium?

(a)PQ_1 (b)PQ_2 (c)PQ_3 (d) Both a and b

(ii).In which configuration is the system in stable equilibrium.

(a)PQ_1 (b)PQ_6 (c)PQ_2 (d) None of these

(iii).In which configuration is the system in unstable equilibrium.

(a)PQ_4 (b)PQ_6 (c)PQ_2 (d) None of these

(iv).Which configuration corresponds to the lowest potential energy among all the configurations shown?

(a)PQ_4 (b)PQ_6 (c)PQ_2 (d) None of these

Q30. Read the following paragraph and answer the questions that follow: -

In 1924, French physicist Louis de Broglie proposed a revolutionary idea: matter, like light, exhibits both wave-like and particle-like properties. This concept, known as wave-particle duality, was a cornerstone in the development of quantum mechanics. De Broglie derived a relation between the momentum (p) of a particle and its wavelength (λ). $\lambda = h/p$, where h is Planck's constant (6.626×10^{-34} J·s)

(i) Calculate the de Broglie wavelength of an electron moving with a velocity of 10^6 m/s. (mass of electron = 9.1×10^{-31} kg)

(a) 7.25×10^{-11} m (b)3.63×10^{-10} m

(c) 1.45×10^{-12} m (d) 2.90×10^{-13} m

(ii) The de Broglie wavelength associated with an electron, accelerated through a potential difference of 100 volts?

(a) 0.123nm (c) 1.227nm

(b) 0nm (d) 12.3nm

(iii) The de Broglie wavelength λ of a molecule of mass m having thermal kinetic energy KT is

(a) $\lambda = h/2mKT$ (b) $\lambda = h/\sqrt{(2mKT)}$

(b) (c) $\lambda = h/(2mKT)^{⅔}$ (d) $\lambda = h/(2mKT)^2$

(iv) An electron, an α-particle, and proton have the same kinetic energy which of these particles has the shortest de Broglie wavelength?

(a) α-particle (b) proton

(c) electron (d) all have same wavelength

Section - E (2x4=8)

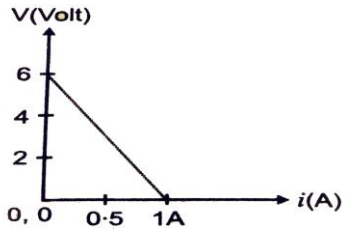
Q31(a).State and explain Kirchhoff's Law. (2)

(b).Use Kirchhoff's rules to obtain the balance condition in a Wheatstone bridge. (3)

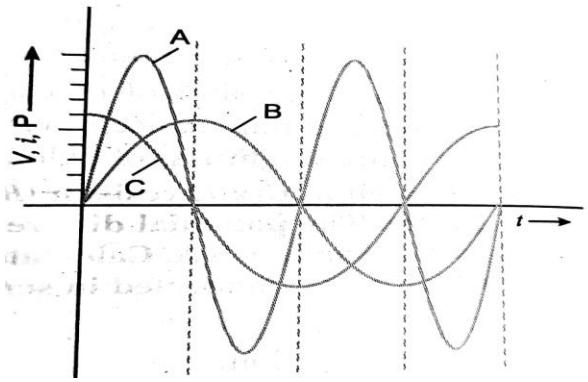
OR

(a).Two cells of emf E1 and E2 have their internal resistances r1 and r2 respectively. Deduce an expression for the equivalent emf and internal resistance of their parallel combination when connected across an external resistance R. Assume that the two cells are supporting each other. (3)

(b).The plot of the variation of potential difference across a combination of three identical cells in series, versus current is shown alongside. What is the emf and internal resistance of each cell? (2)



Q32(a).A device 'X' is connected to an ac source. The variation of voltage, current and power in one complete cycle is shown in the figure.



(i) Identify the device 'X'. (0.5)

(ii) Which of the curves, A, B and C represent the voltage, current and the power consumed in the circuit? Justify your answer. (1.5)

(iii) How does its impedance vary with frequency of the ac source? Show graphically. (1)

(iv) Obtain an expression for the current in the circuit and its phase relation with ac voltage. (2)

OR

(a). What is induced emf? Write Faraday's law of electromagnetic induction. Express it mathematically. (2)

(b) A conducting rod of length 'P', with one end pivoted, is rotated with a uniform angular speed 'ω' in a vertical plane, normal to a uniform magnetic field 'B'. Deduce an expression for the emf induced in this rod. (3)

Q33(a). Two harmonic waves of monochromatic light $y_1 = a\cos\omega t$ and $y_2 = a\cos(\omega t+\Phi)$ are superimposed on each other. Obtain the expression for the resultant intensity at that point. (3)

(b). A beam of light consisting of two wavelengths, 800 nm and 600 nm is used to obtain the interference fringes in a Young's double slit experiment on a screen placed 1.4 m away. If the two slits are separated by 0.28 mm, calculate the least distance from the central bright maximum where the bright fringes of the two wavelengths coincide. (2)

OR

(a). What is an astronomical telescope? Deduce expression for magnifying power when the final image is formed at least distant of vision. (3)

(b). Derive an expression for the e refractive index of the material of a prism in terms of the Is angle of prism and the angle of minimum deviation. (2)

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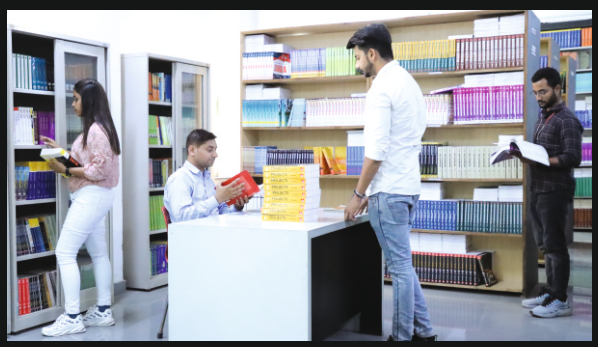

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