Roll No.
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PRACTICE BOARD EXAMINATION 2025

Class 12th Physics (Theory)

Time allowed: 3 hours *Maximum marks: 70*

General Instructions:

(1) There are 33 questions in all. All questions are compulsory.
(2) 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.

SECTION A

Q.1> An electric dipole consisting of charges + q and – q separated by a distance L is in stable equilibrium in a uniform electric field E. The electrostatic potential energy of the dipole is
(A) qLE (B) –qLE (C) Zero (D) None of these

Q.2> Two resistors R1 and R2 of 4Ω and 6 Ω are connected in parallel across a battery. The ratio of power dissipated in them, P1: P2 will be
(A) 4:6 (B) 6:4 (C) 16:36 (D) None of these

Q.3> The magnetic dipole moment of a current carrying coil does ***not*** depend upon
(A) number of turns of the coil. (B) cross-sectional area of the coil.
(C) current flowing in the coil. (D) material of the turns of the coil.

Q.4> Larger aperture of objective lens in an astronomical telescope
(A) increases the resolving power of telescope. (B) decreases the brightness of the image.
(C) increases the size of the image. (D) decreases the length of the telescope.

Q.5> For a glass prism, the angle of minimum deviation will be smallest for the light of
(A) red colour. (B) blue colour. (C) yellow colour. (D) green colour.

Q.6> Photons of energies 1 eV and 2 eV are successively incident on a metallic surface of work function 0·5 eV. The ratio of kinetic energy of most energetic photoelectrons in the two cases will be
(A) 1 : 2 (B) 1 : 1 (C) 1 : 3 (D) 1 : 4

Q.7> In the core of a transformer, laminated iron sheets are used to minimize
(A) Flux leakage (B) Hysteresis (C) Voltage loss (D) Eddy current

Q.8> A capacitor is charged by a battery. Between the plates, during process of charging :
(A) only displacement current exists. (B) only conduction current exists.
(C) both displacement current and conduction current exist. (D) no current exists.

Q.9> For the forward biasing of a p-n junction diode, which of the following statements is not correct ?
(A) The potential barrier decreases. (B) Minority carrier injection occurs.
(C) Width of depletion layer increases. (D) Forward current is due to the diffusion of both holes and electrons.

Q.10> At a certain temperature in an intrinsic semiconductor, the electrons and holes concentration is $1{\cdot}5\ 10^{16}$ m 3. When it is doped with a trivalentdopant, hole concentration increases to $4{\cdot}5\ 10^{22}$ m 3. In the doped semiconductor, the concentration of electrons (n_e) will be: (in per m^3)
(a) $3x10^6$ (b) $5x10^7$ (c) $5x10^9$ (d) $6{\cdot}75x10^{38}$

Q.11> In a single-slit diffraction experiment, the width of the slit is halved. The width of the central maximum, in the diffraction pattern, will become:
(A) half (B) twice (C) four times (D) one-fourth

Q.12> An inductor, a capacitor and a resistor are connected in series across an ac source of voltage. If the frequency of the source is decreased gradually, the reactance of :
(A) both the inductor and the capacitor decreases. (B) inductor decreases and the capacitor increases.
(C) both the inductor and the capacitor increases. (D) inductor increases and the capacitor decreases.

Questions number 13 to 16 are Assertion (A) and 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 Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is notthe correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false and Reason (R) is also false.

Q.13> Assertion (A) : If radius of circular loop carrying steady current is doubled, magnetic moment becomes four times.
Reason (R): The magnetic moment of a circular loop carrying a steady current is proportional to the area of the loop.

Q.14> Assertion (A) : A current carrying square loop made of a wire of length L is placed in a magnetic field. It experiences a torque which is greater than the torque on a circular loop made of the same wire carrying the same current in same field
Reason (R) : A square loop occupies more area than a circular loop, both made of wire of the same length.

Q.15> Assertion (A) : The speed of light decreases when it passes from air into a denser medium.
Reason (R) : The speed of light in a denser medium is given by $c\mu$, where c is the speed of light in air and is μ the refractive index of the denser medium.

Q.16> Assertion (A) : When three electric bulbs of power 200 W, 100 W and 50 W are connected in series to a source, the power consumed by the 50 W bulb is maximum.
Reason (R) : In series circuit, current is the same through each bulb, but the potential difference across each bulb is different.

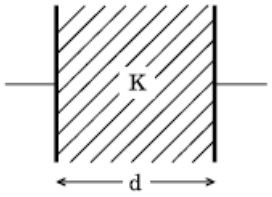
SECTION B

Q.17> A particle of charge q and mass m starts moving with uniform velocity V_o along x axis. Specify the direction of magnetic field which should be set up in the region so that the particle moves
(a) straight undeviated, and (b) in a circle and (c) In a helix. Justify your answers.

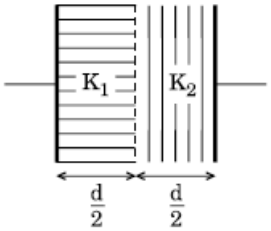
Q.18> Name the electromagnetic waves which are produced by the following:
(i) Radioactive decays of nucleus (ii) Hot bodies. Write one use each of these waves.

Q.19> What are matter waves ? A proton and an alpha particle are accelerated through the same potential difference. Find the ratio of the de Broglie wavelength associated with the proton to that with the alpha particle.

Q.20> The space between the plates of a parallel plate capacitor is completely filled in two ways. In first case, it is filled with a slab of dielectric constant K. In the second case, its filled with two slabs of equal thickness and dielectric constants K1 and K2 respectively as shown in the figure. The capacitance of the capacitor is same in the two cases. Obtain the relationship between K, K1 and K2.



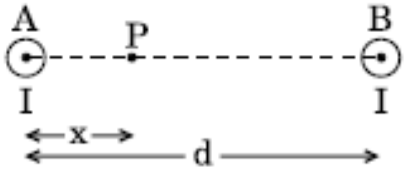
(Case 1)



(Case 2)

Q.21> What is the effect on the interference fringes in Young's double slit experiment due to each of the following operations ? Justify your answers.
(a) The screen is moved away from the plane of the slits.
(b) The source slit is moved closer to the plane of double slit.

SECTION C



Q.22> Two long straight parallel wires A and B separated by a distance d, carry equal current I flowing in same direction as shown in the figure.
(a) Find the magnetic field at a point P situated between them at a distance x from one wire.
(b) Show graphically the variation of the magnetic field with distance x for $0 < x < d$.

Q.23> The nucleus $^{238}Y_{92}$, initially at rest, decays into $^{234}X_{90}$ by emitting alpha-particle. The binding energies per nucleon of the parent nucleus, the daughter nucleus and alpha-particle are 7·8 MeV, 7·85 MeV and 7·05 MeV, respectively. Assuming the daughter nucleus to be formed in the unexcited state and neglecting its share in the energy of the reaction, find
(a) Q value (b) Speed of the emitted alpha-particle. (Mass of alpha-particle = $6{\cdot}68 \times 10^{-27}$kg)

Q.24> In Geiger-Marsden experiment, calculate the distance of closest approach for an alpha particle with energy $2{\cdot}56\ 10^{-12}$ J. Consider that the particle approaches gold nucleus (Z = 79) in head-on position.
(b) If the experiment is repeated with a proton of same energy, then what will be the value of distance of closest approach ?

Q.25> Draw the energy band diagrams of n-type and p-type semiconductor at 0K and mention 2 differences between them.
(b) Derive the expression for the conductivity of a semiconductor in terms of the mobility of carriers. Which of them out of n type or p type has higher conductivity at room temperature and why?

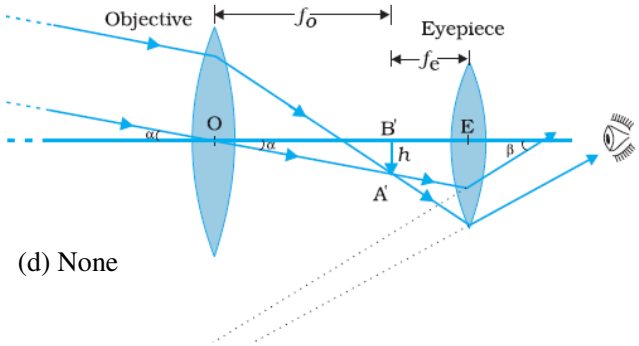
Q.26> Use the mirror equation to deduce that:
(a) A convex mirror always produces a virtual image independent of the location of the object.
(b) The virtual image produced by convex mirror is always diminished and is located between the focus and the pole.

Q.27> State Vector form of Ohm's law
(b) Draw the graph for any 2 non ohmic conductors and explain why their behavior is termed as non-ohmic

Q.28> Mention 2 properties of magnetic field lines out of which one should be similar to electric field lines and the other one should be different from electric field lines.
(b) Draw the magnetic field lines of a straight current carrying conductor carrying current into the plane of the paper clearly showing the direction of current and magnetic field. Are these lines equidistant?
(c) Are there any poles associated with these magnetic field lines? Is is necessary that every magnetic field should have a north and south pole?

SECTION D

Q.29> The telescope is used to provide angular magnification of distant objects. It has an objective and an eyepiece. The objective has a large focal length and a much larger aperture than the eyepiece. Light from a distant object enters the objective and a real image is formed in the tube at its second focal point. The eyepiece magnifies this image producing a final inverted image. The main considerations with an astronomical telescope are its light gathering power and its resolution or resolving power.
The former clearly depends on the area of the objective. With larger diameters, fainter objects can be observed. The resolving power, or the ability to observe two objects distinctly, which are in very nearly the same direction, also depends on the diameter of the objective. So, the desirable aim in optical telescopes is to make them with objective of large diameter. The largest lens objective in use has a diameter of 40 inch



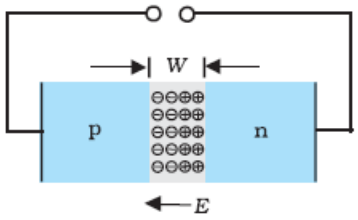
(i) A telescope uses an objective of focal length 50cm and an eyepiece of focal length 5cm. The tube length in case of normal adjustment is
(A) 50cm (B) 55cm (C) 325/6 cm (d) None

(ii) A telescope uses an objective of focal length 50cm and an eyepiece of focal length 5cm. The tube length in case of near point adjustment is
(A) 50cm (B) 55cm (C) 325/6 cm (d) None

(iii) Which of the given statements is not correct
(A) Refracting telescope are bulky and difficult to handle
(B) The defect of chromatic aberration can be prevented by using a telescope made of large aperture
(C) The Cassegrain telescope uses a parabolic objective mirror
(D) The intermediate image in a refracting telescope is real and enlarged

(iv) The resolving power of a telescope can be significantly increased by
(A) Using an objective of large diameter
(B) Using an objective of small diameter
(C) Using an eye piece of large diameter
(D) Using an eye piece of small diameter

Q.30> A p-n junction is the basic building block of many semiconductor devices like diodes, transistor, etc. A clear understanding of the junction behavior is important to analyse the working of other semiconductor devices. Consider a thin p-type silicon (p-Si) semiconductor wafer. By adding precisely a small quantity of pentavelent impurity, part of the p-Si wafer can be converted into n-Si. There are several processes by which a semiconductor can be formed. The wafer now contains p-region and n-region and a metallurgical junction between p-, and n- region. A semiconductor diode is basically a p-n junction with metallic contacts provided at the ends for the application of an external voltage. It is a two terminal device.



(i) The depletion region of a pn junction is
(A) Positively charged on p side and negatively charged on n side
(B) Completely neutral
(C) Positively charged on n side and negatively charged on p side
(D) None of these

(ii) Which statement is correct for an unbiased pn junction
(A) Magnitude of drift and diffusion currents is equal
(B) Magnitude of drift current is higher
(C) Magnitude of diffusion current is higher
(D) Both currents are equal to zero

(iii) The band gap of silicon is around
(A) 0.5eV (B) 0.7eV (C) 1.1eV (D) 1.5eV

(iv) Which of these wavelengths will be able to excite an electron from VB to CB in silicon
(A) 2200nm (B) 1800nm (C) 1100nm (D) None

SECTION E

Q.31> State Gauss theorem and using it derive the electric field inside, outside and on the surface of a charged shell of radius R.
(b) Draw a graph showing the variation of E versus r where r is the distance from the centre
(c) Explain why it is safe inside an aero plane which is flying through lightening clouds

Q.32> Using a neat and labeled diagram explain the construction and working of a moving coil galvanometer.
(b) Explain the usefulness of the radial magnetic field. How is this field produced?
(c) Explain a method by which both the current sensitivity and voltage sensitivity of the galvanometer can be increased

Q.33> State the two kirchoff's laws used to study electrical circuits.
(b) In the adjacent circuit, find the value of I and R if its known that no current flows in the resistor R1
(c) Find the potential drop between A and D