PHYSICS

Question Bank

Bihar Board

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PHYSICS-XII

2016

PHYSICS

Section-I (Objective Type)

Time : 1 Hour 10 Minutes] [Marks : 28

Instructions to the Candidates :

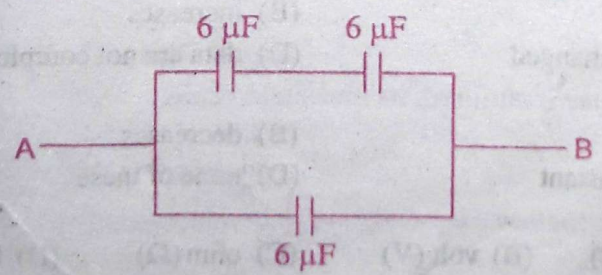
1. Fill in your Roll No. in the space provided on the first page of this question paper.
2. This question paper consists of **28** objective type questions. Total marks allotted is **28.**
3. The candidate has to answer all the questions in the **OMR** Answer-Sheet provided along with this question paper.
4. Before answering the candidate has to ensure that the **OMR** Answer-Sheet is available along with the question paper.
5. All entries must be confined to the area provided in the **OMR** Answer-Sheet.
6. Answer all the questions by completely darkening the circles against the question numbers in the **OMR** Answer-Sheet using Black/Blue Ball point pen only.
7. Do not fold or make any stray marks on the OMR Answer Sheet, failing which it would be difficult to eyaluate the Answer Sheet.
8. Read all the instructions provided in the OMR Answer-Sheet carefully before answering. After you finish answering, hand over the OMR Answer-Sheet to the Invigilator. You are permitted to carry the question paper only along with you.

For the following Question Nos. 1 to 28 there is only one correct answer against each question. For each question, mark the correct option on the answer sheet. $28 \times 1 = 28$

1. **The torque acting on electric dipole of diopole moment $\vec{p}$ placed in electric field of intensity $\vec{E}$**

(A) $\vec{p} \times \vec{E}$ (B) $\vec{p} \cdot \vec{E}$ (C) pE (D) $\vec{p} / \vec{E}$

2. **The equivalent capacity between A and B in the given figure is**



(A) 6 μF (B) 18 μF (C) 9 μF (D) $\frac{1}{9}$ μF

3. The power of electric circuit is
(A) $V \cdot R$ (B) $V^2 \cdot R$ (C) V^2 / R (D) $V^2 \cdot RI$

4. Dimension of magnetic field is
(A) $I^{-1}ML^0T^{-2}$ (B) I^0MLT^{-2} (C) $IMLT^{-1}$ (D) $IM^{-1}L^{-1}T^{-2}$

5. Lenz's law is associated with
(A) charge (B) mass
(C) energy (D) principle of conservation of momentum

6. The power factor of L-R circuit is
(A) $R + WL$ (B) $\frac{R}{\sqrt{R^2 + W^2L^2}}$
(C) $R\sqrt{R^2 + W^2L^2}$ (D) WL / R

7. When the intensity of magnetic field is increased four times, the time-period of suspended magnetic needle becomes
(A) double (B) half
(C) four times (D) one-fourth less

8. The final image in astronomical telescope is
(A) real and erect (B) real and inverted
(C) virtual and inverted (D) virtual and erect

9. β-rays are deflected in
(A) gravitational field (B) only in magnetic field
(C) only in electric field (D) both in magnetic and electric fields

10. The Boolean expression for NOR gate is
(A) $\overline{A \cdot B} = Y$ (B) $A + B = Y$ (C) $A \cdot B = Y$ (D) $\overline{A + B} = Y$

11. 64 identical drops each of capacity 5 μF combine to form a big drop. What is the capacity of big drop?
(A) 25 μF (B) 4 μF (C) 164 μF (D) 20 μF

12. The algebraic sum of all currents meeting at a point in an electrical circuit is
(A) zero (B) infinite (C) positive (D) negative

13. Dimension of electromotive force (emf) is
(A) ML^2T^{-2} (B) $ML^2T^{-2}I^{-1}$ (C) MLT^{-2} (D) $ML^2T^{-3}I^{-3}$

14. Ampere-hour is unit of
(A) power (B) charge (C) energy (D) potential difference

15. The unit of reactance is
(A) mho (B) ohm (C) farad (D) ampere

16. When a ray of light enters a glass slab, its wavelength
(A) decreases (B) increases
(C) remains unchanged (D) data are not complete

17. When an ammeter is shunted, its measuring range
(A) increases (B) decreases
(C) remains constant (D) none of these

18. SI unit of self-inductance is
(A) coulomb (C) (B) volt (V) (C) ohm (Ω) (D) henry (H)

19. Hot wire ammeter measures
(A) peak value of ac (B) average value of ac
(C) rms ac (D) none of these

20. If N_1 and N_2 are numbers of primary and secondary coils of a step-up transformer, then

(A) $N_1 > N_2$ (B) $N_2 > N_1$ (C) $N_1 = N_2$ (D) $N_1 = 0$

21. Electron-volt (eV) is the measure of

(A) charge (B) potential difference
(C) current (D) energy

22. The working of dynamo is based on the principle of

(A) heating effect of current (B) electromagnetic induction
(C) magnetic induction (D) electric induction

23. SI unit of magnetic moment is

(A) JT–2 (B) Am^2 (C) JT (D) Am^{-1}

24. The optical fibre works on the principle of

(A) Scattering (B) Refraction
(C) Dispersion (D) Total internal reflection

25. When the tube length of microscope is increased, its magnifying power

(A) increases (B) decreases
(C) becomes zero (D) remains unchanged

26. The energy of photon of wavelength λ is

(A) $hc\lambda$ (B) hc / λ (C) $h\lambda / c$ (D) λ / hc

27. Which one of the following has maximum penetrating power?

(A) X-rays (B) cathode rays (C) α-rays (D) γ-rays

28. The majority current-carrier in *p*-type semiconductor is

(A) electron (B) hole (C) photon (D) proton

ANSWERS

1. (A)	2. (C)	3. (C)	4. (A)	5. (B)	6. (B)	7. (A)
8. (C)	9. (D)	10. (D)	11. (D)	12. (A)	13. (D)	14. (C)
15. (B)	16. (A)	17. (A)	18. (D)	19. (A)	20. (B)	21. (D)
22. (B)	23. (D)	24. (B)	25. (D)	26. (B)	27. (B)	28. (B)

Section-II (Non-Objective Type)

Time : 2 Hour 05 Minutes] [Marks : 42

Instructions to the Candidates :

1. Candidates are required to give their answers in their own words as far as practicable.
2. Figures in the right-hand margin indicate full marks.
3. Section II of this question paper consists of 15 non-objective type questions having total marks 42.
4. The candidate has to answer all the short answer questions from Q. No. 1 to Q. No. 11 and all 4 long answer type questions from Q. No. 12 to Q. No. 15 in his/her answer-book which is provided separately. Q.Nos. 1 to 11 carry 2 marks each and Q. Nos. 12 to 15 carry 5 marks each.
5. Write the question number with every answer.

Question Nos. 1 to 11 are of short answer type. Each question carries 2 marks.

$11 \times 2 = 22$

Short Answer Type Questions

1. **Define dielectric strength and relative permittivity.**

Ans. See answer Q.No. 2 in 2010.

2. Explain the use of motor starter or choke coil.

Ans. To reduce the current, the choke coil is connected in series with fluorescent mercury tube.

3. Derive dimension and SI unit of magnetic flux.

Ans. S.I. unit of magnetic flux, ϕ_B = Weber (Wb).

Dimension of $\phi_B = [ML^2T^{-2}I^{-1}]$

4. State Kirchhoff's two laws for electrical network.

Ans. See answer Q.No. 14 (Or) in 2015.

5. What is total internal reflection? What are the conditions for it?

Ans. The phenomenon of reflection of light that takes place, when a ray of light travelling in a denser medium gets incident at the interface of two media at an angle greater than the critical angle for that pair of media is called total internal reflection.

Conditions for it :

(i) The ray incident on the interface should travel in optically denser medium.

(ii) The angle of incidence should be greater than the critical angle for the given pair of media.

6. A wire is resistance 16Ω is elongated to double its length. Find the new resistance.

Ans. $R = \rho\frac{l}{A} \Rightarrow \rho = \frac{R \cdot A}{l}$ = constant.

Given, $R_1 = 16\,\Omega$, $R_2 = ?$

Original length = l, New length = $2l$, Area = A [As, area does not change]

$\because$ ρ is constant.

$\therefore \rho_1 = \rho_2 \Rightarrow \frac{R_1 \cdot A}{l} = \frac{R_2 \cdot A}{2l} \Rightarrow R_2 = 2R_1 = 2 \times 16\,\Omega = 32\,\Omega$ **Ans.**

7. Write truth table of NAND and NOR gates.

Ans. Truth table of NAND gates—

A	B	AB	$\overline{AB}$
1	0	0	1
0	1	0	1
0	0	0	1
1	1	1	0

Truth table of NOR gates—

A	B	A + B	$\overline{A+B}$
0	0	0	1
0	1	1	0
1	0	1	0
1	1	1	0

8. Write Lenz's law of electromagnetic induction.

Ans. See answer Q.No. 8 in 2013.

9. Write any two properties of X-rays.

Ans. See answer Q.No. 6 in 2013.

10. What is Peltier effect?

Ans. If two junctions of a thermocouple are initially at the same temperature and an electric current is passed through the circuit by using an external battery, then heat produced at one end is transferred to another. Thus, one junction is warmed up and the other is cooled down due to the currents through the junction. This effect is called Peltier effect.

$$\pi_{AB} = \frac{\Delta H}{\Delta Q} = \frac{\text{Peltier heat}}{\text{Charge transferred}}.$$

11. Explain sky waves and space waves.

Ans. See answer Q.No. 7 in 2010.

Question Nos. 12 to 15 are of long answer type. Answer must be explanatory and in your own language. All questions have alternative out of which you have to choose any one alternative. Each question carries 5 marks. $4 \times 5 = 20$

Long Answer Type Questions

12. Find an expression for capacity of a parallel plate capacitor with compound dielectric.

Ans. See answer Q.No. 12 in 2010.

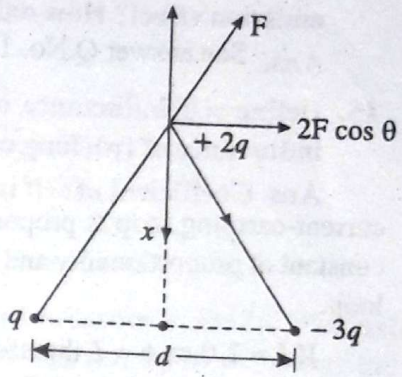
Or,

Two charges q and $-3q$ are placed fixed on X-axis at a separation d. Where should a third charge $2q$ be placed such that it will not experience any force? Also calculate potential energy of the system.

Ans. $F_{net} = 2F\cos\theta$

$$= \frac{2 \cdot Kq(-3q)}{\left\{\left(\frac{d}{2}\right)^2 + x^2\right\}} \cdot \frac{x}{\sqrt{\left(\frac{d}{2}\right)^2 + x^2}}$$

$$= \frac{-6Kq^2 \cdot x}{\left\{\left(\frac{d}{2}\right)^2 + x^2\right\}^{3/2}}$$



$$\Rightarrow \frac{dF_{net}}{dx} = 0 \Rightarrow -6Kq^2 \frac{d}{dx}\left\{\frac{x}{\left(\left(\frac{d}{2}\right)^2 + x^2\right)^{3/2}}\right\} = 0$$

$$\Rightarrow \frac{-6Kq^2 \cdot \left\{\left(\frac{d}{2}\right)^2 + x^2\right\}^{3/2} \cdot 1 - x\left[\frac{3}{2}\left\{\left(\frac{d}{2}\right)^2 + x^2\right\} \cdot \{0 + 2x\}\right]}{\left\{\left(\frac{d}{2}\right) + x^2\right\}^3} = 0$$

$$\Rightarrow -6Kq^2\left\{\left(\frac{d}{2}\right)^2 + x^2\right\}^{3/2} - x\left[3x\left\{\left(\frac{d}{2}\right)^2 + x^2\right\}\right] = 0 \Rightarrow x = q\sqrt{Kd}.$$

13. How are wavefront and secondary wavelets defined? Verify laws of reflection or laws of refraction on the basis of Huygens' wave theory.

Ans. See answer Q.No. 37 in 2014.

Or,

At what distance an object be placed from a convex lens of focal length 15 cm so that its three times magnified image is formed?

Ans. $\because\ m = \frac{h_i}{h_o} \Rightarrow \frac{h_i}{h_o} = -3 \Rightarrow h_i = 3h_o \therefore v = 3u$

Lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{3u} - \frac{1}{u} = \frac{1}{15} \Rightarrow \frac{1-3}{3u} = \frac{1}{15}$$

$$\Rightarrow \quad -\frac{2}{3} \times 15 = u \therefore u = -10 \text{ cm}$$

Hence, object should be placed at 10 cm in front of the lens.

14. Describe amplitude modulation and frequency modulation. Derive an expression for covering range of transmission antenna.

Ans. See answer Q.No. 13 (Or) in 2013.

Or,

Water is photoelectric emission effect? What are the laws of photoelectric emission effect? How did Einstein explain these laws of photoelectric effect?

Ans. See answer Q.No. 15 (Or) in 2011.

15. Define self inductance and mutual inductance. Find an expression for mutual inductance of two long coasial solenoids.

Ans. Coefficient of self induction : The magnetic flux through the area bounded by a current-carrying loop is proportional to the current. Thus, $\phi \propto I$ or, $\phi = LI$, where L is a constant of proportionality and is called coefficient of self induction or self inductance of the loop.

If $I = 1$, then $\phi = L$ therefore, coefficient of the magnetic flux linked with the coil when unit current passes through the loop.

Coefficient of mutual induction : In mutual induction, the change in flux in a circuit is directly proportional to the change in current in nearby circuit.

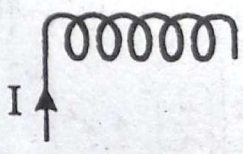
Thus, $d\phi \propto dI$ or, $d\phi = MdI$.

Applying the Faraday's law of induction, the induced emf, $\varepsilon = -\frac{d\phi}{dt}$ or, $\varepsilon = -M\frac{dI}{dt}$.

where M is the coefficient of mutual induction and defined as the induced emf in a circuit when current in nearby circuit changes at the rate of 1 ampere per second.

Coefficient of self induction of a solenoid : Let change in current in a solenoid of length l, number of turns N and area of cross-section A in time dt be dI, then the induced emf in the solenoid.

$$\varepsilon = -\frac{LdI}{dt} \qquad \text{... (i)}$$



$$\text{But } \varepsilon = -\frac{Nd\phi}{dt} = \frac{Nd}{dt}BA = \frac{Nd}{dt}\left(\frac{N\mu_0 IA}{l}\right)$$

$$\text{or, } \varepsilon = \frac{-N^2\mu_0 A}{l}\left(\frac{dI}{dt}\right) \qquad \text{... (ii)}$$

From equation (i) and (ii), the coefficient of self- induction, $L = \frac{N\mu_0 IA}{l}$.

Or,

What is rectifier? How a *p-n* junction diode can be used in (i) forward biased and (ii) reverse biased mode? Draw a labelled *V-I* characteristic of p-n junction diode on a graph.

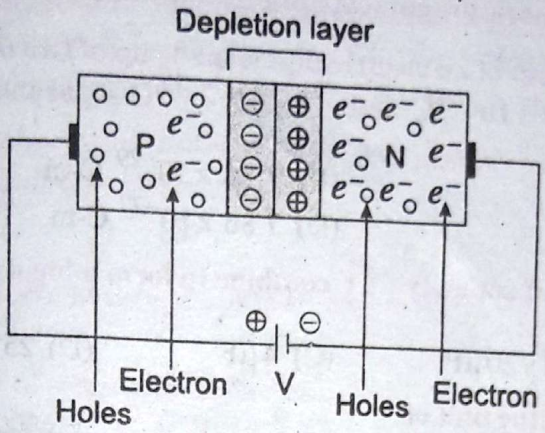
Ans. Rectifier : A rectifier is a circuit which converts the a.c. input voltage into a pulsating d.c.voltage.

The rectifier circuits are classified as :

(1) Single-phase half-wave rectifier.

(2) Single-phase full-wave rectifier.

(i) Forward bias : We know that when we applied the forward bias to the junction diode the potential barrier is reduced, then the little forward current flow as indicated in figure as point *O* to *A*. But after forward voltage '0.3' for 'Ge' and '0.7' for Si, the potential is eliminated and current starts flowing is the circuit as shown in figure as point *A* to *B*.



(ii) Reverse bias : When we applied the reverse bias to the junction diode the potential barrier at the junction is increased, so very small reverse or leakage current flows through the circuit due to minority carrier but practically no current will be flow through the circuit *IF* reverse voltage is increased continuously at this stage break down of the junction occurs. This way destroy the junction permanently.

V-I characteristic of diode :