PHYSICS

Question Bank

Bihar Board

PHOTOGRAPH


2017

2017 (A) एवं 2016 (C) की बोर्ड परीक्षा में पूछे गए प्रश्न एवं उनके उत्तर

2017 (A)

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 evaluate 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.

In 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 electrical intensity inside a charged hollow sphere is

(A) $E_0\sigma$ (B) $\frac{\sigma}{E_0}$ (C) zero (D) $\frac{E_0}{2}$

2. Three capacitors each of capacity C are connected in series. The resultant capacity will be

(A) $3C$ (B) $\frac{3}{C}$ (C) $\frac{C}{3}$ (D) $\frac{1}{3C}$

3. Two cells of emf ε_1, and ε_2, internal resistance r_1 and r_2, connected in parallel. The equivalent emf of the combination is

(A) $\frac{\varepsilon_1 r_1 + \varepsilon_2 r_2}{r_1 + r_2}$ (B) $\frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$ (C) $\sqrt{\varepsilon_1 \times \varepsilon_2}$ (D) $\frac{\varepsilon_1 + \varepsilon_2}{2}$

4. Permeability μ of a ferromagnetic substance

(A) $\mu >> 1$ (B) $\mu = 1$ (C) $\mu < 1$ (D) $\mu = 0$

5. S.I unit of pole strength is
(A) N (B) N/A-m (C) A-m (D) T

6. Which element is used in electric heater?
(A) Copper (B) Platinum (C) Tungsten (D) Nichrome

7. Absorbed electrical energy is
(A) Proportional to the portential difference
(B) Inversely proportional to the potential difference
(C) Proportional to the square of the potential difference
(D) None of these

8. Wheat stone's bridge is used in measuring
(A) High resistance (B) Low resistance
(C) Both high and low resistance (D) Potential difference

9. If the equation of an electric current is $I = 0.6 \sin 100\pi t$, the frequency of electric current is
(A) 50π (B) 50 (C) 100π (D) 100

10. The unit of reactance is
(A) Ohm (B) Farad (C) Ampere (D) Mho

11. The relation between peak current I_o and root mean square current I_{rms} is
(A) $I_o = \sqrt{2}\, I_{rms}$ (B) $I_o = I_{rms}$ (C) $I_o = 2I_{rms}$ (D) $I_o = \frac{I_{rms}}{\sqrt{2}}$

12. A short sighted person uses for clear vision
(A) Convex Lens (B) Concave Lens
(C) Cylindrical lens (D) Bi-focal Lens

13. The critical angle of light passing from glass to air is minimum for
(A) Red colour (B) Green colour
(C) Yellow colour (D) Violet colour

14. The angle of minimum deviation for thin prism of refractive index (μ) is
(A) $(1-\mu)A$ (B) $(\mu - 1)A$ (C) $(\mu + 1)A$ (D) $(\mu + 1)A^2$

15. Transverse nature of light is shown by
(A) Interference (B) Reflection (C) Polarisation (D) Dispersion

16. The focal length of a lens $\mu = 1.5$ in air is 20 cm. Its focal length in medium of refractive index 1.5 is
(A) 20 cm (B) 40 cm (C) 10 cm (D) ∞

17. The direction of transmission of electromagnetic wave is
(A) Parallel to $\vec{E}$ (B) Parallel to $\vec{B}$
(C) Parallel to $\vec{B} \times \vec{E}$ (D) Parallel to $\vec{E} \times \vec{B}$

18. The unit of ratio of magnetic field B and electrical fielld $E(B / E)$ is
(A) ms^{-1} (B) sm^{-1} (C) ms (D) ms^{-2}

19. The energy of emitted photo electron depends up on
(A) Intensity of light (B) Wave length of light
(C) Work [illegible]iction of metal (D) None of these

20. Which one of following is charge less?
(A) Alpha particle (B) Beta particle
(C) Photon particle (D) Proton

21. **Which series of hydrogen spectrum does not lie in infrared region?**
(A) Humphreys series (B) Pfund series
(C) Bracket series (D) Lyman series

22. **The energy of electron in first Bohr orbit of hydrogen atom is – 13.6 eV. What is energy of electron in its 2nd Bohr-orbit.**
(A) – 3.4 eV (B) – 6.8 eV (C) – 27.2 eV (D) + 3.4 eV

23. **Time during which the amount of radioactive substance becomes half of its initial amount is called.**
(A) Average life (B) Half life
(C) Decay constant (D) Time period

24. **β-Rays are deflected in**
(A) Gravitational field (B) Only in magnetic field
(C) Only in electrical field (D) In magnetic and electric field both

25. **For *n*-type Germanium, impurity doped in Germanium is**
(A) Trivalent (B) Tetravalent (C) Pentavalent (D) None of these

26. **Diode is used as**
(A) An amplifier (B) An oscillator (C) A modulator (D) A rectifier

27. **Boolean expression for NAND gate is**
(A) $\overline{A \cdot B} = \gamma$ (B) $\overline{A + B} = \gamma$ (C) $A \cdot B = \gamma$ (D) $A + B = \gamma$

28. **The height of a TV transmission tower at any place on the surface of the earth is 245 m. The maximum distance up to which transmission of tower will reach is**
(A) 245 m (B) 245 km (C) 56 km (D) 112 km

ANSWERS

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

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.

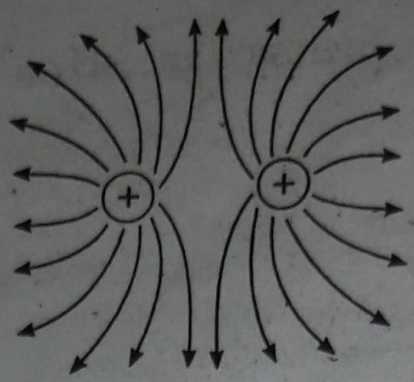
Question Nos. 1 to 11 are of short answer type. Each question carries 2 marks.

$11 \times 2 = 22$

Short Answer Type Questions

1. **Draw lines of force of electric field due to a system of two equal point charges.**

Ans.



2. **Write expression for magnetic field $\vec{B}$ on axis and equator of a short bar magnet.**

Ans. $B = \frac{\mu_0}{\sqrt{\pi}} \frac{m}{d^3}$ and $B = \frac{\mu_0}{\sqrt{\pi}} \frac{2m}{d^3}$

3. **Potential due to a system of charge is $V = 3 + 2x$ in S.I. system. What will be value of elecrtric field at $x = 2$ m?**

Ans. $V = 3 + 2x = 3 \times 2 \times 2 = ?$

$$V = \frac{1}{4\pi\varepsilon_0} \frac{q}{r} = ?$$

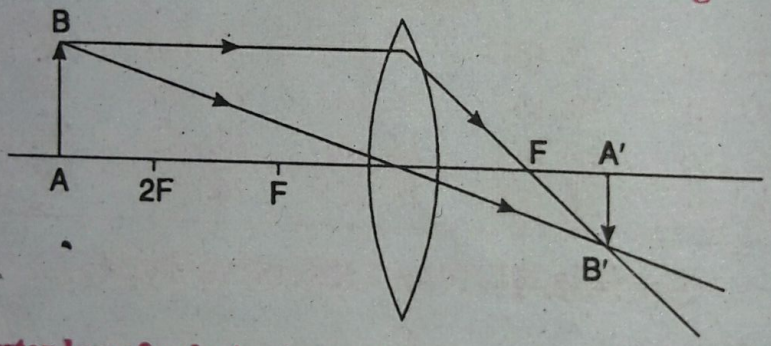
But $E = \frac{1}{4\pi\varepsilon_0} \frac{q}{r^2} = \frac{1}{4\pi\varepsilon_0} \frac{q}{r} \frac{1}{r} = \frac{7}{2} = 3.5.$

4. **Explain that Kirchoff's second law is law of conservation of energy.**

Ans. See answer Q.No. 14 in 2014 (A).

5. **A point object is placed above principal axis at a distance three times focal length of a convex lens. Draw ray diagram showing position of image.**

Ans.



6. **Write Brewster law of polarisation of light.**

Ans. See answer Q.No. 7 in 2014 (A).

7. **Show that a tangent galvanometer measures that current with maximum accuracy which produces 45° deflection.**

Ans. $B = B_H \tan\theta$

but $B = \frac{\mu_0}{4\pi}\left(\frac{2\pi nI}{r}\right) = \frac{\mu_0 nI}{2r}$ or, $\frac{\mu_0 nI}{2r} = B_H \tan\theta$

$\therefore \quad I = \frac{B_H \times 2r}{\mu_0 n} \tan\theta \quad \therefore \quad I = K \tan\theta$

where, $K = \frac{B_H \times 2r}{\mu_0 n}$ is constant is called reduction factor.

Reduction factor of T.G. is numerically equal to the current which produces a deflection of 45°.

8. A bulb rates 100 W, 220 V is connected across 240 volt. Calculate electrical power loss.

Ans. $R = \frac{V^2}{P} = \frac{220 \times 220}{100} = 484\Omega$

$$P_2 = \frac{V_2^2}{R} = \frac{240 \times 240}{484} = 119\,\text{W}$$

$\therefore$ Loss of power $= P_2 - P_1 = 119 - 100 = 19$ watt.

9. A light of wavelength 6000 Å is incident on a metal of work function 2 eV. Will electrons be emitted? If yes, find maximum energy of emitted electron.

Ans. Electrons will be emitted

$$k_{max} = \frac{hc}{\lambda} - \phi = \frac{1242 \times 10}{6000} - 2 = 2.07 - 2 = 0.07 \text{ Joule.}$$

10. Write change in position of atom of an element in periodic table due to emission of α and β particles from its nucleus.

Ans. When a α-particle is emitted from any atom then the atomic number is ↓ red by 2 unit and mass number is ↓ red by 4 unit and when a β-particle is emitted from any atom then the atomic number is ↑ red by 1 unit and mass number does not change.

11. Explain modulation and write types of modulation.

Ans. See answer Q.No. 11 in 2015 (A).

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

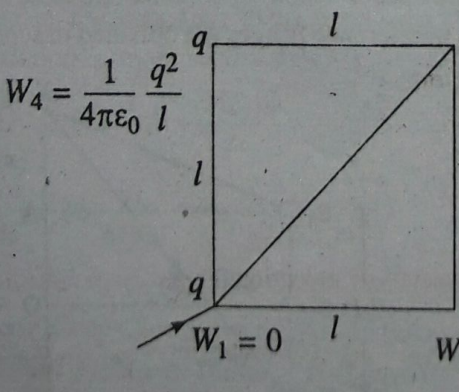
12. Deduce Coulomb's law from Gauss law.

Ans. See answer Q.No. 12 in 2012 (A).

Or,

Explain potential energy of a charge system. Calculate energy needed to place charge q at each corner of a square of side l.

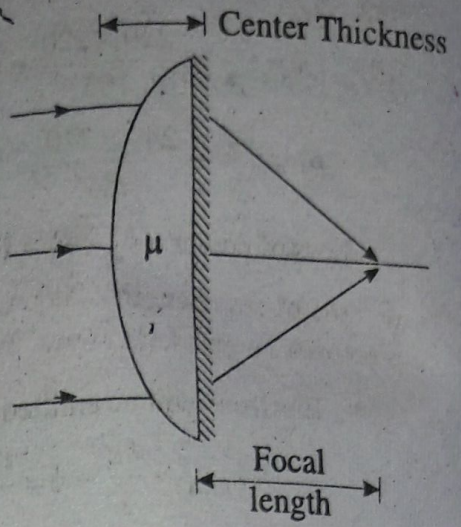
Ans. Electrical potential energy of a charge particle is equal to amount of workdone in bringing that charge from infinity to the given position with constant speed.



$$\therefore \quad U = W_1 + W_2 + W_3 + W_4 = \frac{1}{4\pi\varepsilon_0}\left(0 + \frac{q^2}{l} + \frac{q^2}{l\sqrt{2}} + \frac{q^2}{l}\right).$$

13. An object is at infinity from a planoconvex lens whose plane surface is silvered. Explain formation of its image and hence find its focal length.

Ans. Focal length of planoconvex lens when silvered at its plane surface when an object is placed in front of such a lens the ray of all are refracted from the convex surface then reflected from the polished plane surface and again refracted out from the convex surface if and f_m be the focal length of lens and mirror.



i.e., $f_m = f_e = f$

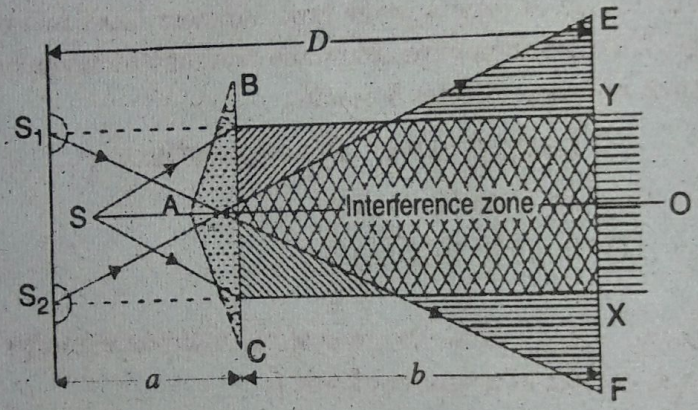
$$\frac{1}{F} = \frac{1}{f_e} + \frac{1}{f_m} \text{ or, } \frac{1}{F} = \frac{1}{f} + \frac{1}{f}$$

or, $$\frac{1}{F} = \frac{1+1}{f} = \frac{2}{f} \therefore F = \frac{f}{2}.$$

Or,

What is a biprism? Explain measurement of wavelength of monochromatic light using biprism.

Ans. Fresnel's biprism : It consists of two acute angled prism with their base in contect forming a single obtused angled prism. It can produce conviently two coherent sources from a single source.



When it is placed near a monochromatic light source, light appears to be coming from S_1 and S_2 i.e., S_1 and S_2 are virtual images which are coherent. So there si superposition of light waves coming out as a result interference fringes are obtained in screen.

Determination of wavelength :

Situation has been shown in figure,

Path difference = $S_2P - S_1P$

From figure,

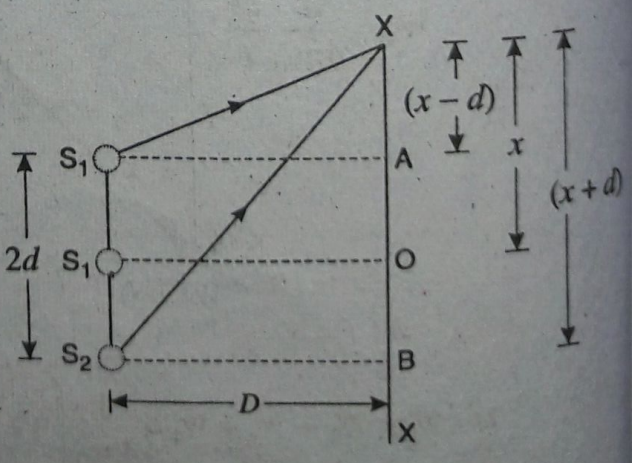
$(S_1P)^2 = D^2 + (x - d)^2$

$(S_2P)^2 = D^2 + (x + d)^2$

Now,

$(S_2P)^2 - (S_1P)^2$

$= (x + d)^2 - (x - d)^2$



or, $(S_2P - S_2P)(S_2P + S_1P) = x^2 + d^2 + 2xd - x^2 - d^2 + 2xd$

or, $(S_2P - S_1P) = \dfrac{4xd}{(S_2P - S_1P)}$

If OP is verey small, then $S_1P \cong S_2P = D$

So, path difference $= \dfrac{4xd}{D + D} = \dfrac{2xd}{D}$

for constructive interference path difference $= n\lambda$

$\therefore \quad \dfrac{2xd}{D} = n\lambda$ or, $x = \dfrac{nD\lambda}{2d}$

If distance of n^{th} and $(n + 1)^{th}$ fringe are x_n and x_{n+1}, then fringe width

$$= x_{n+1} - x_n = \frac{(n + 1)D\lambda}{2d} - \frac{nD\lambda}{2d} = \frac{D\lambda}{2d}$$

$\therefore \quad \lambda = \dfrac{2\beta d}{D}$

where β = fringe width

D = distance of source from screen

λ = wavelength of light waves

and $2d$ = distance between two coherent light source.

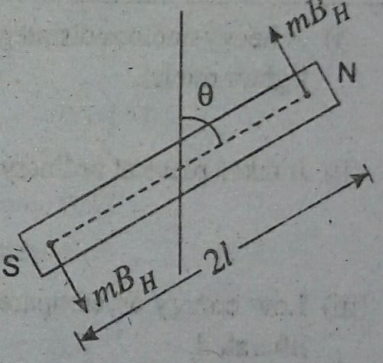
14. What is wheatstone bridge? Explain its use in detail.

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

Or,

Find time period of a bar magnet oscillating freely in a uniform magnetic field $\vec{B}$.

Ans. Figure show the position of the magnet when it is deflected an angle from the the mean position during its oscillation. The magnetic field in the horizontal direction is B_H from south to north. If m be the pole strength, the force on the north pole is mB_H towards north and on the south pole it is mB_H towads south and the length of the magnet is $2l$. The torque of each of the two forces about the vertical axis is $mB_H l \sin\theta$ and it tries to bring the magnet towards the equilibrium position. The not torque about the vertical axis is $\tau = -2\ mB_H\ l \sin\theta = -\ m\ B_H\ \sin\theta$ ... (i)



When we neglect the torque due to the small twist then magnet rotates and the angular amplitude of oscillation is small, $\sin\theta \approx \theta$ then $\tau = -MB_B\theta$

also, $\tau = I\alpha \ \therefore \ \alpha = \dfrac{\tau}{I} = \dfrac{-MB_H\theta}{I} = -\omega^2\theta$, where $\omega = \dfrac{\sqrt{MB_H}}{I}$

and $T = \dfrac{2\pi}{\omega} = 2\pi\dfrac{\sqrt{I}}{MB_H}$

15. Explain : (i) Zener diode (ii) LED (Light Emitting Diode)

Ans. **(i) Zener diode :** See answer Q.No. 15 (Or) in 2012 (A).

(ii) LED (Light Emitting Diode) : It is heavily doped p-n junction which under forward bias emits spontaneous radiation. The diode is encapsulated with a transparent cover so that emitted light come out. When the diode is forward biased, electrons are sent from $n \rightarrow p$ and holes are sent from $p \rightarrow n$. At the junction boundary the concentration of minority

carriers increases compared to the equilibrium concentration. LED are biased such that the light emitting efficiency is maxiumum. LEDs that an emit red, yellow, orange, green and blue light are commercially available.

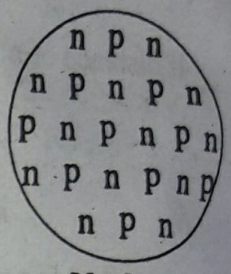
LEDs have following advantages : (i) Low operational voltage and loss power. (ii) Fast action and no ward up time required. (iii) Long life and ruggedness. (iv) Fast on-off switching capability.

Or,

(1) Explain constitution of atomic nucleus

(2) Write difference between nuclear fission and radioactivity.

Ans. (1) A nucleus is made of protons and neutrons. A Proton has a positive charge of magnitude equal to that of an electron and has a mass about 1840 times the mass of an electron. A neutron has a mass slightly greater than than of a proton. The masses of a proton and neutron are



Necleus

$$m_p = 1.6726231 \times 10^{-27} \text{ kg}$$

and $$m_n = 1.6749286 \times 10^{-27} \text{ kg}.$$

Protons and neutrons are collectively called nucleons. The number of protons in a nucleus is denoted by Z, the number of neutrons by N and the total number of nucleons by A. Thus, $A = Z + N$. The total number of nucleons A is also called the mass number of the nucleus. The number of protons Z is called the atomic number.

(2) Difference between nuclear fission and radioactivity :

Nuclear fission	Radioactivity
(i) A heavy nucleus disintegrates into two lighter nuclei.	(i) It is the process of spontaneous emission of radiations by the disintegration of a nucleus.
(ii) It takes place at ordinary temperature.	(ii) When a α-particle is emitted then atomic number is decrease by 2 unit and mass number is decrease by 4 unit.
(iii) Low energy as compared to fusion is liberated.	(iii) When a β-particle is emitted then atomic number is increased by 1 unit and mass number does not change.
(iv) It is used for the production of nuclear bomb.	
(v) Controlled fission reaction are used to produce electricity.	

□