

HIMACHAL PRADESH BOARD OF SCHOOL EDUCATION, DHARAMSHALA
PHYSICS
SAMPLE QUESTION PAPER
CLASS – XII (2026–27)

Time Allowed: 3 Hours

Maximum Marks: 60

General instructions

1. There are 27 questions in all distributed in five sections A, B, C, D and E. All the questions are mandatory. Internal choices are given where applicable.
2. Section A contains 12 MCQ, each of 1 mark. Section B contains 4 questions of 2 marks each. Section C contains 7 questions of 3 marks each. Section D contains 1 case study-based question of 4 marks. Section E contains 3 long answer questions of 5 marks each.
3. Use of calculator or any calculation device is not permitted.
4. You may use the following values of physical constants wherever necessary:

i. $c = 3 \times 10^8 \text{ m s}^{-1}$

ii. $m_e = 9.1 \times 10^{-31} \text{ kg}$

iii. $m_p = 1.67 \times 10^{-27} \text{ kg}$

iv. $e = 1.6 \times 10^{-19} \text{ C}$

v. $\mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$

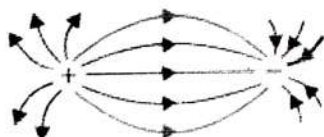
vi. $h = 6.63 \times 10^{-34} \text{ J s}$

vii. $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$

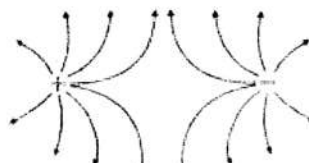
Section A

Mark the right option for Q 1 to 12. There is no negative marking.

1. Study the electric charge distribution given in the figures (i) and (ii) respectively and mark the correct option.



(i)



(ii)

- A) (i) is not possible and (ii) is electric dipole
- B) Both (i) and (ii) are not possible
- C) (i) is electric dipole and (ii) is not possible
- D) Both (i) and (ii) are electric dipoles but the distance between them is different.
2. Choose the correct statements
 - I. Electric field is in that direction in which potential decreases steepest.
 - II. A point closer to a negative source charge is at a higher potential than a farther point.

III. Work done in bringing the first charge q of a charge configuration from infinity to a point P in the absence of external field is zero.

A) Only I B) Only I and III C) Only II and III D) All of I, II and III

3. Match the given column I with the relevant match from column II

Column I	Column II
(a) Low power factor	(i) $X_c - X_L = 0$
(b) Purely inductive circuit	(ii) wattless current
(c) Purely resistive circuit	(iii) large power loss in transmission
(d) Resonant LCR circuit	(iv) power factor is 1

A) (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

B) (a)-(iii), (b)-(i), (c)-(iv), (d)-(ii)

C) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)

D) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

4. The force on a point charge q moving with a velocity $\mathbf{v}$ in presence of electric field $\mathbf{E}$ and magnetic fields $\mathbf{B}$ is given by the Lorentz force and is represented by the relation

A) $\mathbf{F} = q(\mathbf{E} + \mathbf{v} \cdot \mathbf{B})$ B) $\mathbf{F} = \frac{q}{E} + q(\mathbf{v} \times \mathbf{B})$ C) $\mathbf{F} = q(\mathbf{E} + \mathbf{v} \times \mathbf{B})$ D) $\mathbf{F} = \frac{q}{E} + q(\mathbf{v} \cdot \mathbf{B})$

5. Match the given electromagnetic waves with their applications

Electromagnetic wave	Application
(a) Microwaves	(i) help in maintaining earth's warmth
(b) Radio Waves	(ii) can be focussed into very narrow beam for high precision applications like LASIC eye surgery
(c) Infrared waves	(iii) suitable for radar systems used in aircraft navigation
(d) Ultraviolet Rays	(iv) used for short wave bands

A) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)

B) (a)-(iii), (b)-(iv), (c)-(i), (d)-(ii)

C) (a)-(i), (b)-(ii), (c)-(iv), (d)-(iii)

D) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

6. Consider the following statements

I When the final image is formed at infinity, the telescope is said to be in normal adjustment.

II. There is no chromatic aberration in a mirror.

III. Objective mirror in Cassegrain reflecting telescope focuses the light towards inside of the telescope tube.

IV. In Cassegrain telescope the light first strikes secondary mirror and then on the objective mirror.

Which of these statements are correct?

A) I, II, IV B) I, III, IV C) I, II, III D) II, III, IV

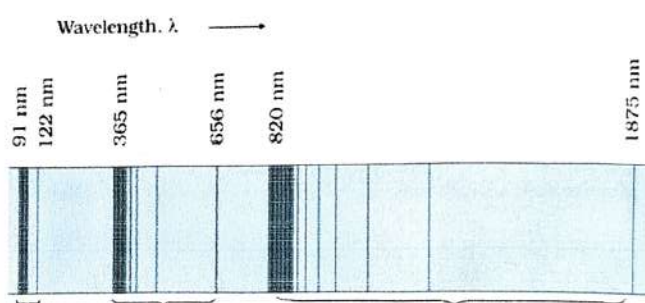
7. The de Broglie wavelength of a dust particle of mass 1.0×10^{-9} kg which drifts with a speed of 2.2 m/s is

A) 3.0×10^{-25} m B) 2.0×10^{-25} m C) 3.0×10^{-24} m D) 2.0×10^{-24} m

8. The ratio of the nuclear densities of two nuclei having the mass numbers 27 and 64 is

A) 3:4 B) 4:3 C) 64:27 D) 1:1

9. Emission lines in the spectrum of hydrogen in the increasing order of wavelength have been shown in the given figure. Identify the spectral series from 820 nm to 1875 nm.



A) Lyman series
B) Paschen series
C) Bracket series
D) Balmer series

10. When a forward bias is applied to a p-n junction, it

A) raises the potential barrier.
B) lowers the potential barrier.
C) reduces the majority carrier current to zero.
D) does not affect the potential barrier.

Questions 11 and 12, consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

(A) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
(B) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
(C) If the Assertion is correct but Reason is incorrect.
(D) If both the Assertion and Reason are incorrect.

11. **Assertion:** A 100 W bulb glows more brightly than a 60 W bulb.

Reason: 60 W bulb has more resistance than the 100 W bulb.

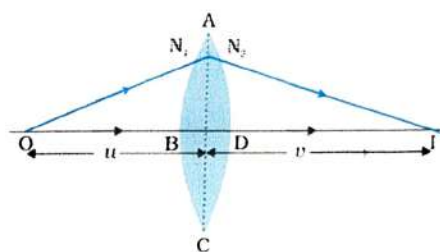
12. **Assertion:** Mutual induction between a system of two coils wound on each other is maximum

Reason: Mutual induction of a pair of coils is independent of the separation and relative orientation of the coils.

Section B

13. With reference to the lens maker's formula, answer these questions

i) Complete the ray diagram to show the image formation after refraction from the first spherical surface ABC.



ii) Write the formula of refraction at

single spherical surface for the first surface ABC. $(1 + 1 = 2)$

14. Give two shortcomings of Rutherford's atomic model based on stability and observed features of atomic spectra. (2)

15. Three photo sensitive metallic surfaces P, Q and R receive light of same wavelength, and it is observed that for P, the photoelectrons do not emit at all, for Q, the photo electrons are just emitted but for R, the emitted photoelectrons have sufficient kinetic energies. Compare the threshold frequencies of the metallic surfaces P, Q and R and justify your answer. (2)

16. Plot a graph of binding energy per nucleon as a function of mass number A. Write any one conclusion evident from this graph. (2)

Section C

17. State linear charge density. Using Gauss theorem, obtain an expression for electric field due to an infinitely long straight uniformly charged wire. (3)

18. A closely wound circular coil with 1000 turns and radius 10 cm carries a current of 3.2 A. Find i) magnetic moment of this coil ii) magnetic field at the centre of this coil. (1.5 + 1.5 = 3)

OR

A charged particle of mass m and charge q moves with velocity $\mathbf{v}$ in a uniform magnetic field $\mathbf{B}$. If $\mathbf{v} \perp \mathbf{B}$, show that the particle describes a circular path having

an angular frequency $\omega = \frac{qB}{m}$. State the condition when this trajectory will be helical. (2.5 + 0.5 = 3)

19. How does oscillating charge produce electromagnetic waves?

Draw a linearly polarized em wave propagating in the x- direction with oscillating electric field E along y-direction and oscillating magnetic field along z-direction. (2+1 = 3)

20. A) Priya moves a bar magnet rapidly towards a closed coil and notices that some force opposes the motion of the magnet. Analyse why this opposing force is necessary?

B) Name the law governing this observation.

C) What would happen if the coil assisted the motion of the magnet instead of opposing it? Relate your answer to the conservation of energy. (1 + 0.5 + 1.5 = 3)

21. Derive an expression for the potential energy of two charges in an external field. How this relation changes when there is no external field. (2.5 + 0.5 = 3)

22. Define magnetic susceptibility of a material. Write an expression relating magnetic susceptibility with relative magnetic permeability. Jones intends to select two materials for an experiment, out of which one has negative susceptibility and the other has positive magnetic susceptibility. Which materials he should select? (2+1 = 3)

23. State the principle of working of a transformer. The primary coil of an ideal transformer having N_p turns is supplied with an ac voltage V_p . Obtain an expression for the induced voltage V_s in the secondary coil having N_s turns. (1+2 = 3)

Section D

24. Study and analyse the paragraph carefully and answer **any four** questions based on this paragraph. Each question carries one mark.

In the discussion of Young's experiment, we stated that a single narrow slit acts as a new source from which light spreads out. It seems to turn around corners and enter regions where we would expect a shadow. When the double slit in Young's experiment is replaced by a single narrow slit and is illuminated by a monochromatic source like laser light, a broad pattern with a central bright region is seen. On both sides, there are alternate dark and bright regions, the intensity becoming weaker away from the centre. It is observed that the intensity has a central maximum at $\theta = 0$ and secondary maxima go on becoming weaker with increasing order. Is it also the redistribution of light? In this context, it is interesting

to note what Richard Feynman has stated that no one has ever been able to define the difference between interference and diffraction satisfactorily. It is just a question of usage, and there is no specific, important physical difference between them.

a) When the width of a slit becomes comparable to the wavelength of light passing through it, the light:

- i) travels only in a straight line ii) spreads out after passing through the slit
- iii) changes its colour iv) gets completely absorbed

b) Diffraction pattern is visible in

- i) sound waves only ii) light waves only
- iii) sound waves as well as light waves iv) light waves of higher frequency

c) If a single slit held in vertical is illuminated by a laser light, in which orientation the diffraction pattern extends?

- i) always vertical ii) always horizontal
- iii) always at 45° to the horizontal iv) It depends on how the light strikes the slit.

d) b) If the width of central maxima is d , the width of first secondary maxima and second secondary maxima will be respectively

- i) d , $d/2$ ii) $2d$, d iii) d , d iv) $d/2$, $d/2$

e) The phenomenon of superposition of two waves, resulting in the redistribution of energy is known as.....

- (i) diffraction (ii) interference (iii) polarisation (iv) refraction (1 × 4 = 4)

Section E

25. a) Khushbu wants to use one p-n junction diode to convert alternating current to direct current. Draw a circuit diagram to help her in this plan.

(1)

b) Describe in brief the working of a half wave rectifier. Why a full wave rectifier is more efficient circuit than half wave rectifier. (1.5+0.5 = 2)

c) Draw a neat diagram for a full wave rectifier with a capacitor filter. Also draw a graph to show the output voltage of a full wave rectifier with capacitor input circuit.

(1+1 = 2)

OR

a) During the formation of a p-n junction, how diffusion is different from drift?

b) Describe p-n junction diode under forward bias. Hence define minority carrier injection.

c) Semiconductor's energy band structure is affected by doping. Draw the formation of additional energy states in n-type semiconductors at $T > 0\text{K}$. (2+2+1)

26. a) Define power of a lens. What will be the power of a lens if its focal length is 25cm. (1.5)

b) Using a ray diagram for a system of two thin lenses of focal lengths f_1 and f_2 placed in contact with each other, show that the two-lens system can be regarded as equivalent to a single lens of focal length f , where $1/f = 1/f_1 + 1/f_2$. (2.5)

c) Ishan wants to use a combination of lenses. In which application, he can use this combination? (1)

OR

a) State the conditions for the phenomenon of total internal reflection to occur. (1)

b) Draw a ray diagram to bend rays by 90° using a $90^\circ - 45^\circ - 45^\circ$ prism. (1.5)

c) A small bulb is placed at the bottom of a tank containing water to a depth of 80cm. Considering the bulb to be a point source, what is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water is 1.33. (2.5)

27. a) What is meant by internal resistance? A battery of emf ξ and internal resistance r is connected to an external resistance R , then I current flows through it. Derive an expression for internal resistance. (1+1.5 = 2.5)

b) On what factors, the internal resistance of a cell depends? (1)

c) Design a circuit using a single cell of emf ξ and internal resistance r to draw the maximum current. What should be the modified formula for this maximum current. (1+0.5 = 1.5)

OR

a) Define drift velocity. (1)

b) Using the concept of drift velocity, derive an expression for the resistivity of a conductor in terms of number density of charge carriers in the conductor and relaxation time. (2)

c) Estimate the average drift speed of conduction electrons in copper wire of cross-sectional area $1.0 \times 10^{-7} \text{ m}^2$ carrying a current of 1.5 A. Assume that each copper atom contributes one conduction electron. Take the number density of copper as $8.5 \times 10^{28} \text{ m}^{-3}$. (2)

FORMAT OF DESIGN (Subject Other Than Language)

Question Paper / Test Blueprint

Subject: Physics
Paper: Sample Question Paper
Class: 12th
Time: 3 hours
Maximum Marks: 60

1. Weightage to Objectives

Objective	Knowledge	Understanding	Application	Analysis	Evaluation	Creation	Total
Percentage of Marks	17.5%	17.5%	35%	24.2%	3.3%	2.5%	100%
Marks Allotted	10.5	10.5	21	14.5	2	1.5	60

2. Weightage to Forms of Questions

Forms of Questions	E/LA	Case study based	SA	VSA	Objective (MCQ)	Total
No. of Questions	3	1	7	4	12	27
Marks Allotted	15	4	21	8	12	60
Estimated Time (Minutes)	54 minutes	15 minutes	56 minutes	20 minutes	23 minutes	168 minutes

3. Weightage to Major Content Areas

S. No.	Unit / Topic / Sub-topic	Marks
1	Electric charges & fields	4
2	Electrostatic potential & capacitance	4
3	Current electricity	6
4	Moving charges and magnetism	4
5	Magnetism and matter	3
6	Electromagnetic induction	4
7	Alternating current	4
8	Electromagnetic waves	4
9	Ray optics and optical instruments	8
10	Wave optics	4
11	Dual nature of radiation and matter	3
12	Atoms	3
13	Nuclei	3
14	Semiconductor electronics	6
Total		60

Schemes of sections	There are 5 sections in all. Section A: It has 12 MCQs including two - match the columns type questions, two - assertion reason type questions, two - diagram based question and two -choose the correct statement type questions. Section B: It has 4 very short answer type questions. One competency based question, one diagram based question and one graph based inference type question. Section C: It has seven short answer type questions. One question is situation based question so as to discourage rote learning. Section D: This section is case study based in which one paragraph has been provided followed by MCQ type 5 questions out of which, 4 are to be attempted. Section E: It has three questions. Every question has three parts, in which first part is based on remember/ recall/ state type question. Second part is based on derivation/ applying type question and the third part is based on the applying/ evaluating/ creating the same concept covered in first and second part.
Pattern of options	1. No option is given section A and B 2. In section C, one internal choice has been given in Q 18 from moving charges and magnetism. 3. In section D, case study based question, five MCQ questions have been given out of which 4 questions are to be attempted by the students. 4. In section E, the internal choices have been provided in all the three questions.

Index of Abbreviations

(E/LA : Essay / Long Answer; SA : Short Answer ; VSA : Very Short Answer, Objective)

PROFORMA FOR ANALYSING QUESTION PAPERS

Part – I : General Information

1. Name of the Board: HPBOSE
2. Name of Examination: Plus Two
3. Year of Examination: 2026-27
4. Class: 12th
5. Subject: Physics
6. Question Paper Number: SQP
7. Maximum Marks: 60
8. Time Allotted: 3 hours
9. Sections, if any: Five sections

Part – II (A): General Item-wise Analysis of Questions

S. No.	Objective	Specification	Content / Topic	Unit / Sub-unit No.	Form of Question	Marks Allotted	Estimated Time (Min.)
1	Understanding	Diagram based MCQ	Electric charges & fields	1	MCQ	1	1.5 minutes
2	Analysing	Choose the correct statement MCQ	Electrostatic potential & capacitance	2	MCQ	1	2.0 minutes
3	Understanding	Matching the columns	Alternating current	7	MCQ	1	2.5 minutes
4	Applying	Fact based	Moving charges and magnetism	4	MCQ	1	1.5 minutes
5	Understanding	Matching the columns	Electromagnetic waves	8	MCQ	1	2.5 minutes
6	Analysing	Choose the correct statement MCQ	Ray optics and optical instruments	9	MCQ	1	2.5 minutes
7	Applying	Numerical	Dual nature of radiation and matter	11	MCQ	1	2.5 minutes
8	Understanding	Fact based	Nuclei	13	MCQ	1	1.0 minutes
9	Remembering	Identification from the figure	Atoms	12	MCQ	1	1.0 minutes
10	Understanding	Fact based	Semiconductor electronics	14	MCQ	1	1.0 minutes
11	Analysing	Assertion-reasoning type	Current electricity	3	MCQ	1	3.0 minutes
12	Analysing	Assertion-reasoning type	Electromagnetic induction	6	MCQ	1	2.0 minutes

13	Understanding	Diagram based application	Ray optics	9	VSA	2	5 minutes
14	Understanding	Inferences from the experiment	Atoms	12	VSA	2	5 minutes
15	Analysing	Comparison and analysis	Dual nature of radiation and matter	11	VSA	2	5 minutes
16	Remembering Evaluating	Graph based	Nuclei	13	VSA	2	5 minutes
17	Remembering Applying	Derivation	Electric charges & fields	1	SA	3	8 minutes
18	Applying	Derivation/ Numerical	Moving charges and magnetism	4	SA	3	8 minutes
19	Understanding	Practical application based/ diagram	Electromagnetic waves	8	SA	3	8 minutes
20	Remembering Analysing	Fact based/ application	Electromagnetic induction	6	SA	3	8 minutes
21	Analysing	Expression	Electrostatic potential & capacitance	2	SA	3	8 minutes
22	Remembering Applying	Application	Magnetism and matter	5	SA	3	8 minutes
23	Remembering Applying	Construction and working	Alternating current	7	SA	3	8 minutes
24	Analysing	Case study based on scientific interpretation, experimental understanding	Wave optics	10	Case study based	4	15 minutes
25	Remembering Understanding Applying	Definition/ state Derivation/ construction Application	Semiconductor electronics	14	LA	5	18 minutes
26	Remembering Understanding Applying	Definition/ state Derivation/ construction Application	Ray optics and optical instruments	9	LA	5	18 minutes
27	Remembering Applying Analysing	Definition/ state Derivation/ construction Application	Current electricity	3	LA	5	18 minutes

FORMAT OF BLUEPRINT (Subject other than language)

Subject :Physics	Class : 12th		
Unit/Paper : Sample Question Paper 2026-27	Maximum marks : 3 hours		Time: 3 hours

S. No.	Objective	Knowledge				Understanding				Application				Analysis				Evaluation				Creation				Total Row Wise
	Form of Questions Content Unit Sub Unit	E/LA	SA	VS A	O	E/ L A	SA	VSA	O	E/L A	SA	VSA	O	E/LA	SA	VSA	O	E/L A	SA	VSA	O	E/L A	S A	VS A	O	
1	Electric charges & fields		1*								2*										1					
2	Electrostatic potential & capacitance										2*				1*		1									
3	Current electricity	1*				1*				1.5*							1					1.5*				
4	Moving charges and magnetism				1						3															
5	Magnetism and matter		2*				1*																			
6	Electromagnetic induction				1										3											
7	Alternating current		1*								2*						1									
8	Electromagnetic waves		1*								2*						1									
9	Ray optics and optical instruments	1.5*						2		3.5*							1									
10	Wave optics												1*				3*									

S. No.	Objective	Knowledge				Understanding				Application				Analysis				Evaluation				Creation				Total Row Wise
	Form of Questions Content Unit Sub Unit	E/LA	SA	VS A	O	E/ L A	SA	VSA	O	E/L A	SA	VSA	O	E/LA	SA	VSA	O	E/L A	SA	VSA	O	E/L A	S A	VS A	O	
11	Dual nature of radiation and matter												1			2										
12	Atoms				1			2																		
13	Nuclei							1*					1							1*						
14	Semiconduct or electronics					2.5*			1	2*				0.5*												
	Sub Total	B				B				b				b				b				b				
	Total	10.5				10.5				21.0				14.5				2				1.5				
		(Marks Total)				(Marks Total)				(Marks Total)				(Marks Total)				(Marks Total)				(Marks Total)				

Note: Figures within brackets to indicate the number of questions and figures outside the brackets to indicate marks. * Denotes that marks have been combined to form one question.

Summary: Essay (E) No. 3 Marks 15
 Short Answer (SA) No. 7 Marks 21
 Very Short Answer (VSA) No. 4 Marks 8
 Case study based No. 1 Marks 4
 Objective (O) No. 12 Marks 12

Pattern of options: In Q 18, Q 24 and all the 5 marks questions.

Schemes of section: Five sections. Section A: MCQ, Section B -VSA
 Section C – SA, Section D- Case study based and Section E- LA