

Sample Paper 8

Series RBTC 1/1

SET-1

2025

प्रश्न-पत्र कोड 55/1/1
Q.P. Code

रोल नं.

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Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।
Candidates must write the Q.P. Code on the title page of the answer-book.

- ☆ * * * * *
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 11 हैं।
 - कृपया जाँच कर लें कि इस प्रश्न-पत्र में 33 प्रश्न हैं।
 - प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।
 - कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें।
 - इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है। प्रश्न-पत्र का वितरण पूर्वान्ह में 10.15 बजे किया जाएगा। 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे।
 - Please check that this question paper contains 11 printed pages.
 - Please check that this question paper contains 33 questions.
 - Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
 - Please write down the serial number of the question in the answer-book before attempting it.
 - 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.
- ☆ * * * * *

NOTE: This is Educart provided Mock Set to help students experience the exam pattern beforehand.

भौतिक विज्ञान (सैद्धान्तिक) PHYSICS (THEORY)

निर्धारित समय : 3 घण्टे

Time allowed: 3 Hours

अधिकतम अंक : 80

Maximum Marks: 80

General Instructions:

Read the following instructions carefully and follow them :

- (i) This question paper contains 33 questions. All questions are compulsory.
- (ii) This question paper is divided into five sections Sections A, B, C, D and E.
- (iii) In Section A Questions no. 1 to 16 are Multiple Choice type questions. Each question carries 1 mark.

- (iv) In **Section B** Questions no. 17 to 21 are Very Short Answer type questions. Each question carries 2 marks.
- (v) In **Section C** Questions no. 22 to 28 are Short Answer type questions. Each question carries 3 marks.
- (vi) In **Section D** Questions no. 29 and 30 are case study-based questions. Each question carries 4 marks.
- (vii) In **Section E** Questions no. 31 to 33 are Long Answer type questions. Each question carries 5 marks.
- (viii) There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the Sections except Section A.
- (ix) Kindly note that there is a separate question paper for Visually Impaired candidates.
- (x) Use of calculators is **not** allowed.

You may use the following values of physical constants wherever necessary :

$$c = 3 \times 10^8 \text{ m/s}$$

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

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

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

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

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N m}^2 \text{C}^{-2}$$

$$\text{Mass of electron } (m_e) = 9.1 \times 10^{-31} \text{ kg}$$

$$\text{Mass of neutron} = 1.675 \times 10^{-27} \text{ kg}$$

$$\text{Mass of proton} = 1.673 \times 10^{-27} \text{ kg}$$

$$\text{Avogadro's number} = 6.023 \times 10^{23} \text{ per gram mole}$$

$$\text{Boltzmann constant} = 1.38 \times 10^{-23} \text{ JK}^{-1}$$

SECTION - A

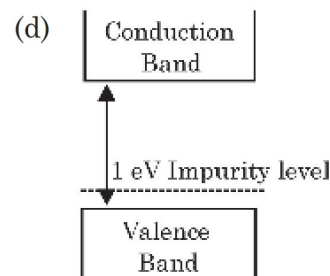
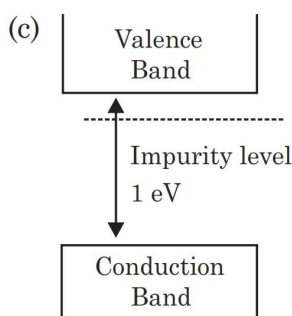
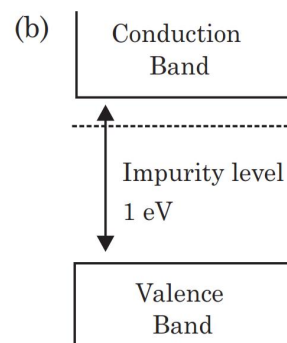
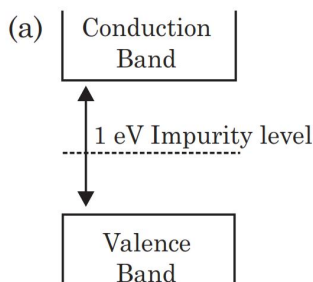
16 Marks

1. A charge is to be placed between two charges of 9e and 16e respectively, placed 70 cm apart. The position of the third charge placed between the two charges so that the system is in equilibrium will be:

- (a) 30 cm from 9e
- (b) 30 cm from 16e
- (c) 40 cm from 9e
- (d) 35 cm from either charge

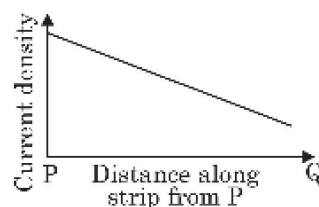
1

2. Identify the n -type semiconductor from the given figures.



1

3. Variation between current density and distance of an insulated strip PQ of a metallic conductor, through which current is flowing is shown.



Which one of the following statements are correct?

- (I) The strip gets narrower from Q to P.
- (II) The potential gradient along the strip is uniform.
- (III) The strip has equal width along its length.

- (a) (I) only
- (b) (II) only
- (c) (II) and (III)
- (d) (I), (II) and (III)

1

4. Two small nuclei forms a bigger nuclei, when the binding energy per nucleon in two smaller nuclei:

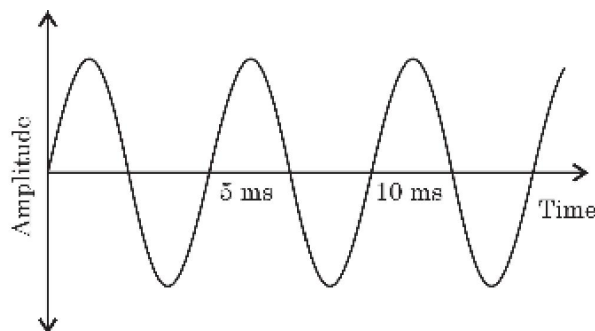
- (a) increases with mass number at high mass number.
- (b) decreases with mass number at high mass number.
- (c) increases with mass number at low mass number.
- (d) decreases with mass number at low mass number.

1

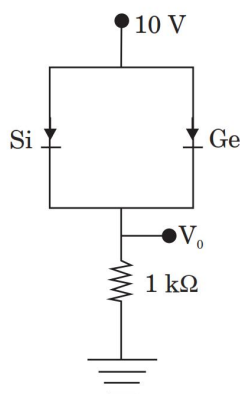
5. Magnetic field produced by a current carrying circular coil is always:
- (a) uniform everywhere (b) non-uniform everywhere
(c) uniform at centre of coil (d) uniform at axis of coil 1
6. How will the motion of an electron projected in the direction of magnetic field will be affected by the action of magnetic field?
- (a) Electron will be accelerated (b) Electron will be decelerated
(c) It cannot be affected (d) It will move in circular path 1

7.	C-I (Scenarios)	C-II (Image Characteristics)
	(1) Object at the center of curvature (Concave Mirror)	P. Virtual, upright, and diminished
	(2) Object at infinity (Convex Mirror)	Q. Virtual, upright, and magnified
	(3) Object between focus and lens (Convex Lens)	R. Real, inverted, and same size
	(4) Object at infinity (Convex Lens)	S. Real, inverted, and highly diminished
	(a) 1-R, 2-P, 3-Q, 4-S (c) 1-Q, 2-S, 3-R, 4-P	(b) 1-P, 2-R, 3-S, 4-Q (d) 1-R, 2-S, 3-P, 4-Q 1

8. In a moving coil galvanometer, if the magnetic field is increased by 20% and the area of the coil is decreased by 20%, the current sensitivity will:
- (a) increase by 20% (b) decrease by 20%
(c) decrease by 4% (d) remains the same 1
9. If AC waveform shown in the figure is fed to a half wave rectifier then the fundamental frequency in the output ripple would be:



- (a) 100 Hz (b) 200 Hz
(c) 300 Hz (d) 400 Hz 1
10. In an ON state, the individual silicon and germanium diodes, allow a voltage drop of 0.7 V and 0.3 V respectively across them. In the circuit shown, the Si and the Ge diode, are connected in a parallel combination to a voltage source of 10 V.



What is the voltage V_o for the circuit network?

- (a) 0 volt (b) 9.3 volt
(c) 9.7 volt (d) 10 volt

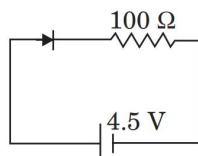
1

11. A particle of charge $+2\text{ C}$ and mass 0.1 kg is accelerated from the rest in an electric field of 2 V/m along x -axis. What will be the change in potential for this charge after it travels for 5 seconds?

- (a) 1000 V (b) -1000 V
(c) 500 V (d) -500 V

1

12. Figure shows a diode connected to an external resistance and an e.m.f. If the barrier potential developed in diode is 0.5 V , Calculate the value of current in the circuit in milliamperes.



- (a) 20 mA (b) 50 mA
(c) 40 mA (d) 60 mA

1

For Questions 13 to 16, two statements are given – one labelled as Assertion (A) and other labelled as Reason (R). Select the correct answer to these questions from the options (a), (b), (c) and (d) as given below.

- (a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.
(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

13. Assertion (A): A galvanometer can be converted into an ammeter by connecting a thick wire in parallel with it.

Reason (R): The current dispersion is more in the path with less resistance.

1

14. Assertion (A): Fusion is the main source of energy in Sun.

Reason (R): It takes four hydrogen atoms to fuse into each helium atom. This is called nuclear fusion.

1

15.Assertion (A): The atomic mass of an element is the weighted average of the atomic masses of different isotopes.

Reason: (R): If we consider masses of individual isotopes, they are not strictly integer multiples of the mass of a hydrogen atom. 1

16.Assertion (A): The stopping potential for a photoelectron increases with the increase in the intensity of incident radiation.

Reason: (R): The intensity of the radiation is directly proportional to energy of incident photons. 1

SECTION - B

10 Marks

17. A thin glass having refractive index 1.5 has a power of -5 D in air. What will be its optical power in a liquid medium having refractive index 1.6? 2

18. A particle of mass m and positive charge q is released from point A. Its speed is found to be v , when it passes through a point B. Show that point A is at higher potential than point B. 2

19. AC generator consists of a coil of 50 turns and area 2.5 m^2 rotating at an angular speed of 60 rad s^{-1} in a uniform magnetic field 0.30 T between two fixed pole pieces. The resistance of the circuit including that of coil is $50\ \Omega$.

(A) What is the maximum current drawn from the generator?

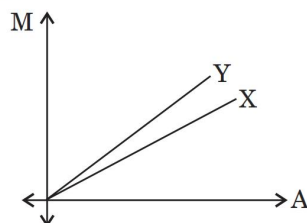
(B) What is the flux through the coil, when the current is zero and maximum? 2

20. Plot a graph showing the variation of stopping potential with the frequency of incident radiation of two different photosensitive materials having work function W_1 and W_2 , ($W_1 > W_2$). On what factors does the slope and intercept of lines depend? 2

OR

When the monochromatic radiation of wavelength 2000 \AA falls upon a nickel plate, the latter acquires a positive charge. The wavelength is increased gradually to 3000 \AA however intense the incident radiation may be, the effect is found to cease. Explain. 2

21. Two inductance coils of same radius and same number of turns are coupled together in two configurations X and Y such that their mutual inductance is M_1 and M_2 , respectively in each configuration. Following graph shows the variation of mutual inductance with area of cross section of the coils.



Identify the configuration that has:

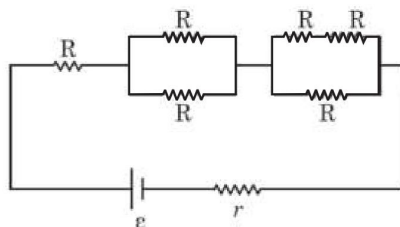
(A) larger coupling coefficient

(B) higher mutual inductance. 2

SECTION - C

21 Marks

- 22.** If resistors in given circuit are identical and emf and internal resistance of the battery are 14 V and 0.5Ω respectively. Calculate the resistance of each resistor if a total current of 2 A is flowing in the circuit.



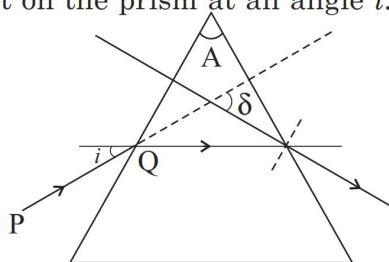
3

- 23.** While cycling at her gym, Neha paddles 120 times per minute. If the cycle wheel has 10 metallic spokes each 0.5 m long and it is positioned so that rotation is normal to the Earth's magnetic field ($B = 0.40 \text{ G}$), then what is the induced emf between the axle and the rim of the wheel? 3
- 24.** An electron and a photon each have a wavelength 1.00 nm. Find:
 (A) their momenta,
 (B) the energy of the photon, and
 (C) the kinetic energy of electron. 3
- 25.** A hydrogen atom is excited from its ground state to the third excited state. How many different spectral lines can be emitted when it returns to the ground state? Calculate the longest wavelength among these transitions. 3

OR

State the limitations of Bohr's atomic model. 3

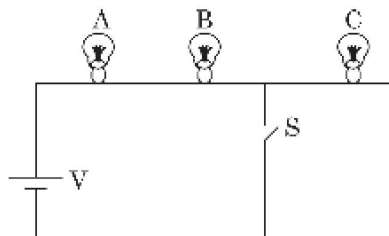
- 26.** If refractive index for prism shown in the figure is equal to cotangent of half of the angle of prism then derive the relation between angle of prism and angle of minimum deviation for a ray of light PQ incident on the prism at an angle i .



3

- 27.** Explain the prismatic action of a convex lens. 3

- 28.** (A) Consider the given figure and conclude the observation if switch S is closed.



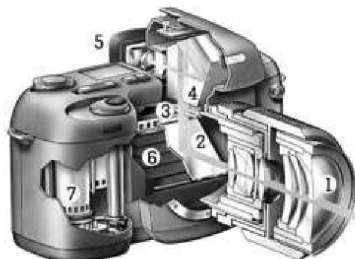
- (B) If the resistance of three bulbs is R_A , R_B and R_C then derive an expression for current in bulb A while switch is open. 3

SECTION - D

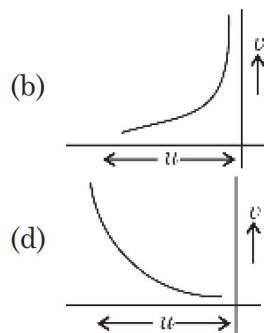
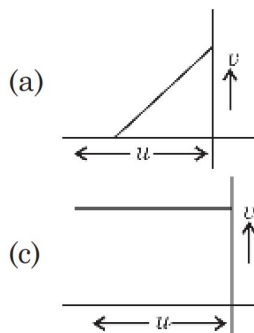
8 Marks

Questions number 29 and 30 are case study-based questions. Read the following paragraphs and answer the questions that follow:

29. A camera consists of a light-proof box provided with a lens system. A light sensitive photographic film is placed at the back of the lens. A focussing device is used to adjust the distance between the lens and the film. By this adjustment, a real and inverted image of an object located at any distance can be cast sharply on the film. Another device, called aperture or stop varies the area of the lens exposed to the film. By varying the size of this aperture, the amount of light reaching the film can be controlled. A shutter is placed between the lens and the film. The shutter opens and closes quickly exposing the film to the light for a short time. A timing device with a spring-catch fixes the time for which the film is exposed to the light coming from the object. For obtaining a good photograph of an object, an adequate amount of light should fall on the film, when the shutter is open.

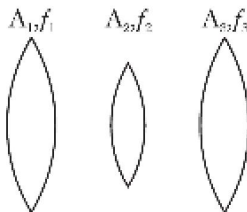


- (A) Which of the following graph(s) shows the correct variation of v with u , if object is placed at distance u from the lens and distance v of the image pin is measured?



1

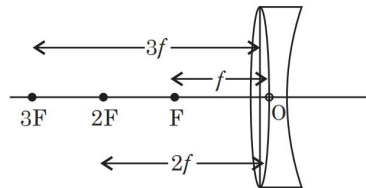
- (B) The given figure shows three convex lenses of various focal lengths and apertures. Which among these do you think are most suitable to be used as objective and eyepiece of an astronomical telescope?



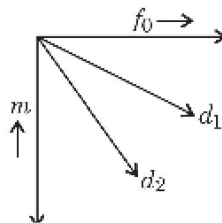
$$A_1 > A_3 > A_2$$

$$f_1 > f_2 > f_3$$

- (a) Objective: lens 1, Eyepiece: lens 2 (b) Objective: lens 2, Eyepiece: lens 3
 (c) Objective: lens 3, Eyepiece: lens 1 (d) Objective: lens 1, Eyepiece: lens 3 1
- (C) In the given figure, convex lens has a focal length f and concave lens has a focal length $2f$. Where should object be placed so that the image formed by this combination is virtual?



- (a) Between F and O (b) Between 2F and P
 (c) Between F and 2F (d) Anywhere on the principal axis 1
- (D) The following graph shows the variation of magnifying power of an astronomical telescope with the focal length of the objective for two eyepieces of focal length d_1 and d_2 . Then which of the following statement is true?



- (a) $d_1 > d_2$
 (b) $d_1 < d_2$
 (c) $d_1 = d_2$
 (d) No information can be obtained from the graph about relationship of d_1 and d_2 . 1

OR

A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then the focal length of the lens:

- (a) Increases (b) Decreases
 (c) becomes zero (d) becomes infinite 1

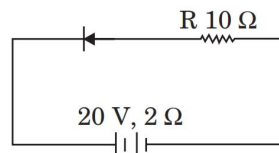
- 30.** Beyond forward voltage $V = V_k$, also known as the knee voltage, when the diode is forward biased, it is discovered that the conductivity is quite high. The potential barrier has been overcome at this level of battery biasing for p-n junction, and the current increases quickly as the forward voltage rises. When the diode is reverse biased, the reverse bias voltage generates a very small flow of a few microamperes that nearly stays constant with bias. This small current is known as a reverse saturation current.



- (A) In a p - n junction diode the depletion region formed is:
 (a) symmetrical on both sides of the junction
 (b) wider on the p -side
 (c) wider on the n -side
 (d) independent of doping concentrations 1
- (B) The ratio of knee voltage of an ideal diode with the knee voltage of a silicon diode is:
 (a) 1 : 1 (b) 0.7 : 1
 (c) 1 : 0.7 (d) zero 1
- (C) The reverse breakdown voltage in a diode is 15 V. This means:
 (a) the forward bias voltage should not exceed 15 V.
 (b) conductivity in forward bias increases suddenly at 15 V.
 (c) the reverse bias voltage should not exceed 15 V.
 (d) the diode is ideal in nature. 1

OR

If an ideal junction diode is connected as shown in the figure, then the value of the current I is:

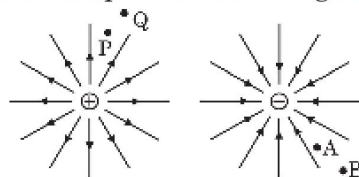


- (a) 2 A (b) 1.25 A
 (c) 0.78 A (d) Zero 1
- (D) A diode of barrier voltage 0.5 V is connected in series to an AC source of 20 V peak voltage and a resistance 4.8 kΩ. If the forward resistance of diode is 75 Ω then the peak value of current flowing in the circuit will be:
 (a) 1 mA (b) 2 mA
 (c) 4 mA (d) 8 mA 1

SECTION - E

15 Marks

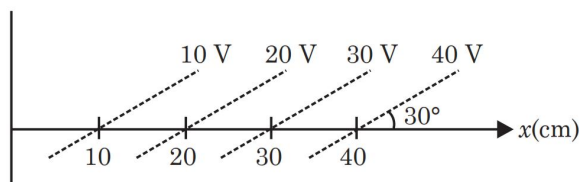
31. Given figures show the field lines of a positive and negative point charge respectively.



- (A) Give the signs of the potential difference $V_P - V_Q$; $V_B - V_A$.
- (B) What will be the change in the potential energy difference if a small negative charge is moved from points Q to P; from point A to B.
- (C) Give the sign of the work done by the field in moving a small positive charge from Q to P.
- (D) Give the sign of the work done by the external agency in moving a small negative charge from B to A.
- (E) Does the kinetic energy of a small negative charge increase or decrease in going from B to A? 5

OR

Some equipotential surfaces are shown in the figure below. Draw electric field lines for given potential surface. What can you say about the magnitude and the direction of the electric field?



Draw electric field lines for given potential surfaces. 5

- 32.** (A) Calculate the resistance or inductance required to operate a lamp (60 V, 10 W) from a source of 100 V, 50 Hz. 5
- (B) Plot a graph showing the variation of capacitive reactance with the frequency of AC source. 5

OR

Using the help of a labelled diagram, explain the working of a transformer. 5

- 33.** Using the Huygens' construction, explain how a parallel beam of light on reflection from a concave mirror gets converged. 5

OR

There are n identical sources and each of them is emitting light intensity I_0 . Derive an expression for resultant intensity of light on interference, when the sources of light are coherent and incoherent. 5