



Series A5BAB/5



SET No. 2

प्रश्न पत्र कोड
Q.P. Code

55/5/2

रोल नं.

Roll No.

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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.

नोट :	NOTE :
(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 15 हैं।	(I) Please check that this question paper contains 15 printed pages.
(II) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।	(II) 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.
(III) कृपया जाँच कर लें कि इस प्रश्न-पत्र में 12 प्रश्न हैं।	(III) Please check that this question paper contains 12 questions.
(IV) कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें।	(IV) Please write down the Serial Number of the question in the answer-book before attempting it.
(V) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है। प्रश्न-पत्र का वितरण पूर्वाह्न 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।	(V) 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.

भौतिक विज्ञान (सैद्धान्तिक)

PHYSICS (Theory)

निर्धारित समय : 2 घण्टे

Time allowed : 2 hours

अधिकतम अंक : 35

Maximum Marks : 35

55/5/2

1

[P.T.O.]



सामान्य निर्देश:

निम्नलिखित निर्देशों को ध्यान से पढ़ें और उनका पालन करें :

1. इस प्रश्न-पत्र में कुल 12 प्रश्न हैं। सभी प्रश्न अनिवार्य हैं।
2. यह प्रश्न-पत्र तीन खण्डों में विभाजित है, खण्ड - क, ख और ग।
3. खण्ड क - प्रश्न संख्या 1 से 3 तक प्रत्येक प्रश्न 2 अंक का है।
4. खण्ड ख - प्रश्न संख्या 4 से 11 तक प्रत्येक प्रश्न 3 अंक का है।
5. खण्ड ग - प्रश्न संख्या 12 प्रकरण आधारित प्रश्न है। यह प्रश्न 5 अंक का है।
6. प्रश्न-पत्र में कोई समग्र विकल्प नहीं है। हालांकि कुछ प्रश्नों में आंतरिक विकल्प प्रदान किए गए हैं। इनमें से केवल एक ही प्रश्न का उत्तर लिखिए।
7. लॉग टेबल का उपयोग कर सकते हैं लेकिन कैलकुलेटर के उपयोग की अनुमति नहीं है।

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

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

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

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

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

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

$$\text{इलेक्ट्रॉन का द्रव्यमान (} m_e \text{)} = 9.1 \times 10^{-31} \text{ kg}$$

$$\text{न्यूट्रॉन का द्रव्यमान} = 1.675 \times 10^{-27} \text{ kg}$$

$$\text{प्रोटॉन का द्रव्यमान} = 1.673 \times 10^{-27} \text{ kg}$$

$$\text{आवोगाद्रो संख्या} = 6.023 \times 10^{23} \text{ प्रति ग्राम मोल}$$

$$\text{बोल्ट्ज़मान नियतांक} = 1.38 \times 10^{-23} \text{ JK}^{-1}$$

.55/5/2



General Instructions :

Please read the following instructions carefully and follow them :

1. This question paper contains **12** questions. **All** questions are compulsory.
2. This question paper is divided into **THREE** sections, **Section - A, B and C.**
3. **Section A** - Question number 1 to 3 are of **2** marks each.
4. **Section B** - Question number 4 to 11 are of **3** marks each.
5. **Section C** - Question number 12 is a case study based question of **5** marks.
6. There is no overall choice in the question paper. However, internal choice has been provided in some of the questions. Attempt **any one** of the alternatives in such questions.
7. Use of log tables is permitted, if necessary, but use of calculator is not permitted.

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

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

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

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

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

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

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

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

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

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

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

55/5/2

3

[P.T.O.]





खण्ड क

1. शुद्ध सिलिकॉन के बने दो क्रिस्टलों C_1 और C_2 का मादन क्रमशः आर्सेनिक और एलुमिनियम से किया गया है। 2
- (i) इस प्रकार बने अपद्रव्यी अर्धचालक की पहचान कीजिए।
- (ii) नैज़ अर्धचालक का मादन क्यों आवश्यक है ?
2. यद्यपि अग्रदिशिक बायस में पश्चदिशिक बायस की तुलना में विद्युतधारा बहुत अधिक होती है फिर कोई फोटो-डायोड पश्चदिशिक बायस में क्यों प्रचालित होता है ? व्याख्या कीजिए। इसके दो उपयोगों का उल्लेख कीजिए। 2
3. (क) यदि α -कण प्रकीर्णन प्रयोग को स्वर्ण पत्र के स्थान पर हाइड्रोजन की एक पतली शीट (हाइड्रोजन 14K से कम ताप पर ठोस अवस्था में होती है) के साथ दोहराया जाए, तो आप किस परिणाम की अपेक्षा करते हैं ? व्याख्या कीजिए। 2

अथवा

- (ख) ऐसा क्यों है कि किसी प्रकाश स्रोत की आवृत्ति, न कि तीव्रता, यह निर्धारित करती है कि प्रकाशिक इलेक्ट्रॉनों का उत्सर्जन होगा अथवा नहीं होगा ? व्याख्या कीजिए। 2

खण्ड ख

4. यंग के द्वि-झिरी प्रयोग में व्यतिकरण पैटर्न किस प्रकार प्रभावित होगा, यदि : 3
- (i) पर्दे को झिर्रियों के तल से दूर ले जाया जाए।
- (ii) स्रोत झिरी को झिर्रियों के तल से दूर ले जाया जाए।
- (iii) दोनों झिर्रियों S_1 और S_2 से निकलने वाली प्रकाश तरंगों के बीच कलान्तर 0 से π हो जाता है और यह नियत रहता है।





SECTION A

1. Two crystals C_1 and C_2 , made of pure silicon, are doped with arsenic and aluminium respectively. 2
- (i) Identify the extrinsic semiconductors so formed.
- (ii) Why is doping of intrinsic semiconductors necessary ?
2. Why a photo-diode is operated in reverse bias whereas current in the forward bias is much larger than that in the reverse bias ? Explain. 2
Mention its two uses.
3. (a) What results do you expect if α -particle scattering experiment is repeated using a thin sheet of hydrogen in place of a gold foil ? Explain. (Hydrogen is a solid at temperature below 14K) 2

OR

- (b) Why it is the frequency and not the intensity of light source that determines whether emission of photoelectrons will occur or not ? Explain. 2

SECTION B

4. How will the interference pattern in Young's double-slit experiment be affected if : 3
- (i) The screen is moved away from the plane of the slits.
- (ii) The source slit is moved away from the plane of the slits.
- (iii) The phase difference between the light waves emanating from the two slits S_1 and S_2 changes from 0 to π and remains constant. (ii)





5. किसी α -कण को 100 V विभवान्तर से त्वरित किया गया है। परिकलित कीजिए : 3

(i) α -कण द्वारा अर्जित चाल

(ii) इससे संबद्ध दे-ब्रॉग्ली तरंगदैर्घ्य (α -कण का द्रव्यमान = 6.4×10^{-27} kg लीजिए)

6. (क) (i) लेंस की क्षमता के SI मात्रक की परिभाषा लिखिए। 3

(ii) कोई समतल-उत्तल लेंस 1.5 अपवर्तनांक के कांच का बना है। इसके उत्तल पृष्ठ की वक्रता त्रिज्या 25 cm है।

(ii.i) इस लेंस की फोकस दूरी परिकलित कीजिए।

(ii.ii) यदि कोई बिम्ब इस लेंस के सामने 50 cm दूरी पर स्थित है तो बनने वाले प्रतिबिम्ब की स्थिति और प्रकृति ज्ञात कीजिए।

अथवा

(ख) 0.6 mm चौड़ी किसी झिरी को 600 nm और 480 nm तरंगदैर्घ्य के किसी प्रकाश पुंज द्वारा प्रकाशित किया गया है। विवर्तन पैटर्न को झिरी से 1 m दूर स्थित पर्दे पर प्रेक्षित किया गया है। 3

(i) 600 nm के प्रकाश के केन्द्रीय उच्चिष्ठ से दूसरी चमकीली फ्रिन्ज की दूरी ज्ञात कीजिए।

(ii) केन्द्रीय उच्चिष्ठ से वह अल्पतम दूरी ज्ञात कीजिए जिस पर दोनों तरंगदैर्घ्यों की चमकीली फ्रिन्जें संपात करेंगी।

7. (क) (i) नीचे दी गई विद्युत-चुम्बकीय विकिरण को उनकी आवृत्तियों के आरोही (बढ़ते) क्रम में व्यवस्थित कीजिए : 3

X-किरणें, सूक्ष्म तरंगें, गामा किरणें, रेडियो-तरंगें

(ii) इन विकिरणों में से किन्हीं दो विकिरणों के दो-दो उपयोग लिखिए।



5. An alpha particle is accelerated through a potential difference of 100 V. Calculate : 3

(i) The speed acquired by the alpha particle, and

(ii) The de-Broglie wavelength associated with it.

(Take mass of alpha particle = 6.4×10^{-27} kg)

6. (a) (i) Define SI unit of power of a lens. 3

(ii) A plano convex lens is made of glass of refractive index 1.5. The radius of curvature of the convex surface is 25 cm.

(ii.i) Calculate the focal length of the lens.

(ii.ii) If an object is placed 50 cm in front of the lens, find the nature and position of the image formed.

OR

(b) A slit of width 0.6 mm is illuminated by a beam of light consisting of two wavelengths 600 nm and 480 nm. The diffraction pattern is observed on a screen 1.0 m from the slit. Find : 3

(i) The distance of the second bright fringe from the central maximum pertaining to light of 600 nm.

(ii) The least distance from the central maximum at which bright fringes due to both the wavelengths coincide.

7. (a) (i) Arrange the following electromagnetic radiation in the ascending order of their frequencies : 3

X-rays, microwaves, gamma rays, radio waves

(ii) Write two uses of any two of these radiation.

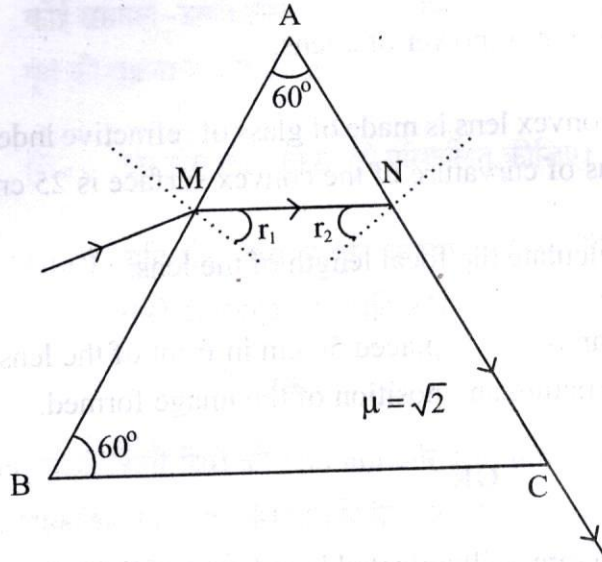




अथवा

- (ख) किरण आरेख की सहायता से किसी परावर्ती दूरदर्शक की कार्यविधि की व्याख्या कीजिए। 3
अपवर्ती दूरदर्शक की तुलना में परावर्ती दूरदर्शक की दो विशेषताओं का उल्लेख कीजिए।

8. अपवर्तनांक $\sqrt{2}$ के किसी प्रिज़्म से कोई प्रकाश की किरण, आरेख में दर्शाए अनुसार गमन कर रही है। 3



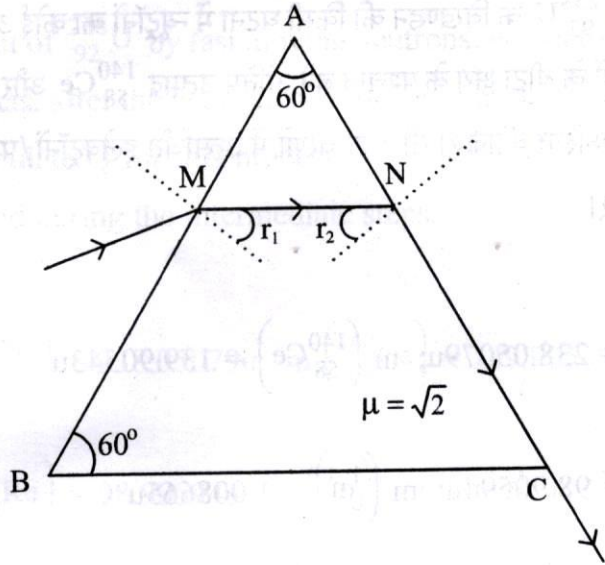
- (i) फलक AC पर आपतन कोण ($\angle r_2$) का मान ज्ञात कीजिए।
(ii) प्रिज़्म के लिए न्यूनतम विचलन कोण का मान ज्ञात कीजिए।
9. (क) बोर के अभिगृहीत का उपयोग करके यह सत्यापित कीजिए कि किसी हाइड्रोजन परमाणु में n वीं कक्षा की त्रिज्या n^2 के अनुक्रमानुपाती है। 3
(ख) यदि n के मान में 1 से ∞ तक वृद्धि की जाती है तो किसी हाइड्रोजन परमाणु की ऊर्जा किस प्रकार परिवर्तित होगी ?



OR

- (b) With the help of a ray diagram explain the working of a reflecting telescope. Mention two advantages of a reflecting telescope over a refracting telescope. 3

8. A ray of light passes through a prism of refractive index $\sqrt{2}$ as shown in the figure. Find : 3



- (i) The angle of incidence ($\angle r_1$) at face AB.
(ii) The angle of minimum deviation for this prism.
9. (a) Use Bohr's postulate to prove that the radius of n^{th} orbit in a hydrogen atom is proportional to n^2 . 3
(b) How will the energy of a hydrogen atom change if n increases from 1 to ∞ ?





3

10. (i) किसी p-n संधि डायोड का V-I अभिलाक्षणिक खींचिए।
- (ii) किसी डायोड के लिए देहली वोल्टता और भंजन वोल्टता के बीच विभेदन कीजिए।
- (iii) संधि डायोड के उस गुण का उल्लेख कीजिए जो उसे ac वोल्टता के दिष्टकरण के लिए उपयुक्त बनाता है।

11. तीव्र गतिशील न्यूट्रॉनों द्वारा $^{238}_{92}\text{U}$ के विखण्डन की किसी घटना में न्यूट्रॉनों का कोई उत्सर्जन नहीं होता है तथा प्राथमिक खण्डों के बीटा क्षय के पश्चात् बने अंतिम उत्पाद $^{140}_{58}\text{Ce}$ और $^{99}_{44}\text{Ru}$ हैं। इस प्रक्रिया के लिए Q परिकलित कीजिए। बीच के चरणों में उत्सर्जित इलेक्ट्रॉनों/पाज़िट्रॉनों के द्रव्यमानों की उपेक्षा कीजिए।

दिया है : $m\left(^{238}_{92}\text{U}\right) = 238.05079\text{u}$; $m\left(^{140}_{58}\text{Ce}\right) = 139.90543\text{u}$

$$m\left(^{99}_{44}\text{Ru}\right) = 98.90594\text{u}; m\left(^1_0\text{n}\right) = 1.008665\text{u}$$



10. (i) Draw V-I characteristics of a p-n Junction diode. 3
- (ii) Differentiate between the threshold voltage and the breakdown voltage for a diode.
- (iii) Write the property of a junction diode which makes it suitable for rectification of ac voltages.

11. In a fission event of ${}_{92}^{238}\text{U}$ by fast moving neutrons, no neutrons are emitted and final products, after the beta decay of the primary fragments, are ${}_{58}^{140}\text{Ce}$ and ${}_{44}^{99}\text{Ru}$. Calculate Q for this process. Neglect the masses of electrons/positrons emitted during the intermediate steps. 3

Given : $m({}_{92}^{238}\text{U}) = 238.05079\text{u}$; $m({}_{58}^{140}\text{Ce}) = 139.90543\text{u}$

$m({}_{44}^{99}\text{Ru}) = 98.90594\text{u}$; $m({}_0^1\text{n}) = 1.008665\text{u}$

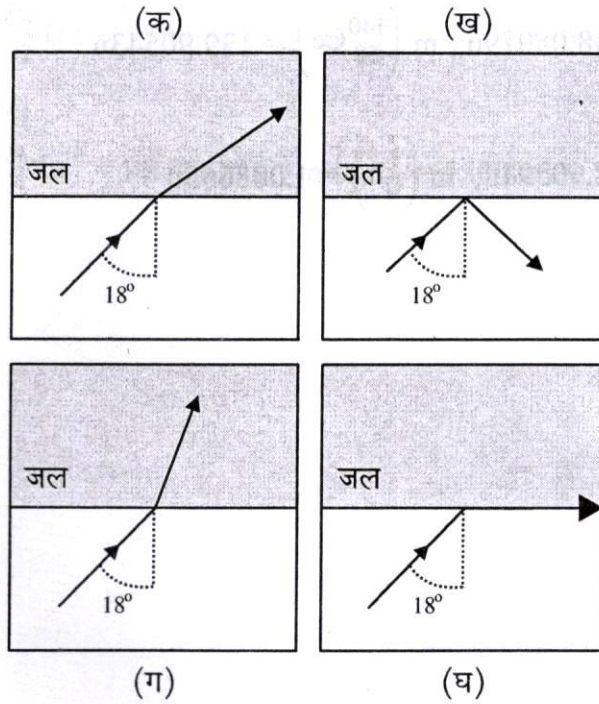




12. कोई प्रकाश किरण किसी सघन माध्यम से विरल माध्यम में गमन करती है। अपवर्तन के पश्चात् यह अभिलम्ब से दूर मुड़ जाती है। जब हम आपतन कोण में वृद्धि करते जाते हैं तो अपवर्तन कोण में भी उस समय तक वृद्धि होती जाती है जब तक कि अपवर्तित किरण दोनों माध्यमों के अन्तरापृष्ठ के अनुदिश पृष्ठसर्पी नहीं हो जाती है। जिस आपतन कोण पर ऐसा होता है उसे क्रांतिक कोण कहते हैं। यदि आपतन कोण में और अधिक वृद्धि करें तो यह किरण निर्गत नहीं होगी और सघन माध्यम में ही वापस परावर्तित हो जाएगी। इस परिघटना को प्रकाश का पूर्ण आंतरिक परावर्तन कहते हैं।

5

- (i) कोई प्रकाश किरण किसी माध्यम से जल में 18° के आपतन कोण से गमन करती है। इस माध्यम का अपवर्तनांक जल के अपवर्तनांक से अधिक है तथा इन दोनों माध्यमों के अन्तरापृष्ठ पर क्रांतिक कोण 20° है। नीचे दिए गए किस आरेख में प्रकाश किरण के पथ का सर्वोत्तम निरूपण किया गया है ?



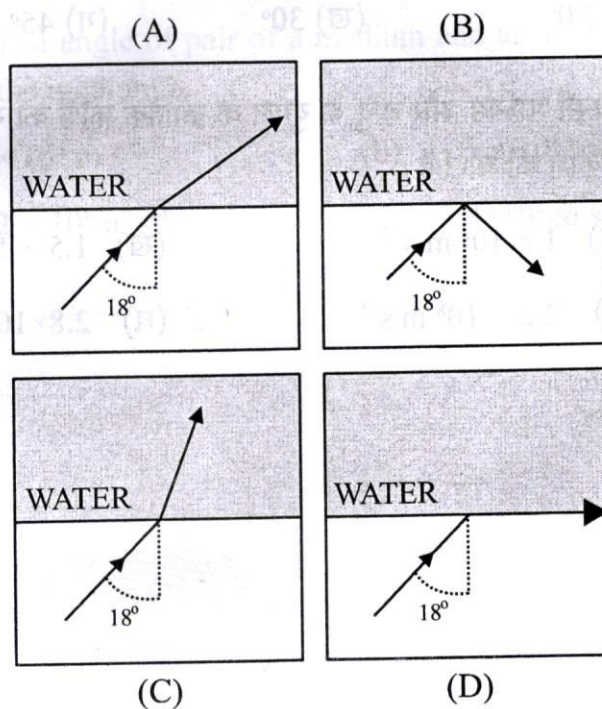


SECTION C

12. A ray of light travels from a denser to a rarer medium. After refraction, it bends away from the normal. When we keep increasing the angle of incidence, the angle of refraction also increases till the refracted ray grazes along the interface of two media. The angle of incidence for which it happens is called critical angle. If the angle of incidence is increased further the ray will not emerge and it will be reflected back in the denser medium. This phenomenon is called total internal reflection of light.

5

- (i) A ray of light travels from a medium into water at an angle of incidence of 18° . The refractive index of the medium is more than that of water and the critical angle for the interface between the two media is 20° . Which one of the following figures best represents the correct path of the ray of light ?



.55/5/2

13

[P.T.O.]





(ii) प्रकाश का कोई बिन्दु स्रोत अपवर्तनांक μ के पानी से भरी किसी टंकी, जिसकी गहराई d है, की तली पर रखा है। जल के पृष्ठ का वह क्षेत्रफल क्या है जिससे होकर स्रोत का प्रकाश निर्गत हो सकता है :

(क) $\frac{\pi d^2}{2(\mu^2 - 1)}$ (ख) $\frac{\pi d^2}{(\mu^2 - 1)}$ (ग) $\frac{\pi d^2}{\sqrt{2}\sqrt{\mu^2 - 1}}$ (घ) $\frac{2\pi d^2}{(\mu^2 - 1)}$

(iii) निम्नलिखित में से किस माध्यम का, वायु के सापेक्ष, क्रांतिक कोण का मान अधिकतम है ?

(क) क्राउन कांच (ख) फ्लिंट कांच (ग) पानी (घ) हीरा

(iv) दो माध्यमों A (अपवर्तनांक 2.0) और B (अपवर्तनांक 1.0) के किसी युगल के लिए क्रांतिक कोण का मान है :

(क) 0° (ख) 30° (ग) 45° (घ) 60°

(v) किसी माध्यम और वायु के युगल के क्रांतिक कोण का मान 30° है। इस माध्यम में प्रकाश की चाल है :

(क) $1 \times 10^8 \text{ m s}^{-1}$ (ख) $1.5 \times 10^8 \text{ m s}^{-1}$
(ग) $2.2 \times 10^8 \text{ m s}^{-1}$ (घ) $2.8 \times 10^8 \text{ m s}^{-1}$



- (ii) A point source of light is placed at the bottom of a tank filled with water, of refractive index μ , to a depth d . The area of the surface of water through which light from the source can emerge, is :

(a) $\frac{\pi d^2}{2(\mu^2 - 1)}$ (b) $\frac{\pi d^2}{(\mu^2 - 1)}$ (c) $\frac{\pi d^2}{\sqrt{2}\sqrt{\mu^2 - 1}}$ (d) $\frac{2\pi d^2}{(\mu^2 - 1)}$

- (iii) For which of the following media, with respect to air, the value of critical angle is maximum ?

(a) Crown glass (b) Flint glass (c) Water (d) Diamond

- (iv) The critical angle for a pair of two media A and B of refractive indices 2.0 and 1.0 respectively is :

(a) 0° (b) 30° (c) 45° (d) 60°

- (v) The critical angle of pair of a medium and air is 30° . The speed of light in the medium is :

(a) $1 \times 10^8 \text{ m s}^{-1}$ (b) $1.5 \times 10^8 \text{ m s}^{-1}$
(c) $2.2 \times 10^8 \text{ m s}^{-1}$ (d) $2.8 \times 10^8 \text{ m s}^{-1}$



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Senior Secondary School Term II Examination, 2022

Marking Scheme – PHYSICS (SUBJECT CODE – 042)

(PAPER CODE – 55/5/2)

General Instructions: -

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2. **“Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. Its’ leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc may invite action under IPC.”**
3. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one’s own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them. In class-X, while evaluating two competency based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, marks should be awarded.**
4. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
5. Evaluators will mark(\checkmark) wherever answer is correct. For wrong answer ‘X’ be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
6. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.
7. If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
8. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.



10. A full scale of marks 35 has to be used. Please do not hesitate to award full marks if the answer deserves it.
11. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 30 answer books per day in main subjects and 35 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
12. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
 - Leaving answer or part thereof unassessed in an answer book.
 - Giving more marks for an answer than assigned to it.
 - Wrong totaling of marks awarded on a reply.
 - Wrong transfer of marks from the inside pages of the answer book to the title page.
 - Wrong question wise totaling on the title page.
 - Wrong totaling of marks of the two columns on the title page.
 - Wrong grand total.
 - Marks in words and figures not tallying.
 - Wrong transfer of marks from the answer book to online award list.
 - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
 - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
14. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
15. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
16. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.



MARKING SCHEME
 Senior Secondary School Examination TERM–II, 2022
PHYSICS (Subject Code–042)
[Paper Code : 55/5/2]

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks	Total Marks				
SECTION—A							
1.	<table border="1" style="width: 100%;"> <tr> <td style="width: 70%;">Identifying the semiconductors</td> <td style="text-align: right;">½ + ½</td> </tr> <tr> <td>Reason</td> <td style="text-align: right;">1</td> </tr> </table> <p>i) C₁ n-type C₂ p-type ii) To have higher and regulated conductivity</p>	Identifying the semiconductors	½ + ½	Reason	1	½ ½ 1	2
Identifying the semiconductors	½ + ½						
Reason	1						
2.	<table border="1" style="width: 100%;"> <tr> <td style="width: 70%;">Explanation</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Two uses</td> <td style="text-align: right;">½ + ½</td> </tr> </table> <p>It is easier to observe the change in current with change in light intensity if a reverse bias is applied.</p> <p><u>Alternatively:</u></p> <p>The fractional change due to photo effect on the minority carrier dominated reverse bias current, is more readily measurable than the fractional change in the forward bias current.</p> <p>Uses: (Any two uses)</p> <ul style="list-style-type: none"> • Smoke detector • Remote control • Medical devices • Optical signal detection (Any other) 	Explanation	1	Two uses	½ + ½	1 ½+½	2
Explanation	1						
Two uses	½ + ½						
3.	<p>a)</p> <table border="1" style="width: 100%;"> <tr> <td style="width: 70%;">Writing of the result</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Explanation</td> <td style="text-align: right;">1</td> </tr> </table> <p>There would be no large angle scattering / Size of nucleus can't be determined.</p> <p>As hydrogen atom which is a target nucleus has only one proton whereas approaching α particle is more massive than the target nucleus.</p>	Writing of the result	1	Explanation	1	1 1	
Writing of the result	1						
Explanation	1						

	<p>Alternatively: Repulsive force between target nucleus (Hydrogen) and α-particles will be very less. (Note: Give full credit for other correct explanations.) OR</p> <p>b)</p> <table border="1" data-bbox="332 378 1209 430"> <tr> <td>Explanation</td> <td>2</td> </tr> </table> <p>According to the photon picture of light the emission of photoelectrons depend on the energy of photon incident on the metal surface which is determined by the frequency not by the intensity which determines the number of electrons emitted.</p>	Explanation	2	2	2						
Explanation	2										
SECTION—B											
4.	<table border="1" data-bbox="332 745 1201 913"> <tr> <td>Effect on interference pattern</td> <td></td> </tr> <tr> <td>(i) On moving screen away</td> <td>1</td> </tr> <tr> <td>(ii) On moving source slit away</td> <td>1</td> </tr> <tr> <td>(iii) Changing phase difference</td> <td>1</td> </tr> </table> <p>i) $\beta = \frac{\lambda D}{d}$ As D increases fringe width increases (Note: Give full credit, if students does not write the formula)</p> <p>ii) Fringe width remains same but intensity of fringes decreases.</p> <p>Alternatively s=size of source S=distance between source and slit for interference to be seen $\frac{s}{S} < \frac{\lambda}{D}$ remains satisfied</p> <p>Sharpness of fringes increases/interference pattern may disappear. There will be no distinct pattern.</p> <p>iii) There will be a dark fringe at the centre instead of a bright fringe.</p> <p>Alternatively As the phase difference changes from 0 to π there will be a shift in pattern on the screen till the central maximum turns to dark fringe.</p>	Effect on interference pattern		(i) On moving screen away	1	(ii) On moving source slit away	1	(iii) Changing phase difference	1	<p>$\frac{1}{2}$ $\frac{1}{2}$ 1 1</p>	3
Effect on interference pattern											
(i) On moving screen away	1										
(ii) On moving source slit away	1										
(iii) Changing phase difference	1										
5.	<table border="1" data-bbox="332 1659 1201 1764"> <tr> <td>(i) Speed of α particle</td> <td>1 $\frac{1}{2}$</td> </tr> <tr> <td>(i) de-Broglie wavelength</td> <td>1 $\frac{1}{2}$</td> </tr> </table> <p>i) $v = \sqrt{\frac{2qV}{m}}$</p>	(i) Speed of α particle	1 $\frac{1}{2}$	(i) de-Broglie wavelength	1 $\frac{1}{2}$	$\frac{1}{2}$					
(i) Speed of α particle	1 $\frac{1}{2}$										
(i) de-Broglie wavelength	1 $\frac{1}{2}$										



	$= \sqrt{\frac{2 \times 2 \times 1.6 \times 10^{-19} \times 100}{6.4 \times 10^{-27}}}$ $= 1 \times 10^5 \text{ m/s}$ <p>ii) $\lambda = \frac{h}{p} = \frac{h}{mv}$</p> $= \frac{6.63 \times 10^{-34}}{6.4 \times 10^{-27} \times 10^5}$ $\lambda = 10^{-12} \text{ m}$	1/2							
	$= 1 \times 10^5 \text{ m/s}$ <p>ii) $\lambda = \frac{h}{p} = \frac{h}{mv}$</p> $= \frac{6.63 \times 10^{-34}}{6.4 \times 10^{-27} \times 10^5}$ $\lambda = 10^{-12} \text{ m}$	1/2							
		1/2							
		1/2	3						
		1/2							
6.	<p>a)</p> <table border="1" data-bbox="329 764 1219 909"> <tbody> <tr> <td>Definition</td> <td>1</td> </tr> <tr> <td>Calculation of focal length</td> <td>1</td> </tr> <tr> <td>Nature and position of image</td> <td>1</td> </tr> </tbody> </table> <p>(i) Diopetre is the reciprocal of focal length of lens in metre. <u>Alternatively:</u></p> $\text{Diopetre} = \frac{1}{\text{focal length (m)}}$ <p><u>Alternatively:</u></p> One diopetre is the power of a lens of focal length of one metre <p>ii.i)</p> $\frac{1}{f} = (\mu - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$ $R_1 = \infty, R_2 = -25 \text{ cm}, \mu = 1.5$ $\frac{1}{f} = (\mu - 1) \left(\frac{1}{\infty} + \frac{1}{25} \right)$ $\text{or } \frac{1}{f} = 0.5 \times \frac{1}{25} \text{ or } f = 50 \text{ cm}$ <p>ii.ii) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$</p> $\frac{1}{50} = \frac{1}{v} - \frac{1}{-50}$ $\frac{1}{v} = 0$ <p>$\therefore v = \infty,$</p>	Definition	1	Calculation of focal length	1	Nature and position of image	1	1	
Definition	1								
Calculation of focal length	1								
Nature and position of image	1								
		1/2							
		1/2							
		1/2							

Microwaves-

- Microwave oven
- Speed of automobiles
- Radar
- Air craft navigation

Gamma rays-

- Treatment of cancer
- Sterilisation and disinfection

X rays-

- Diagnostic tool in medicine
 - Treatment for certain forms of cancer
- (Two uses of any two of these radiations)

OR

b)

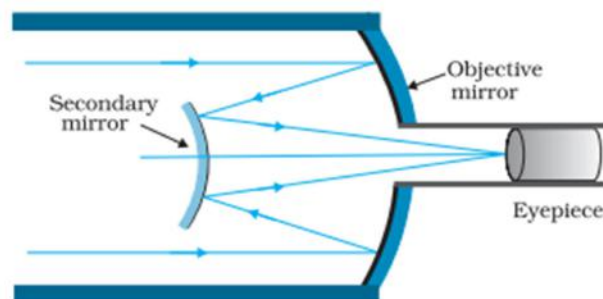
Ray Diagram and explanation of working

2

Advantages

$\frac{1}{2} + \frac{1}{2}$

Ray diagram of reflecting telescope Working



1 $\frac{1}{2}$

Working: Parallel beam of light gathered by objective mirror is reflected to the secondary mirror, which further forms the image in front of the eyepiece.

$\frac{1}{2}$

(Note: deduct $\frac{1}{2}$ marks for not showing the direction of propagation of rays and give full credit for the ray diagram of Newtonian telescope)

Two Advantages (Any Two)

- High resolving power
- No chromatic aberration
- Reduced spherical aberration
- Brighter image is formed
- Easy mechanical support
- Large magnifying power

$\frac{1}{2} + \frac{1}{2}$

3

<p>8.</p>	<table border="1" style="width: 100%;"> <tbody> <tr> <td>Calculation of $\angle r_2$</td> <td style="text-align: right;">1 ½</td> </tr> <tr> <td>Calculation of angle of minimum deviation</td> <td style="text-align: right;">1 ½</td> </tr> </tbody> </table> <p>(i) As the emergent ray grazes along the side AC, therefore</p> $\frac{1}{\sqrt{2}} = \frac{\sin r_2}{\sin 90^\circ}$ $\therefore r_2 = 45^\circ$ <p>(ii) $\mu = \frac{\sin\left(\frac{A + \delta m}{2}\right)}{\sin \frac{A}{2}}$</p> $\sqrt{2} = \frac{\sin\left(\frac{60^\circ + \delta m}{2}\right)}{\sin 30^\circ}$ $\therefore \delta_m = 30^\circ$	Calculation of $\angle r_2$	1 ½	Calculation of angle of minimum deviation	1 ½	<p>1 ½</p> <p>½</p> <p>½</p> <p>½</p>	<p>3</p>
Calculation of $\angle r_2$	1 ½						
Calculation of angle of minimum deviation	1 ½						
<p>9.</p>	<table border="1" style="width: 100%;"> <tbody> <tr> <td>Proof of radius $r \propto n^2$</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Explanation</td> <td style="text-align: right;">1</td> </tr> </tbody> </table> <p>(a) centripetal force = electrostatic force of attraction</p> $\frac{mv^2}{r} = \frac{ke^2}{r^2}$ $r = \frac{ke^2}{mv^2} \quad \text{----- (i)}$ <p>From Bohr's II postulate of quantization</p> $L = mvr = \frac{nh}{2\pi} \quad \text{----- (ii)}$ <p>Substitute v from eq (ii) into eq (i)</p> $r = \frac{ke^2}{m \cdot n^2 h^2} \times 4\pi^2 m^2 r^2$ $r = \frac{n^2 h^2}{4\pi^2 m k e^2}$ $r \propto n^2$ <p>(b) $E_n = \frac{-13.6}{n^2} \text{ eV}$</p>	Proof of radius $r \propto n^2$	2	Explanation	1	<p>½</p> <p>½</p> <p>½</p> <p>½</p>	
Proof of radius $r \propto n^2$	2						
Explanation	1						



	<p>For $n=1$, $E_1 = -13.6\text{eV}$, for $n = \infty$, $E_\infty=0$</p> <p>As n increases from $n = 1$ to ∞, energy increases (Note: Give full credit of part (b) if a student does not write the formula)</p>	$\frac{1}{2}$	3						
10.	<table border="1"> <tr> <td>V-I characteristics</td> <td>1</td> </tr> <tr> <td>Difference between threshold voltage and breakdown voltage</td> <td>1</td> </tr> <tr> <td>Property of junction diode</td> <td>1</td> </tr> </table> <p>i)</p> <p>(Note : Full credit if values on the axis are not mentioned)</p> <p>ii)</p> <p>Threshold Voltage: Forward bias voltage at which the current increases significantly(exponentially) even for a very small increase in voltage.</p> <p>Alternatively: Forward bias voltage at which the width depletion layer and barrier potential decreases significantly.</p> <p>Alternatively: The voltage at which resistance of junction decreases significantly.</p> <p>Break down voltage: Reverse bias voltage at which current increases suddenly</p> <p>Alternatively: Large number of covalent bonds present in the depletion layer break suddenly</p> <p>iii) Junction Diode conducts when it is forward biased and does not conduct when reverse biased.</p>	V-I characteristics	1	Difference between threshold voltage and breakdown voltage	1	Property of junction diode	1	1	$\frac{1}{2}$
V-I characteristics	1								
Difference between threshold voltage and breakdown voltage	1								
Property of junction diode	1								
		1	3						
11.	<table border="1"> <tr> <td>Calculation of mass defect</td> <td>2</td> </tr> <tr> <td>Calculation of Q value</td> <td>1</td> </tr> </table>	Calculation of mass defect	2	Calculation of Q value	1				
Calculation of mass defect	2								
Calculation of Q value	1								

	$\Delta m = \text{total mass of the reactants} - \text{total mass of the products}$ $= [m({}^{238}_{92}\text{U}) + m_n - m({}^{140}_{58}\text{Ce}) - m({}^{99}_{44}\text{Ru})]$ $= [238 \cdot 05079 + 1 \cdot 008665 - 139 \cdot 90543 - 98 \cdot 90594]u$ $= [239 \cdot 059455 - 238 \cdot 81137]u$ $= 0 \cdot 248085 u$ Q-value $= 0 \cdot 248085 \times 931.5 \text{ MeV}$ $= 231.09 \text{ MeV}$ (Note: Award this 1 mark even if Q-value is not calculated)	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ 1	3
SECTION—C			
12.	(i)—a (ii)—b (iii)—c (iv)—b (v)—b	1 1 1 1 1	5

* * *