

This Question Paper consists of 43 questions and 8 printed pages.

इस प्रश्न-पत्र में 43 प्रश्न तथा 8 मुद्रित पृष्ठ हैं।

Roll No.
अनुक्रमांक

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Code No. 71/SS/312
कोड नं.

SET/सेट - **A1**

PHYSICS
भौतिक विज्ञान
(312)

Day and Date of Examination
(परीक्षा का दिन व दिनांक)

Signature of Invigilators :
(निरीक्षकों के हस्ताक्षर)

1. _____
2. _____

General Instructions :

1. Candidate must write his/her Roll Number on the first page of the Question Paper.
2. Please check the Question Paper to verify that the total pages and total number of questions contained in the Question Paper are the same as those printed on the top of the first page. Also check to see that the questions are in sequential order.
3. Making any identification mark in the Answer-Book or writing Roll Number anywhere other than the specified places will lead to disqualification of the candidate.
4. Write your Question Paper Code No. **71/SS/312, Set - A1** on the Answer-Book.
5. (a) The Question Paper is in English/Hindi medium only. However, if you wish, you can answer in any one of the languages listed below :
English, Hindi, Urdu, Punjabi, Bengali, Tamil, Malayalam, Kannada, Telugu, Marathi, Oriya, Gujarati, Konkani, Manipuri, Assamese, Nepali, Kashmiri, Sanskrit and Sindhi.
You are required to indicate the language you have chosen to answer in the box provided in the Answer-Book.
(b) If you choose to write the answer in the language other than Hindi and English, the responsibility for any errors/mistakes in understanding the questions will be yours only.

सामान्य अनुदेश :

1. परीक्षार्थी प्रश्न-पत्र के पहले पृष्ठ पर अपना अनुक्रमांक अवश्य लिखें।
2. कृपया प्रश्न-पत्र को जाँच लें कि प्रश्न-पत्र के कुल पृष्ठों तथा प्रश्नों की उतनी ही संख्या है जितनी प्रथम पृष्ठ के सबसे ऊपर छपी है। इस बात की जाँच भी कर लें कि प्रश्न क्रमिक रूप में हैं।
3. उत्तर-पुस्तिका में पहचान-चिह्न बनाने अथवा निर्दिष्ट स्थानों के अतिरिक्त कहीं भी अनुक्रमांक लिखने पर परीक्षार्थी को अयोग्य ठहराया जायेगा।
4. अपनी उत्तर-पुस्तिका पर प्रश्न-पत्र का कोड नं **71/SS/312, सेट - A1** लिखें।
5. (क) प्रश्न-पत्र केवल अंग्रेजी/हिंदी माध्यम में है। फिर भी, यदि आप चाहें तो नीचे दी गई किसी एक भाषा में उत्तर दे सकते हैं :
अंग्रेजी, हिंदी, उर्दू, पंजाबी, बाँगला, तमिल, मलयालम, कन्नड़, तेलुगु, मराठी, उड़िया, गुजराती, कोंकणी, मणिपुरी, असमिया, नेपाली, कश्मीरी, संस्कृत और सिंधी।
कृपया उत्तर-पुस्तिका में दिए गए बॉक्स में लिखें कि आप किस भाषा में उत्तर लिख रहे हैं।
(ख) यदि आप हिंदी एवं अंग्रेजी के अतिरिक्त किसी अन्य भाषा में उत्तर लिखते हैं, तो प्रश्नों को समझने में होने वाली त्रुटियों / गलतियों की जिम्मेदारी केवल आपकी होगी।

PHYSICS

(312)

Time : 3 Hours]

[Maximum Marks : 80

- Note :**
- (i) This question paper consists of **43** questions in all.
 - (ii) All questions are **compulsory**.
 - (iii) Marks are given against each question.
 - (iv) Use log tables if required.
 - (v) **Section - A consists of :**
 - (a) Q. Nos. **1** to **16** - Multiple Choice type questions (MCQs) carrying **1** mark each. Select and write the most appropriate option out of the four options given in each of these questions.
 - (b) Q. Nos. **17** to **28** - Objective type questions carrying **2** marks each. Attempt these questions as per the instructions given for each.
 - (vi) **Section - B consists of :**
 - (a) Q. Nos. **29** to **37** - Very short answer type questions carrying **2** marks each and to be answered in the range of **30** to **50** words.
 - (b) Q. Nos. **38** to **41** - Short answer type questions carrying **3** marks each and to be answered in the range of **50** to **80** words.
 - (c) Q. Nos. **42** and **43** - Long answer type questions carrying **5** marks each and to be answered in the range of **80** to **120** words.

NOTE :

- (1) Answers of all questions are to be given in the Answer-Book given to you.
- (2) 15 minutes time has been allotted to read this question paper. The question paper will be distributed at 02.15 p.m. From 02.15 p.m. to 02.30 p.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

SECTION - A

Note : Question Nos. 1 to 16 - Multiple choice type questions (MCQs) carrying 1 mark each.

1. The proper use of lubricants cannot reduce : 1
(A) Static friction (B) Inertia
(C) Sliding friction (D) Rolling friction
2. A long spring is stretched by 2 cm. Its potential energy is V . If the spring is stretched by 10 cm, its potential energy would be : 1
(A) $V/25$ (B) $V/5$ (C) $5V$ (D) $25V$
3. The Bernoulli's theorem is based on conservation of : 1
(A) Mass (B) Momentum
(C) Energy (D) Kinetic Energy
4. In a container having water filled upto a height h , a hole is made in the bottom. The velocity of water flowing out of the hole is : 1
(A) independent of h (B) proportional to h^2
(C) proportional to $h^{1/2}$ (D) proportional to h^3
5. The internal energy of an ideal gas depends on : 1
(A) Pressure (B) Temperature
(C) Volume (D) Size of molecule
6. 110 J of heat is added to a gaseous system and its internal energy increases by 40 J. Then, the amount of workdone is : 1
(A) 150 J (B) 70 J (C) 110 J (D) 40 J
7. Motion of an oscillating liquid column in a U - tube is : 1
(A) periodic but not simple harmonic
(B) non-periodic
(C) simple harmonic and time period is independent of the density of the liquid
(D) simple harmonic and time period is directly proportional to the density of the liquid
8. Sound waves of wavelength λ , travelling in a medium with a speed of v m/s enter into another medium where its speed is $2v$ m/s. The wavelength of sound waves in the second medium is : 1
(A) λ (B) $\lambda/2$ (C) 2λ (D) 4λ
9. A spherical shell has uniform surface charge density. What is the electric field inside a spherical shell ? 1
(A) Zero
(B) Less than zero
(C) Directly proportional to the distance from the centre
(D) Greater than zero

10. If two streams, one of electrons and another of protons, move parallel to each other in the same direction, then they : 1
 (A) Attract each other (B) Repel each other
 (C) Do not interact (D) Neither attract nor repel
11. Which of the following is the correct definition of interference ? 1
 (A) It is superposition of light waves.
 (B) It is superposition of light waves from two incoherent sources.
 (C) It is redistribution of energy due to superposition of light waves from two coherent sources.
 (D) It is superposition of light waves from two coherent sources.
12. Two coherent monochromatic light beams of intensities I and $4I$ superimpose. The maximum and minimum possible intensities in the resulting beam are : 1
 (A) $5I$ and I (B) $5I$ and $3I$ (C) $3I$ and I (D) $9I$ and I
13. An object is immersed in a fluid. In order that the object becomes invisible, it should : 1
 (A) Behave as a perfect reflector
 (B) Absorb all the light falling on it
 (C) Have refractive index one
 (D) Have refractive index exactly matching with that of the surrounding fluid
14. Which of the following spectral series in hydrogen atom gives spectral line of $4800 \text{ \AA}$? 1
 (A) Lyman (B) Balmer (C) Paschen (D) Brackett
15. A proton, a neutron, an electron and an α -particle have same energy. Then their de Broglie wavelengths compare as : 1
 (A) $\lambda_p = \lambda_n > \lambda_e > \lambda_\alpha$ (B) $\lambda_\alpha < \lambda_p = \lambda_n < \lambda_e$
 (C) $\lambda_e < \lambda_p = \lambda_n > \lambda_\alpha$ (D) $\lambda_e = \lambda_p = \lambda_n = \lambda_\alpha$
16. Electrical Conductivity of a semiconductor : 1
 (A) decreases with rise in its temperature
 (B) increases with rise in its temperature
 (C) does not change with rise in its temperature
 (D) first increases and then decreases with rise in its temperature

Note : Q.Nos. 17 to 28 are objective type questions of 2 marks each.

17. (a) Surface tension of liquid _____ with rise in temperature of the liquid. 1x2=2
 (b) If the liquid neither rises nor falls in a capillary tube, then angle of contact is _____.
18. (a) The phenomenon of rise or fall of a liquid in capillary tube is known as _____. 1x2=2
 (b) Property of liquid surface by virtue of which it behaves as an elastic stretched membrane and tends to have minimum surface area known as _____.

19. (a) _____ waves do not transfer any energy and momentum in the material medium. **1x2=2**
 (b) Resonance is an example of _____ vibration.
20. (a) Maximum displacement of the oscillating particle on either side of its mean position is called its _____. **1x2=2**
 (b) State of particle regarding its position and direction of motion at any instant is known as _____.
21. (a) Name the physical quantity whose SI unit is V-m. **1x2=2**
 (b) One end of a copper wire is connected to a neutral pith ball and other end to a negatively charged plastic rod. What will be the nature of charge acquired by the pith ball ?
22. (a) Which of the following options are correct ? **1x2=2**
 In a region of constant potential
 (A) The electric field is uniform.
 (B) The electric field is zero.
 (C) There can be charge inside the region.
 (D) The electric field shall necessarily change if a charge is placed outside the region.
 (b) What is the geometrical shape of equipotential surface due to a single isolated charge ?
23. (a) Locus of particles of the medium vibrating in the same phase at any instant is known as _____. **1x2=2**
 (b) What is the phase difference between two points on the same wavefront ?
24. (a) When a ray of light enters from one medium to another, then which of the following does not change ? **1x2=2**
 Frequency / Wavelength / Amplitude
 (b) A double convex lens of refractive index μ_1 is immersed in a liquid of refractive index μ_2 . The lens will act as transparent plane sheet when
 $\mu_1 > \mu_2$, $\mu_1 = \mu_2$, $\mu_1 < \mu_2$
25. (a) In Rutherford's scattering experiment, the target was bombarded by _____. **1x2=2**
 (b) What is the ratio of radii of the orbits corresponding to first excited state and ground state in a hydrogen atom ?
26. (a) For a given photosensitive material and with a source of constant frequency of incident radiation, how does the photocurrent vary with intensity of incident light ? **1x2=2**
 (b) Show on a graph the variation of de-broglie wavelength (λ) associated with an electron with the square root of accelerating potential (V).

27. (a) A photo diode is operated in _____. 1x2=2
 (b) A narrow region near the junction has deficiency of mobile charges. This region is called _____ region.
28. (a) When forward bias is applied on a p - n junction diode, the width of the depletion region _____. 1x2=2
 (b) Zener diode is used as _____.

SECTION - B

Note : For Q. Nos. 29 to 37, an internal choice has been provided in some of these questions. You have to attempt only one of the given choices in such questions.

29. Explain why passengers are thrown forward from their seats when a speeding bus stops suddenly. 2

OR

Why do the passengers fall in backward direction when a bus suddenly starts moving from the rest position ?

30. What are conservative forces ? Give one example for conservative force. 2
31. Calculate the change in the internal energy of a system when 2
 (a) The system absorbs 2000 J of heat and produces 500 J of work.
 (b) The system absorbs 1100 J of heat and 400 J work is done on it.
32. The resistivity of a conducting wire of length l and area of cross-section A is $2 \times 10^{-8} \Omega m$. 2
 What will be the resistivity of the same metallic wire of length $2l$ and area of cross-section $2A$?

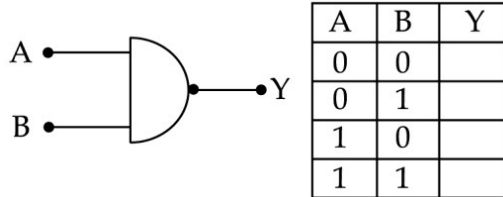
OR

A potential difference of 8 V is applied across the ends of a conducting wire of length 3 cm and area of cross-section 2 cm^2 . The resulting current in the wire is 0.15 A. Calculate the resistance and resistivity of the wire.

33. What are Anti-stokes lines ? 2
- OR**
- What is dispersion of light ? Would you prefer small angled or large angled prism to produce dispersion ?
34. The angle of the minimum deviation for a 60° glass prism is 39° . Calculate refractive index of the material of the prism. (Take $\sin 49.5^\circ = 0.760$) 2
35. Define. 2
 (a) Stopping potential
 (b) Threshold frequency

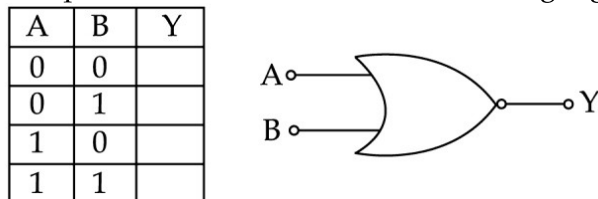
36. Complete the truth table for the following logic gate.

2



OR

Complete the truth table for the following logic gate.



37. Explain why efficiency of Carnot engine cannot be 100% ?

2

38. What is meant by positive work, negative work and zero work ? Give examples of each type.

3

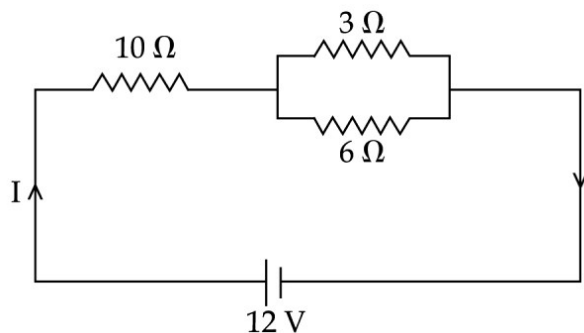
OR

State whether the following quantities are positive or negative or zero. Explain.

- Workdone by friction on a body sliding down an inclined plane.
- Workdone by a man lifting a bucket out of a well by means of a rope tied to bucket.
- Workdone by a coolie walking on a horizontal platform with a load on his head.

39. For the circuit shown below calculate the value of current I and equivalent resistance R.

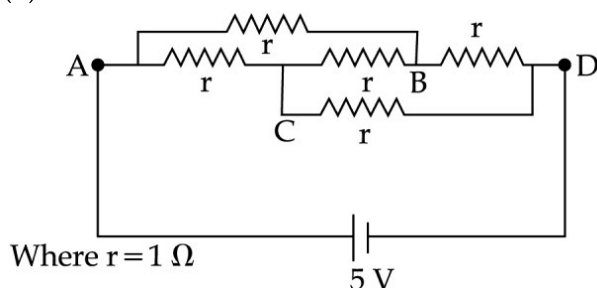
3



OR

The following Wheatstone bridge is balanced. Calculate :

- The value of equivalent resistance R in the circuit, and
- The current in the arms AB and DC.



40. What happens to the interference pattern obtained in the Young's Double slit experiment when : 3
- The separation between the two slits is gradually increased.
 - White light is used in place of monochromatic light.
 - The experiment is performed in water instead of air.
41. Define forward bias and reverse bias. Plot the variation of current with applied voltage for forward and reverse bias for p - n Junction diode. 3
42. State and prove Law of conservation of linear momentum using Newton's Third law of motion. Aman weighs 60 kg and travels with a velocity 1 m/s towards Manoj who weighs 40 kg and moving with 1.5 m/s towards Aman. Calculate their Momenta. 3+2=5
- OR**
- State and prove Newton's second law of motion.
A ball of mass 0.4 kg starts rolling on the ground at 20 m/s and comes to rest after 10 s. Calculate the force which stops the ball, assuming it to be of constant magnitude throughout.
43. Show that the deflection produced in a galvanometer is directly proportional to the current flowing through it. 3+2=5
- A galvanometer with a coil of resistance $12\ \Omega$ shows a full scale deflection for a current of 2.5 mA. How will you convert it into an ammeter of range 0 – 2 A ?
- OR**
- Show that voltage leads current by $\pi/2$ in a inductive circuit.
A transformer has 100 turns in its primary windings and 500 turns in its secondary windings. If the primary voltage and current are respectively 120 V and 3 A, what are secondary voltage and current ?

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