SET-2

No of printed Pages: 03

INDIAN SCHOOL SOHAR
UNIT TEST II - 2024-25
PHYSICS (042)

CLASS: XI **Max Marks: 20**
DATE: 20-01-2025 **Time: 45 Minutes**

General Instructions:

(i) There are 10 questions in all. All questions are compulsory.

(ii) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

(iii) Section **A** contains **six** questions of **one** mark each, Section **B** contain **one** question of **two** marks, Section **C** contain **one** question of **three** marks, Section **D** contains **one case study-based** question of **four** marks and Section **E** contain one question of **five** marks.

(iv) There is no overall choice. However, an internal choice has been provided in one question of five mark. You have to attempt only one of the choices in such questions.

Section - A

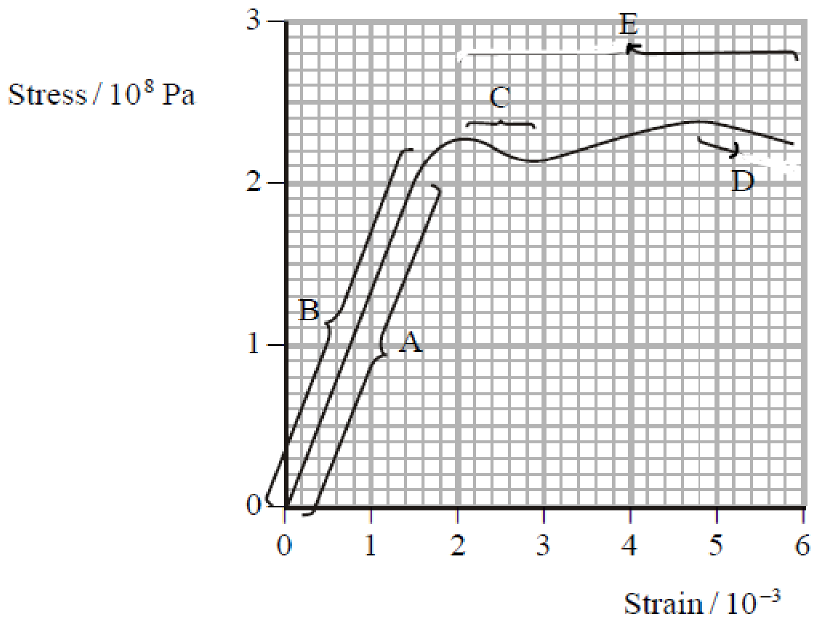
All questions are compulsory. In case of internal choices, attempt any one of them.

1	A wire fixed at the upper end stretches by length l by applying a force F. The work done in stretching is: (a) $\frac{Fl}{2}$ (b) Fl (c) $2Fl$ (d) $\frac{F}{2l}$	1
2	Atmospheric pressure at sea level has a value of 100 kPa. The density of sea water is 1020 kg m^{-3}. At what depth in the sea would the total pressure be 110 kPa? (take g = 9.8 m/s^2) (a) 9.8 m (b) 1.0 m (c) 10 m (d) 11 m	1
3	Pressure inside two soap bubbles are 1.01 and 1.02 atmospheres. Ratio between their volumes is (a) 16:3 (b) 4:3 (c) 8:1 (d) 2:1	1
4	The molar specific heat at constant pressure of an ideal gas is (7/2)R. The ratio of specific heat at constant pressure to that at constant volume is (a) 9/7 (b) 5/7 (c) 8/7 (d) 7/5	1

Two statements are given-one labelled Assertion **(A)** and the other labelled Reason**(R)**. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is correct but R is incorrect
(d) A is incorrect and R is also incorrect.

5	**Assertion**: A blue star is at high temperature(T) than a red star. **Reason**: Wein's displacement law states that T ∝ λ_m (where λ_m is the maximum wavelength)	1
6	**Assertion**: The zeroth law said that, when two systems A and B, are in thermal equilibrium, there must be a physical quantity that has the same value for both. **Reason**: The physical quantity that is the same for both systems is temperature.	1

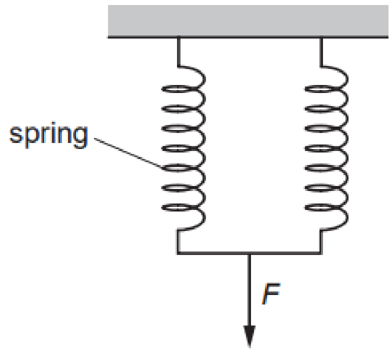
	Section - B	
7	State Stefan-Boltzmann law. A black metal foil is warmed by radiation from a small sphere at temperature T and at a distance *d.* if the power received by the foil is P, find the power received when both the temperature and distance are doubled.	2
	Section - C	
8	What is an adiabatic process? Derive the expression for the work done during such a process.	
	Section - D (CASE STUDY)	
9	**Read the following text and answer the following questions on the basis of the same:** The graph shows the behaviour of a copper alloy when it is stressed.  I. Copper alloy can be classified as a strong material. This is because A. it has a large Young modulus value B. it has a large ultimate tensile stress value C. it is difficult to deform D. it breaks shortly after its proportional limit II. Which of the following options is correct? A. B – yield point, C - permanent set, D – ultimate tensile strength, E – fracture point B. A – yield point, D - permanent set, C – ultimate tensile strength, E – fracture point C. B – yield point, C - permanent set, E – ultimate tensile strength, D – fracture point D. A – yield point, B - permanent set, D – ultimate tensile strength, E – fracture point III. A copper wire of diameter 1.6 mm is stretched within its limit of proportionality by a tensile force of 430 N. The Young modulus of copper is $1.30 \times 10^{11} Pa$. What is the strain in the wire? A. 4.1×10^{-3} B. 1.3×10^{-4} C. 1.1×10^{-4} D. 1.1×10^{-3} IV. The proportional limit of the above stress – strain curve is A. $2.2 \times 10^8 Pa$ B. $2.0 \times 10^8 Pa$ C. $1.2 \times 10^8 Pa$ D. $3.0 \times 10^8 Pa$	4

OR

V. A spring has spring constant k. The spring obeys Hooke’s law and experiences extension x when a force F is applied to it. The resulting elastic potential energy of the spring is E_P. The diagram shows two of these springs joined together in parallel and hanging from a fixed beam.

What is the extension and total elastic potential energy of this arrangement when the same force F is applied?

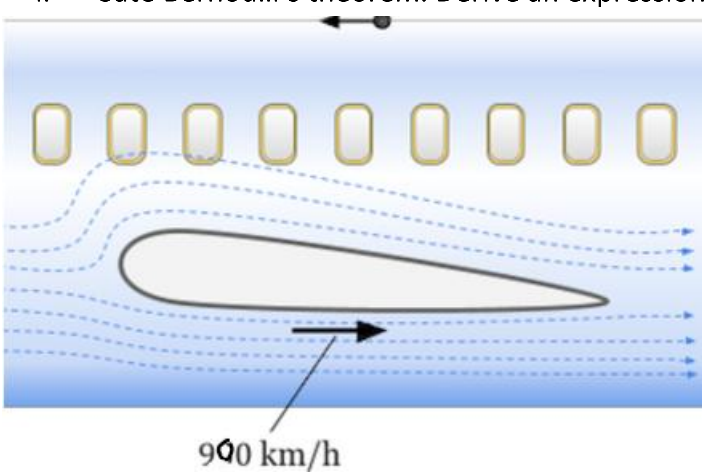
	extension	total elastic potential energy
A	$\frac{1}{2}x$	$\frac{1}{2}E_P$
B	$\frac{1}{2}x$	$\frac{1}{4}E_P$
C	x	$\frac{1}{2}E_P$
D	x	$\frac{1}{4}E_P$



Section - E

In case of internal choices, attempt any one of them.

10. i. Sate Bernoulli’s theorem. Derive an expression for it.



i. A loaded aircraft has a mass of $6.25\times 10^5 Kg$ and wing area $125\ m^2$. It's in level flight at a high speed. Air moves at $900\ km\ h^{-1}$ past the bottom of the wing during flight. How fast does the air move relative to the top of the wing? (Density of air $\rho = 1.25\ kg/m^3$ and take $g = 10\ ms^{-2}$)

OR

i. What is capillarity? Derive an expression for the height to which the liquid rises in a capillary tube of radius r. 5

ii. The lower end of a capillary tube of diameter 2.0 mm is dipped 8.00 cm below the surface of water in a beaker. What is the pressure required in the tube in order to blow a hemispherical bubble at its end in water? The surface tension of water at temperature of the experiments is $7.30\times 10^{-2}\,\frac{\mathrm{N}}{\mathrm{m}}$, 1 atmospheric pressure $= 1.01\times 10^5\ Pa$, $density\ of\ water = 1000\ kg\ m^{-3}$. Also calculate the excess pressure.

SET-2

No of printed Pages: 02

INDIAN SCHOOL SOHAR
UNIT TEST I - 2024-25
PHYSICS (042)
MARKING SCHEME

CLASS: XI **Max Marks: 20**
DATE: 20-01-2025 **Time: 45 Minutes**

Q.No	Value Points	Score
1.	(a)	1
2	(b)	1
3	(c)	1
4	(d)	1
5	(c)	1
6	(a)	1
7	Stefan-Boltzmann's law, which states that the radiant heat energy emitted from a unit area of the black body in one second (E) is directly proportional to the fourth power of its absolute temperature, or E = σ x T^4. $P' = \sigma A \left(\frac{T_2^4}{d_2^2}\right)$ - Substituting T_2 and d_2: $P' = \sigma A \left(\frac{(2T_1)^4}{(2d_1)^2}\right)$ - Simplifying this expression: $P' = \sigma A \left(\frac{16T_1^4}{4d_1^2}\right) = \sigma A \left(\frac{16}{4} \cdot \frac{T_1^4}{d_1^2}\right)$ $= 4\sigma A \left(\frac{T_1^4}{d_1^2}\right)$ - Thus, we find that: $P' = 4P$	1 1
8	An adiabatic process is defined as a process in which no heat transfer takes place. This does not mean that the temperature is constant, but rather that no heat is transferred into or out from the system. Derivation:	1 2

9	i. A ii. A iii. D iv. B OR v. A	
10	This states that, in a steady flow, the sum of all forms of energy in a fluid is the same at all points that are free of viscous forces. This requires that the sum of kinetic energy, potential energy and internal energy remains constant. Derivation: $P_1 + \frac{1}{2}\rho v_1^2 = P_2 + \frac{1}{2}\rho v_2^2$ $\Rightarrow P_2 - P_1 = \frac{1}{2}\rho(v_1^2 - v_2^2)$ $\Rightarrow \frac{W}{A} = \frac{1}{2}\rho(v_1^2 - v_2^2)$ $\Rightarrow v_1^2 = \frac{2W}{\rho A} + v_2^2$ Using the known values, we have, $v_1^2 = \frac{2W}{\rho A} + {v_2}^2$ $\frac{2(6.25 \times 10^5)(10)}{125 \times 1.25} + (250)^2 = 14.25 \times 10^4$ $v_1 = 377 m/s$ **OR** The force that causes liquid to rise in a tube or other narrow space against the force of gravity. Derivation: $P_{hydrostatic} = 1000\,kg/m^3 \times 9.80\,m/s^2 \times 0.08\,m = 784\,Pa$ $P_{excess} = \frac{2 \times 7.30 \times 10^{-2}\,N/m}{1.0 \times 10^{-3}\,m} = 146\,Pa$ $P = P_0 + P_{hydrostatic} + P_{excess}$ Substituting the values: $P = 1.01 \times 10^5\,Pa + 784\,Pa + 146\,Pa = 1.02 \times 10^5\,Pa$	