विद्या सर्वार्थि साधिका

ANANDALAYA

PERIODIC TEST - 3

Class : XI

Subject: Physics (042) MM : 40

Date : 03-01-2024 Time: 1 Hr. 30 min.

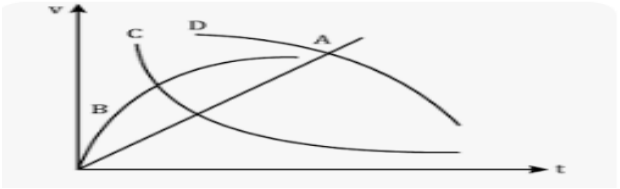
General Instructions:

1. There are 20 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.
3. Section A consists of twelve MCQs of 1 mark each, Section B consists of two questions of2 marks each, Section C consists of two questions of 3 marks each, Section D consists of two long questions of 5 marks each and Section E consists two case study-based questions of 4 marks each.
4. There is no overall choice. However, an internal choice has been provided in section D and E. You have to attempt only one of the choices in such questions.
5. Use of calculators is not allowed.

SECTION A

1. Practically the value of Poisson's ratio σ lies between _____.
   (A) $0 < \sigma < 1$ (B) $0 < \sigma < 0.5$ (C) $-1 < \sigma < 1$ (D) $0.5 < \sigma < 1$ (1)

2. A spherical ball is dropped in a long column of a viscous liquid. The speed of the ball as a function of time may be best represented by the graph: (1)



   (A) A (B) B (C) C (D) D

3. The excess pressure inside the first soap bubble is three times that inside the second soap bubble, then the ratio of volume of first to second will be ____. (1)
   (A) 9:1 (B) 1:9 (C) 27:1 (D) 1: 27

4. Calorimetry is a measurement of _____. (1)
   (A) Temperature (B) Heat (C) Resistance (D) Conductance

5. With increase in temperature the viscosity of ____.
   (A) a gas decreases and a liquid increases (B) a gas increases and a liquid decreases
   (C) both gases and liquids decrease (D) both gases and liquids increase

6. When water is heated from 0^oC to 10^oC, its volume _____. (1)
   (A) first increases and then decreases (B) increases
   (C) first decreases and then increases (D) decreases

7. Two brass wires of lengths 1 m and 2 m have diameters 1 mm and 2 mm, respectively. If they are stretched by forces of 40 N and 80 N, respectively, their elongation will be in the ratio _____. (1)
   (A) 1:1 (B) 1:2 (C) 1:4 (D) 4:1

8. The fractional change in volume per unit increase in pressure is called _____. (1)
   (A) Pressure gradient (B) Volume flux (C) Bulk Modulus (D) Compressibility

9. Surface tension of a soap solution is 1.9×10^{-2} N/m. Work done in blowing a bubble of 2cm diameter will be _____. (1)
   (A) $1.9\pi \times 10^{-4}$ J (B) $3.8\pi \times 10^{-4}$ J (C) $7.6\pi \times 10^{-4}$ J (D) $15.2\pi \times 10^{-4}$ J

10. The dimensional formula for specific heat capacity of substance is __. (1)
(A) $[M^0L^2T^{-2}K^1]$ (B) $[M^0L^2T^{-2}K^{-1}]$ (C) $[M^1L^2T^{-2}K^{-1}]$ (D) $[M^1L^2T^2K^1]$

For question numbers 11 and 12, two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(B) Both Assertion and Reason are true but Reason is NOT the correct explanation of Assertion.
(C) Assertion is true but Reason is false.
(D) Assertion is false and Reason is also false.

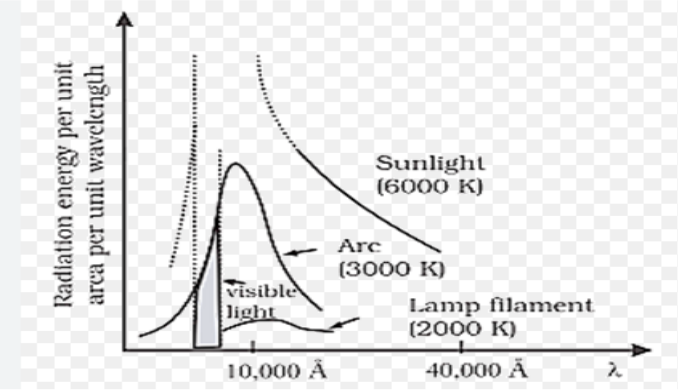
11. Assertion (A): Elasticity of material increases on increasing the temperature of the material. (1)
Reason (R): Modulus of elasticity does not depend on temperature.

12. Assertion (A): An ideal fluid is flowing in a tube of varying cross section. The radius of the tube at one point is r_1 and another point is r_2 where $r_1 > r_2$. The velocity of fluid flow at these points in the tube is related as $v_1 < v_2$. (1)
Reason (R): As per equation of continuity, the flow rate or volume flux is constant for an ideal fluid.

SECTION B

13. Explain why: (2)
(a) A drop of liquid under no external forces is always spherical in shape.
(b) Mercury does not wet the glass but water does.

14. The distribution of energy in the spectrum of black body is shown below. (2)



Write any two important conclusions drawn from the black body spectrum.

SECTION C

15. (a) What is the operating principle of hydraulic lift? (3)
(b) A hydraulic automobile lift is designed to lift cars with a maximum mass of 3000 kg. The area of cross-section of the piston carrying the load is 425 cm^2. What maximum pressure would the smaller piston have to bear?

16. State Hooke's law. Draw typical stress-strain graph for a loaded wire. Show elastic and plastic region in the graph. (3)

SECTION D

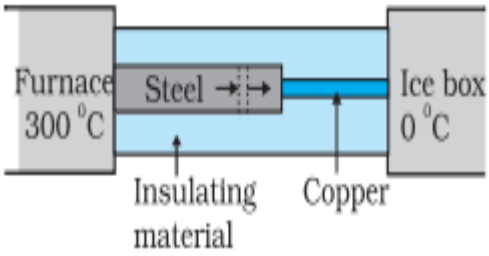
17. (a) State and prove Bernoulli's principle for an ideal fluid. (5)
(b) On the basis of Bernoulli's principle, explain the lift of an aircraft wing.

OR

(a) Obtain an expression for the rise of liquid in a capillary tube.
(b) What happens when a capillary tube of insufficient length is dipped in a liquid?

18. (a) Define coefficient of thermal conductivity. (5)
(b) Explain steady state in thermal conduction in case of a thick copper bar with its two ends maintained at two different temperature.

(c) What is the temperature of the steel-copper junction in the steady state of the system shown in figure? In the given figure, length of the steel rod and the length of copper rod is 15.0 cm and 10.0 cm respectively. The area of cross section of the steel rod is twice that of the copper rod. (Coefficient of thermal conductivity of steel = 50.2 J s^{-1} m^{-1} K^{-1}; and of copper = 385 J $s^{-1}m^{-1}$ K^{-1}).



SECTION E

Questions 19 and 20 are Case Study Based questions and are compulsory. Each question carries 4 marks.

19. ELASTIC BEHAVIOUR OF SOLIDS: We know that in a solid, each atom or molecule is surrounded by neighbouring atoms or molecules. These are bonded together by interatomic or intermolecular forces and stay in a stable equilibrium position. When a solid is deformed, the atoms or molecules are displaced from their equilibrium positions causing a change in the interatomic (or intermolecular) distances. When the deforming force is removed, the interatomic forces tend to drive them back to their original positions. Thus the body regains its original shape and size. The ability of a body to regain its original shape and size is called elasticity. Even fluids exhibit elasticity. Hooke's law relates stress and strain of a body and this law, like Boyle's law, is one of the earliest quantitative relationships in science. It is very important to know the behaviour of the materials under various kinds of load from the context of engineering design.

(i) Stretching a wire store energy in the form of : (1)

(A) Elastic potential energy (C) Elastic kinetic energy

(B) Mechanical Energy (D) Intermolecular energy

(ii) Rigidity modulus of steel is η and its Young's modulus is Y. A piece of steel of cross-sectional area 'A' is changed into a wire of length L and area A/10 then: (1)

(A) Both η and Y decrease. (C) Both η and Y remain same.

(B) η increases and Y decreases. (D) η decreases and Y increases.

(iii) What are elastomers? Draw stress-strain graph for elastomers. (2)

OR

(iii) Explain why are girders given I shape.

20. When solid is heated, the amplitude of vibration of atoms and molecules increases. Therefore effective interatomic separation increases and cause thermal expansion. Thermal expansion in solids is three types. They are linear expansion, area expansion and volume expansion Area and volume. Thermal expansion in liquid occurs in form of volume expansion. Thermal expansion of gases is more than solids and liquid but coefficient of volume expansion is dependent on temperature of gases. Based on the above information, answer the following:

(i) On what factor(s) the coefficient of thermal expansion depend? (1)

(A) nature of material (B) Size of material (C) State of material (D) all of these

(ii) How is coefficient of thermal expansion of gases related to temperature? (1)

(A) $\gamma \propto T$ (B) $\gamma \propto \sqrt{T}$ (C) $\gamma \propto 1/\sqrt{T}$ (D) $\gamma \propto 1/T$

(iii) The coefficient of linear expansion of Iron is 0.000011 per K. An iron rod is 10 m long at 27° C. The length of the rod will be decreased by 1.1 mm when it is subjected to the certain temperature. Find the final temperature. (2)

OR

(iii) A metal ball 11 cm in radius is heated from 10°C to 80° C. Calculate the increase in surface area of the ball. The coefficient of linear expansion of metal ball is 0.000017 per K.