**PHYSICS**

**DPP**

DAILY PRACTICE PROBLEMS

# DPP No. 58

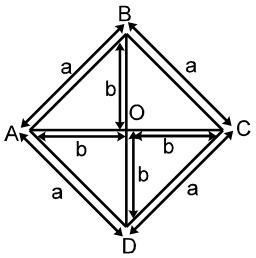
**Total Marks : 25**

**Max. Time : 26 min.**

**Topics : Heat, Kinematics, Simple Harmonic Motion, Viscosity, Elasticity, Capacitance, Current Electricity**

| **Type of Questions** | | **M.M., Min.** |
|---|---|---|
| **Single choice Objective ('–1' negative marking) Q.1 to Q.5** | **(3 marks, 3 min.)** | **[15, 15]** |
| **Subjective Questions ('–1' negative marking) Q.6** | **(4 marks, 5 min.)** | **[4, 5]** |
| **Comprehension ('–1' negative marking) Q.7 to Q.8** | **(3 marks, 3 min.)** | **[6, 6]** |

**1.** All the rods have same conductance 'K' and same area of cross section 'A'. If ends A and C are maintained at temperature $2T_0$ and $T_0$ respectively then which of the following is/are correct:



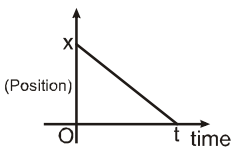

(A) Rate of heat flow through ABC, AOC and ADC is same

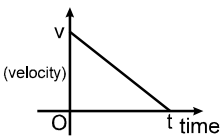
(B) Rate of heat flow through BO and OD is not same

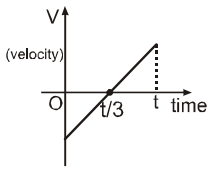
(C) Total Rate of heat flow from A to C is $\frac{3K\,A\,T_0}{2a}$

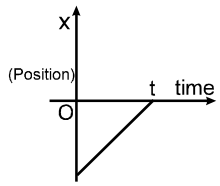
(D) Temperature at junctions B, O and D are same

**2.** For which of the following graphs the average velocity of a particle moving along a straight line for time interval (0, t) must be negative -

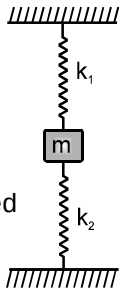
(A) 


(B) 


(C) 


(D) 


**3.** In the figure shown a block of mass m is attached at ends of two springs. The other ends of the spring are fixed. The mass m is released in the vertical plane when the spring are relaxed. The velocity of the block is maximum when:




(A) $k_1$ is compressed and $k_2$ is elongated

(B) $k_1$ is elongated and $k_2$ is compressed

(C) $k_1$ and $k_2$ both are compressed

(D) $k_1$ and $k_2$ both are elongated.

**4.** Rigidity modulus of steel is $\eta$ 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 :

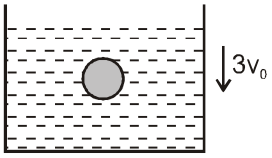
(A) Y increases and $\eta$ decrease

(B) Y and $\eta$ remains the same

(C) both Y and $\eta$ increase

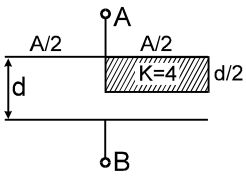
(D) both Y and $\eta$ decrease

**5.** A container filled with viscous liquid is moving vertically downwards with constant speed $3v_0$. At the instant shown, a sphere of radius r is moving vertically downwards (in liquid) has speed $v_0$. The coefficient of viscosity is $\eta$. There is no relative motion between the liquid and the container. Then at the shown instant, the magnitude of viscous force acting on sphere is




(A) $6\pi\eta r v_0$ (B) $12\pi\eta r v_0$
(C) $18\pi\eta r v_0$ (D) $24\pi\eta r v_0$

**6.** Find the equivalent capacitance between terminals 'A' and 'B'. The letters have their usual meaning.




**COMPREHENSION**

A galvanometer measures current which passes through it. A galvanometer can measure typically current of order of mA. To be able to measure currents of the order of amperes of main current, a shunt resistance 'S' is connected in parallel with the galvanometer.


Figure-I

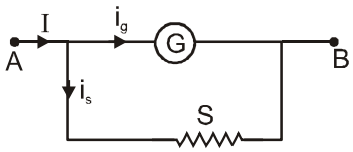



Figure-II

**7.** The resistance of the shunt 'S' and resistance 'G' of the galvanometer should have the following relation.
(A) S = G (B) S >> G (C) S << G (D) S < G

**8.** If resistance of galvanometer is $10\Omega$ and maximum current $i_g$ is 10mA then the shunt resistance required so that the main current '$I$' can be upto 1A is (in $\Omega$)

(A) $\frac{99}{10}$ (B) $\frac{10}{99}$ (C) 990 (D) $\frac{99}{1000}$

# Answers Key

**1.** (D) **2.** (A) **3.** (B) **4.** (B)

**5.** (B) **6.** $\frac{13}{10}\frac{\in_0 A}{d}$ **7.** (C)

**8.** (B)

# Hints & Solutions

**1.** By symmetry

$I_{AB} = I_{BC}$ & $I_{AD} = I_{DC}$

$\therefore$ No current in BO and OD

$\therefore$ $T_B = T_O = T_D$

**2.** In (A) $x_f - x_i$

$0 - x = -x = -$ ve

So average velocity is – ve.

**3.** Speed of block is maximum at mean position. At mean position upper spring is extended and lower spring is compressed.

**4.** $\eta$ and Y are properties of material.

These coefficients are independent of geometry of body.

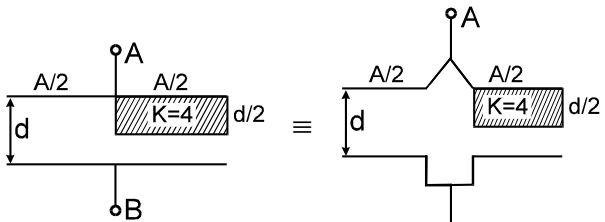
**5.** Relative to liquid, the velocity of sphere is $2v_0$ upwards.

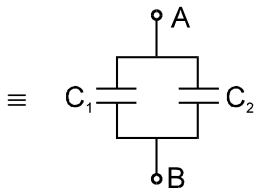
$\therefore$ viscous force on sphere

$= 6\pi\eta r\, 2v_0$ downward

$= 12\pi\eta r\, v_0$ downward

**6.**




$C_1 = \frac{\varepsilon_0 A/2}{d}$ , $C_2 = \frac{\varepsilon_0 A/2}{\frac{d/2}{k} + \frac{d}{2}} = \frac{4\varepsilon_0 A}{5d}$ C

$= C_1 + C_2 = \frac{13}{10}\frac{\varepsilon_0 A}{d}$ **Ans.** $\frac{13}{10}\frac{\in_0 A}{d}$

**7.** The current through the galvanometer is ~ $\frac{1}{1000}$ of total current, the S << G.

**8.** Potential difference across galvanometer = Potential difference across S.

$\Rightarrow i_g \cdot G = (I - i_g) \cdot S$

$\Rightarrow 10 \times 10^{-3} \cdot 10 = (1 - 10 \times 10^{-3}) \cdot S$

$\Rightarrow R_S = \frac{10^{-1}}{1-10^{-2}} = \frac{10}{99}\,\Omega$