PHYSICS
DPP
DAILY PRACTICE PRACTICE PROBLEMS

DPP No. 58

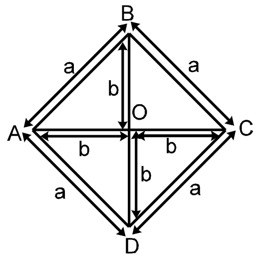
Total Marks : 25

Max. Time : 26 min.

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

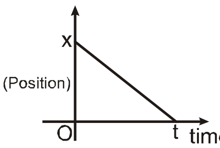
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Subjective Questions ('–1' negative marking) Q.6	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.7 to Q.8	(3 marks, 3 min.)	[6, 6]

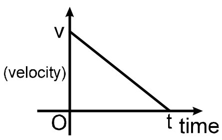
1. All the rods have same conductance 'K' and same area of cross section 'A'. If ends A and C are maintained at temperature $2T_0$ and T_0 respectively then which of the following is/are correct:

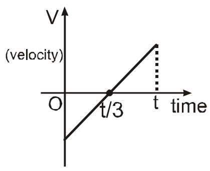


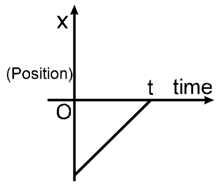
(A) Rate of heat flow through ABC, AOC and ADC is same
(B) Rate of heat flow through BO and OD is not same
(C) Total Rate of heat flow from A to C is $\frac{3KAT_0}{2a}$
(D) Temperature at junctions B, O and D are same

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 -

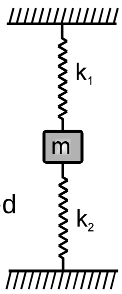
(A) 

(B) 

(C) 

(D) 

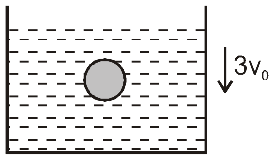
3. In the figure shown a block of mass m is attached at ends of two springs. The other ends of the spring are fixed. The mass m is released in the vertical plane when the spring are relaxed. The velocity of the block is maximum when:



(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.

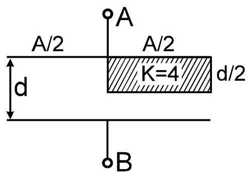
4. Rigidity modulus of steel is η and its young's modulus is Y. A piece of steel of cross–sectional area 'A' is changed into a wire of length L and area A/10 then :
(A) Y increases and η decrease
(B) Y and η remains the same
(C) both Y and η increase
(D) both Y and η decrease

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 η. 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.

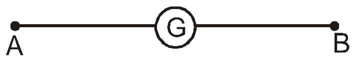


Figure-I

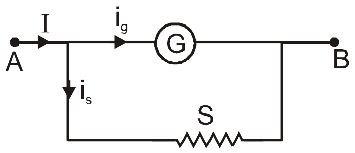


Figure-II

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 10Ω and maximum current i_g is 10mA then the shunt resistance required so that the main current 'I' can be upto 1A is (in Ω)

(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.**	$\frac{13}{10}\frac{\epsilon_0 A}{d}$			**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. η and Y are properties of material.

These coefficients are independent of geometry of body.

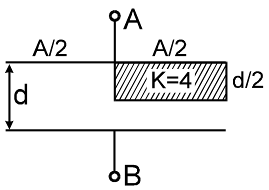
5. Relative to liquid, the velocity of sphere is $2v_0$ upwards.

$\therefore$ viscous force on sphere

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

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

6.



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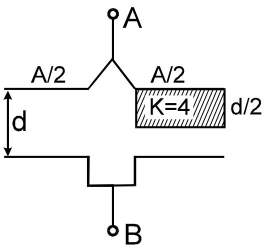

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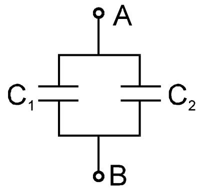

$$C_1 = \frac{\varepsilon_0 A/2}{d}, \quad C_2 = \frac{\varepsilon_0 A/2}{\frac{d/2}{k} + \frac{d}{2}} = \frac{4\varepsilon_0 A}{5d} \text{ C}$$

$$= C_1 + C_2 = \frac{13}{10}\frac{\epsilon_0 A}{d} \qquad \textbf{Ans. } \frac{13}{10}\frac{\epsilon_0 A}{d}$$

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.

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

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

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