PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 56

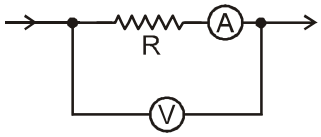
Total Marks : 28

Max. Time : 28 min.

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

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.5	**(3 marks, 3 min.)**	**[15, 15]**
Multiple choice objective ('–1' negative marking) Q.6	**(4 marks, 4 min.)**	**[4, 4]**
Comprehension ('–1' negative marking) Q.7 to Q.9	**(3 marks, 3 min.)**	**[9, 9]**

1. In the, Ohm's law experiment to find resistance of unknown resistor R, the arrangement is as shown. The resistance measured is given by $R_{measured} = \frac{V}{i}$, V = voltage reading of voltmeter, i = current reading of ammeter. The ammeters and the voltmeter used are not ideal, and have resistances R_A and R_V respectively. For arrangement shown , the measured resistance is

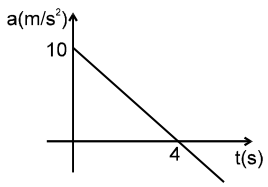


(A) $R + R_V$ (B) $R + R_A$ (C) $\frac{RR_V}{R+R_V}$ (D) $\frac{RR_V}{R+R_V} + R_A$

2. Two identical plates with thermal conductivities K and 3K are joined together to form a single plate of double thickness. The equivalent thermal conductivity of one composite plate so formed for the flow of heat through its thickness is:

(A) K (B) 1.5 K (C) 2.5K (D) 3K

3. The acceleration time graph of a particle moving along a straight line is as shown in the figure. At what time the particle acquires its velocity equal to initial velocity ?



(A) 12 sec (B) 5 sec

(C) 8 sec (D) none of these

4. As the distance between the plates of a parallel plate capacitor is decreased

(A) chances of electrical break down will increase if potential difference between the plates is kept constant.

(B) chances of electrical break down will decrease if potential difference between the plates is kept constant.

(C) chances of electrical break down will increase if charge on the plates is kept constant.

(D) chances of electrical break down will decrease if charge on the plates is kept constant.

5. All linear dimensions are doubled then the capacitance of the parallel plate capacitor will

(A) Remain unchanged

(B) become double

(C) increase by eight times

(D) increases by four times

6. The x-coordinate of a particle moving on x-axis is given by $x = 3 \sin 100t + 8 \cos^2 50t$, where x is in cm and t is time in seconds. Which of the following is/are correct about this motion.

(A) the motion of the particle is not S.H.M.

(B) the amplitude of the S.H.M. of the particle is 5 cm

(C) the amplitude of the resultant S.H. M. is $\sqrt{73}$ cm

(D) the maximum displacement of the particle from the origin is 9 cm.

COMPREHENSION

Charges are concentrated exclusively on the external surface of a conductor. Therefore neither the material of the conductor nor its mass are of any importance for its capacitance. Capacitance depends on the shape and surface area of the conductor. Since a conductor liable to be electrified by induction, its capacitance is influenced by other conductors in its vicinity and by the medium they are in.

To fulfil its function the capacitor must be able to store accumulated charges and energy for appreciable time to obtain a definite capacitance. One can conveniently take two conductors and arrange them as close to each other as possible and place a dielectric between them. The dielectric between the conductors plays two fold role. Firstly, it increases the capacitance and secondly prevents the neutralization of the charges, i.e. it prevents them from jumping from one conductor to the other. For this reason electrical breakdown strength (The maximum electrical field which a dielectric can withstand, also called dielectric strength of dielectric) should be high.

In order to keep the capacitance constant & independent of surrounding bodies the entire electric field should be contained between the plates. For this reason the distance between the plates should be small as compound to their linear dimensions. To protect the capacitor from external influences it is housed in a shell. Mathematically we can relate q = CV and for a parallel plate capacitor fully filled with a dielectric $C = \frac{\varepsilon_r \varepsilon_0 A}{d}$.

7. Capacitance does not depend on

(A) Area of plates (B) Separation between plates

(C) Surrounding bodies (D) Potential difference across plates

8. Two plates of a capacitor kept on insulating stand are fully charged. Now the ebonite plate between the capacitor plates is removed then the capacitance of capacitor will

(A) Increase (B) Decrease

(C) Remains same (D) May increase or decrease

9. A table for parallel plate capacitors along with the properties of dielectrics used in these is given. Choose the most appropriate capacitor.

(Assuming same potential difference across each capacitor)

Capacitor	Dielectric Constant	Dielectric strength (V/m)	Distance between plates (m)	Area of plates (m^2)
A	2.8	3×10^7	0.01	0.125
B	3.3	6×10^7	0.01	0.125
C	2.2	7×10^7	0.01	0.25
D	4.4	1×10^7	0.01	0.125

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

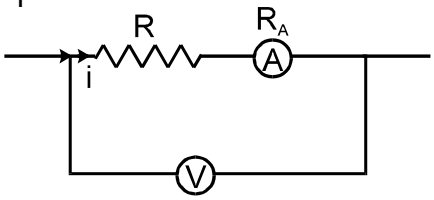
Answers Key

1.	(B)	**2.**	(B)	**3.**	(C)	**4.**	(A)
5.	(B)	**6.**	(B,D)	**7.**	(D)	**8.**	(B)
9.	(C)						

Hints & Solutions

1. Potential drop. $\rightarrow V = i(R + R_A)$

$\frac{V}{i} = R + R_A = R_{measured}$.



4. When charge on plate is constant electric field remains constant $E = \frac{Q}{2A\varepsilon_0}$

In case when potential difference is constant $E = \frac{V}{d}$

Electric field increases when 'd' decreases and hence chances of breakdown increases.

5. $C = k \in_0 A/d$

$A_f = 4A_i$

$d_f = 2\, d_i$

Because, ALL linear dimensions are doubled so capacitance become doubled.

6. $x = 3 \sin 100\, t + 8 \cos^2 50\, t$

$= 3 \sin 100\, t + \frac{8[1+\cos 100t]}{2}$

$x = 4 + 3 \sin 100\, t + 4 \cos 100\, t$

$(x - 4) = 5 \sin (100t + \phi)$ $\quad \left\{\tan\phi = \frac{4}{3}\right\}$

Amplitude = 5 units

Maximum displacement = 9 units.

7. $C = k \in_0 A/d$
formula suggest that it depends on area, separation and surrounding medium.

9. Most Appropriate capacitor is a capacitors of high capacitance & high dielectric strength. By dielectric strength

$C > B > A > D$

By capacitance $C = \frac{k\varepsilon_0 A}{d}$

$C = D > B > A$

So C is best.