PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 47

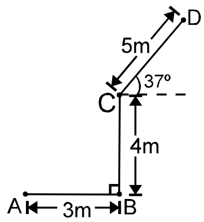
Total Marks : 24

Max. Time : 24 min.

Topics : Rectilinear Motion, Friction, Circular Motion, Gravitation, Relative Motion, Electrostatics

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.5	**(3 marks, 3 min.)**	**[15, 15]**
Comprehension ('–1' negative marking) Q.6 to Q.8	**(3 marks, 3 min.)**	**[9, 9]**

1. A particle moves along a path ABCD as shown in the figure. Then the magnitude ofnet displacement of the particle from position A to D is :



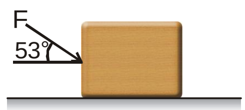
(A) 10 m

(B) $5\sqrt{2}$ m

(C) 9 m

(D) $7\sqrt{2}$ m

2. A block of mass 20 kg is acted upon by a force F = 30 N at an angle 53° with the horizontal in downward direction as shown. The coefficient of friction between the block and the horizontal surface is 0.2. The friction force acting on the block by the ground is (g = 10 m/s^2)



(A) 40.0 N (B) 30.0 N (C) 18.0 N (D) 44.8 N

3. The wire of the potentiometer has resistance 4 ohms and length 1 m. It is connected to a cell of e.m.f. 2 volts and internal resistance 1 ohm. If a cell of e.m.f. 1.2 volts is balanced by it, the balancing length will be:

(A) 90 cm (B) 60 cm (C) 50 cm (D) 75 cm

4. If the apparent weight of the bodies at the equator is to be zero, then the earth should rotate with angular velocity

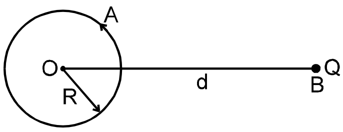
(A) $\sqrt{\frac{g}{R}}$ rad/sec

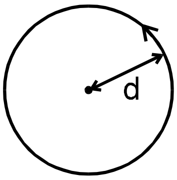
(B) $\sqrt{\frac{2g}{R}}$ rad/sec

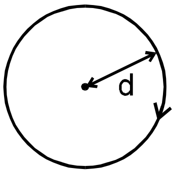
(C) $\sqrt{\frac{g}{2R}}$ rad/sec

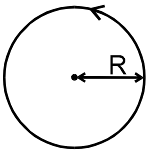
(D) $\sqrt{\frac{3g}{2R}}$ rad/sec

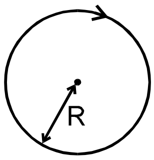
5. A particle 'A' is rotating in a circle of radius R with centre at O. Another particle B in the same plane is resting at point Q which is at a distance d from O. The path of B as seen from A is :



(A) 

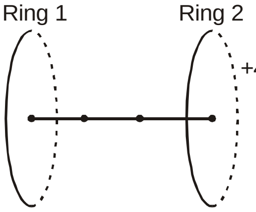
(B) 

(C) 

(D) 

COMPREHENSION

Two uniformly charged fixed rings, each of radius R are separated by a distance of 3r (r > > R). Ring, 1 has charge Q and ring 2 has net charge 4Q. A neutral point is a point in space at which the value of electric field intensity is zero, while its value is non zero at any neighbouring point.



6. The position of a neutral point N is at a distance of

(A) r from the center of ring 1 towards right
(B) 2r from the center of ring 1 towards right
(C) r from the center of ring 1 towards left
(D) None of these

7. A negatively charged particle is projected from the center of ring 1 towards the neutral point N with just enough energy to pass the neutral point. Its subsequent motion will be

(A) Oscillatory
(B) SHM
(C) Unidirectional
(D) Non oscillatory rectilinear but not unidirectional

8. A positively charged particle is released from the center of ring 2 by slightly pushing it towards left. Its subsequent motion will be

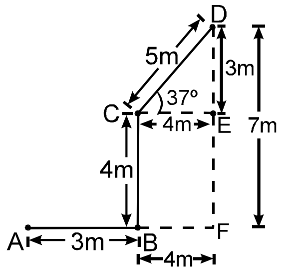
(A) Oscillatory
(B) SHM
(C) Unidirectional
(D) Non oscillatory rectilinear but not unidirectional

Answers Key

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

Hints & Solutions

1. As seen from the figure



the displacement is $\sqrt{(AF)^2 + (FD)^2}$

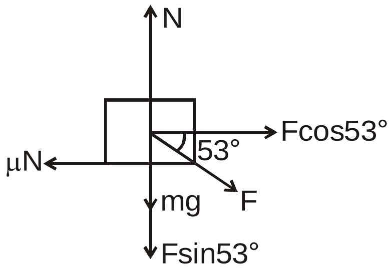
= $7\sqrt{2}$ m

2. Max. frictional force

f_{max} = μN

= μ(mg + F sin53°)

= 0.2 (20 × 10 + 30 × $\frac{4}{5}$)



= 44.8 N

As applied horizontal force is Fcos53°

= 18N < f_{max}, friction force will also be 18 N.

3. Potential gradient = 1.6 v/m

E.M.F. = potential gradient × balancing length

1.2 = 1.6 × ℓ

$\therefore \ \ell = \frac{1.2}{1.6} = \frac{3}{4}$ = 0.75 m = 75cm

4. mg = mω^2 R , $\omega = \sqrt{\frac{g}{R}}$

6. $\frac{KQ}{x^2} = \frac{K4Q}{(3r-x)^2}$ (Since r >> R)

$\Rightarrow$ (3r – x) = 2r

$\Rightarrow$ x = r

7. Once the charge reaches the neutral point it will be accelerated towards center of ring 2, will cross it, be reatarded, come to rest and then return towards it. Thus the motion is oscillatory, but not SHM.

8. $U_{in} = \frac{4KQq}{R} + \frac{KQq}{3r}$

Its energy when it reaches the center of ring 1

$U_{fin.} = \frac{KQq}{R} + \frac{4KQq}{3r} + K.E. = U_{in}$

$\Rightarrow$ K.E. is positive