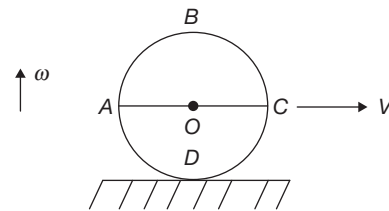


Engineering Mechanics

Time: 60 Minutes

- The value of coefficient of restitution is one for
 - perfectly elastic collision.
 - perfectly inelastic collision.
 - neither plastic nor elastic collision.
 - None of these
- The radius of gyration for a sphere and cylinder of radius ' R ' are respectively.
 - $0.6324 R$ and $0.707 R$
 - $0.6234 R$ and $0.77 R$
 - $0.6432 R$ and $1.414 R$
 - $0.6324 R$ and $1.414 R$
- Which of the following relation represents motion under variable acceleration?
 - $v = a \frac{dv}{ds}$
 - $a = v \frac{dv}{ds}$
 - $v = \frac{1}{a} \frac{dv}{ds}$
 - None of these
- If a projectile motion with usual notations is expressed as $y = xP - \frac{gx^2}{2u^2Q^2}$ (α = Angle of projection), then ' P ' and ' Q ' are
 - $\tan \alpha$ and $\cos^2 \alpha$
 - $\tan \alpha$ and $\cos \alpha$
 - $\tan \alpha$ and $\sec \alpha$
 - $\tan \alpha$ and $\sec^2 \alpha$
- A mechanism has 5 numbers of joints and 6 members. The number of additional members needed to make it a perfect frame will be
 - 4
 - 3
 - 2
 - 1
- The rate of change of velocity and the rate of change of momentum of a moving body respectively are
 - acceleration and impulse
 - acceleration and force
 - displacement and force
 - force and displacement
- In the equation of virtual work, which of the following force is neglected?
 - Reaction at any smooth surface with which the body is in contact
 - Reaction of rough surface of a body which rolls on it without slipping
 - Reaction at a point on an axis fixed in space, around which a body is constrained to turn.
 - All of these
- Two metallic balls having potential energy in the ratio 3 : 5 are made to slide down a frictionless inclined plane with zero position. What will be the ratio of their kinetic energy when they reach at bottom of inclined plane?
 - 5 : 3
 - 3 : 5
 - 1 : 1
 - 2 : 3

- Two forces form a couple only when
 - magnitude is same have parallel lines of action and same sense.
 - magnitude is different, have parallel lines of action but same sense.
 - magnitude is same have non parallel lines of action but same sense.
 - magnitude is same and have parallel lines of action and opposite sense.
- A wheel is rolling on a straight road as shown below. For this wheel the acceleration of the center ' O ' and its instantaneous centre are



- $\omega^2 r$ and O
- $\omega^2 r$ and D
- v^2/r and D
- zero and O

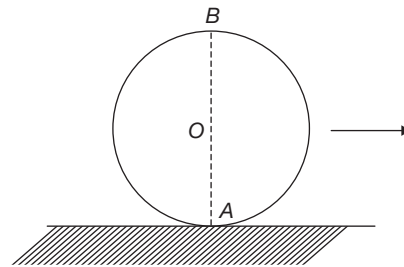
- A particle moving from rest moves in a straight line. Its acceleration is given by the equation:

$$a = 10 - 0.006S^2$$

Velocity of the particle when it has travelled 40 m is

- 19.16 m/s
- 23.32 m/s
- 26.84 m/s
- 30.14 m/s

-



A wheel of radius 1 m rolls on a flat horizontal ground without slipping as shown in figure. Resultant velocity at point B is 1 m/s. Angular velocity of the wheel about its centre in rad/s is

- $\frac{1}{\sqrt{2}}$
- $\sqrt{2}$
- 1
- $\frac{1}{2}$

- Acceleration of a particle is given by:

$$a = t^3 - 3t^2 + 5$$

Where, t = time in seconds and a = acceleration in m/s^2 . Velocity of particle when $t = 2$ second is 8 m/s. Velocity of the particle when $t = 4$ second is

- (A) 22 m/s (B) 25 m/s
(C) 28 m/s (D) 32 m/s

Direction for questions 14 and 15:

14. A body of mass 5 kg falls from a height of 50 m and penetrates into the ground by 90 cm. Average resistance to penetration is

- (A) 2668 N (B) 2774 N
(C) 2814 N (D) 2892 N

15. Time taken for penetration is

- (A) 19.7 second (B) 12.7 second
(C) 17.4 second (D) 15.4 second

16. Angular displacement of a body is given by

$$\theta = 6t^2 + 3t + 10$$

Where t is in seconds. Angular velocity and angular acceleration of the body when $t = 10$ seconds are

- (A) 123 rad/s, 12 rad/s²
(B) 135 rad/s, 14 rad/s²
(C) 142 rad/s, 16 rad/s²
(D) 153 rad/s, 18 rad/s²

Direction for questions 17 and 18:

A ball can be projected with a maximum velocity of 50 m/s. On an inclined plane, the maximum range obtained on projecting the ball is 190 m.

17. Inclination of the plane to the horizontal is

- (A) 20° (B) 18°
(C) 16° (D) 14°

18. The projection angle from horizontal is

- (A) 68° (B) 65°
(C) 60° (D) 55°

Direction for questions 19 and 20:

A projectile is fired at an angle of 30° in a horizontal level ground with a velocity of 50 m/s.

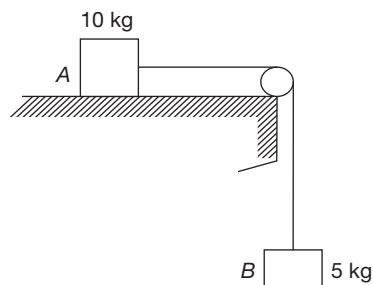
19. Time taken by the projectile to reach the ground after firing is

- (A) 9.8 second (B) 8.6 second
(C) 7.2 second (D) 5.1 second

20. Horizontal range of the projectile is

- (A) 220.7 m (B) 208.5 m
(C) 192.6 m (D) 186.1 m

Direction for questions 21 to 23:



Block A of mass 10 kg placed on a rough horizontal plane is connected to another block B of mass 5 kg by a string passing over a pulley as shown in figure. Coefficient of friction between block A and horizontal plane is 0.25. If the system is released from rest and block B is falling,

21. Tension on the string is

- (A) 28.43 N (B) 33.41 N
(C) 37.62 N (D) 40.88 N

22. Acceleration of block B is

- (A) 1.268 m/s² (B) 1.635 m/s²
(C) 1.824 m/s² (D) 2.116 m/s²

23. Velocity acquired by block B when it falls through a vertical distance of 1 m, is

- (A) 1.24 m/s (B) 1.56 m/s
(C) 1.81 m/s (D) 2.35 m/s

Direction for questions 24 and 25:

Angular displacement of a particle, moving in a circular path of 150 m radius is given by:

$$\theta = 18t + 3t^2 - 2t^3$$

24. Angular acceleration at 2 seconds from start is

- (A) 15 rad/s² (B) 18 rad/s²
(C) -15 rad/s² (D) -18 rad/s²

25. Maximum angular velocity is

- (A) 16.4 rad/s (B) 19.5 rad/s
(C) 22.3 rad/s (D) 25.4 rad/s

ANSWER KEYS

- | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. A | 2. A | 3. B | 4. B | 5. D | 6. B | 7. D | 8. B | 9. D | 10. D |
| 11. B | 12. D | 13. A | 14. B | 15. C | 16. A | 17. A | 18. D | 19. D | 20. A |
| 21. D | 22. B | 23. C | 24. D | 25. B | | | | | |