Exam 3-031

Q1 A uniform rod AB is 1.5 m long and weighs 20 N. It is suspended by wires AC and BD as shown in Fig. 1. A block P weighing 80 N is attached at E, 0.50 m from A. The tension in the wire BD is:

A1: 37 N
A2: 63 N
A3: 100 N
A4: 28 N
A5: 72 N

Q2 A man weighing 720 N stands halfway up a 5.0 m ladder of negligible weight. The base of the ladder is 3.0 m from the wall as shown in Fig. 2. Assume that the wall-ladder contact is frictionless. With what force does the wall push against the ladder?

A1: 270 N
A2: 350 N
A3: 500 N
A4: 600 N
A5: 720 N

Q3 A steel rod has a radius of 8.5 mm and a length of 100 cm. A force of 6.0 x 10**4 N stretches it along its length. Take Young's modulus for steel as 11 x 10**11 N/m**2. The increase in the length of the rod in mm is:

A1: 0.24
A2: 0.36
A3: 0.14
A4: 0.71
A5: 1.42

Q4 The diagrams in Fig. 6 show forces applied to a wheel of weight W=20 N. Which diagram is the wheel in equilibrium?

A1: diagram (3)
A2: diagram (2)
A3: diagram (1)
A4: diagram (4)
A5: none of them

Q5 A satellite circles a planet every 2.8 h in an orbit of radius 1.2 x 10**7 m. If the radius of the planet is 5.0 x 10**6 m, what is the mass of the planet?

A1: 1.0 x 10**25 kg
A2: 3.1 x 10**26 kg
A3: 3.4 x 10**24 kg
A4: 4.0 x 10**27 kg
A5: 1.9 x 10**23 kg

Q6 Two stars of masses M and 6M are separated by a distance D. Calculate the distance (measured from M) to a point at which the net gravitational force on a third mass would be zero.

A1: 0.29 D
A2: 0.41 D
A3: 0.33 D
A4: 0.37 D
A5: 0.14 D

Q7 A spaceship of mass m circles a planet (mass = M) in an orbit of radius R. How much energy is required to transfer the spaceship to a circular orbit of radius 3R?

A1: GmM/(3R)
A2: GmM/(6R)
A3: GmM/(2R)
A4: GmM/(4R)
A5: 3GmM/(4R)

Q8 A planet has a mass of 5.0 x 10**23 kg and radius of 2.0 x 10**6 m. A rocket is fired vertically from the surface of the planet with an initial speed of 4.0 km/s. What is the speed of the rocket when it is 1.0 x 10**6 m from the surface of the planet?

A1: 2.2 km/s
A2: 3.0 km/s
A3: 1.6 km/s
A4: 5.9 km/s
A5: 3.7 km/s

Q9 A uniform U-tube is partially filled with water. Oil, of density 0.75 g/cm**3, is poured into the left arm until the water level in the right arm rises 3 cm (see Fig. 3). The length of the oil column, L, is then:

A1: 8 cm
A2: 2 cm
A3: 6 cm
A4: 4 cm
A5: 10 cm

Q10 An object hangs from a spring balance. The balance indicates 30 N in air, 20 N when the object is completely submerged in water, and 24 N when the object is completely submerged in an unknown liquid. The density of the unknown liquid equals:

A1: 0.6 g/cm**3
A2: 2.5 g/cm**3
A3: 1.2 g/cm**3
A4: 0.4 g/cm**3
A5: 0.3 g/cm**3

Q11 A large open tank filled with water has two small holes in its bottom, one with twice the radius of the other (see Fig. 4). In steady flow, the speed of water leaving the larger hole is and the speed of the water leaving the smaller hole is v2. Which of the following statements is correct?

A1: v1 = v2
A2: v1 = 2 v2
A3: v1 = v2 / 2
A4: v1 = v2 / 4
A5; v1 = 4 v2

Q12 Water flows from a 6.0-cm diameter pipe into an 8.0-cm diameter pipe. The speed in the 6.0-cm pipe is 5.0 m/s. The speed in the 8-cm pipe is:

A1: 2.8 m/s
A2: 3.7 m/s
A3: 6.6 m/s
A4: 8.8 m/s
A5: 9.9 m/s

Q13 The displacement of a particle moving with simple harmonic motion is given by: x = 0.02 cos (300 t - pi/3), where x is in m and t is in sec. What is the maximum speed of the particle?

A1: 6   m/s
A2: 3   m/s
A3: 300 m/s
A4: 0.02 m/s
A5: pi/3 m/s

Q14 A 0.65 kg block is fastened to a spring whose spring constant is 65 N/m. The block is pulled a distance 20 cm from its equilibrium position on a frictionless horizontal surface and released from rest. What is the angular frequency of the resulting motion?

A1: 10   rad/s
A2: 20   rad/s
A3: 65   rad/s
A4: 0.65 rad/s
A5: 2.0 rad/s

Q15 A block-spring system is set in a simple harmonic motion. The block has a kinetic energy of 6 J and an elastic potential energy of 2 J when the displacement of the block is 2.0 cm from the equilibrium point. What is the amplitude of the simple harmonic motion?

A1: 4 cm
A2: 2 cm
A3: 8 cm
A4: 10 cm
A5: 6 cm

Q16 A particle of mass m is acted upon by a force F. Which of the following relationships between (F) and the displacement of the particle (x) will result in simple harmonic motion?

A1: F = -5 x
A2: F = -400 x**2
A3: F = 10 x
A4: F = 3 x**2
A5: F = 5

Q17 What is the mass of air in a room that measures 5.0 m x 8.0 m x 3.0 m?
1 Q0 (the density of air is 1.25 x 10**(-3) g/cm**3)

A1: 150 kg
A2: 120 kg
A3: 100 kg
A4: 200 kg
A5: 50 kg

Q18 A rock is thrown directly downward from the top of a building with an initial speed of 10 m/s. It strikes the ground 3.0 s later. What is the height of the building?

A1: 74 m
A2: 44 m
A3: 30 m
A4: 60 m
A5: 14 m

Q19 If A = (-10 i + 10 j) and B = (-10 i - 10 j), which statement is CORRECT?

A1: (A-B) is perpendicular to (A+B)
A2: (A-B) is perpendicular to (B-A)
A3: The magnitude of (A-B) is larger than the magnitude of (A+B)
A4: The magnitude of (A-B) is smaller than the magnitude of (A+B)
A5: (A-B) is parallel to (A+B)

Q20 A projectile is thrown from the origin with an initial velocity Vo = (20 i + 98 j) m/s. If the projectile hits a target that is a horizontal distance of 400 m away, what is the time of flight of the projectile?

A1: 20 s
A2: 10 s
A3: 25 s
A4: 15 s
A5: 30 s

Q21 A block is released from rest on a 27 degree incline and moves 6.0 m during the next 2.0 s. What is the coefficient of kinetic friction between the block and the incline?

A1: 0.17
A2: 0.28
A3: 0.22
A4: 0.35
A5: 0.12

Q22 A 0.5 kg mass attached to the end of a string swings in a vertical circle of radius = 2.0 m. When the mass is at its lowest point on the circle, its speed is 12 m/s. What is the magnitude of the tension of the string at this point?

A1: 41 N
A2: 31 N
A3: 36 N
A4: 46 N
A5: 23 N

Q23 A conservative force F = (-15 j) N acts on a particle as it moves from the origin (0,0) to the point (3m,3m). How much work is done by the given force during this displacement?

A1: -45 J
A2: +45 J
A3: -30 J
A4: +30 J
A5: +75 J

Q24 A 4.0 kg block starts moving up a 30 degrees incline with an initial kinetic energy of 300 J. How far will it slide up the incline if the coefficient of kinetic friction between the block and the incline is 0.3 ?

A1: 10 m
A2: 30 m
A3: 20 m
A4: 35 m
A5: 15 m

Q25 At what rate is the weight of a 2.0 kg projectile doing work at an instant when the velocity of the projectile is 4.0 m/s directed 30 degrees above the horizontal?

A1: -39 W
A2: +39 W
A3: -78 W
A4: +78 W
A5: +25 W

Q26 A 4.0 kg object slides with speed v on a frictionless surface explodes into two 2.0 kg parts, one moving at 3.0 m/s, due north, and the other at 4.0 m/s, due east (Fig. 7). What is original speed of the object (v)?

A1: 2.5 m/s
A2: 2.2 m/s
A3: 5.0 m/s
A4: 2.7 m/s
A5: 3.1 m/s

Q27 Body A of mass =M1 moves along the x axis with speed =v1i before it has an elastic head-on collision with body B of mass = M2 which was at rest. After the collision, A has a velocity = v1f and B has a velocity = v2f.
Which of the following statements is CORRECT?

A1: If M1 = M2, v1f = 0 and v2f = v1i.
A2: If M1 > M2, the direction of v1f is in the -x direction.
A3: If M2 > M1, the direction of v1f is in the +x direction.
A4: If M2 >> M1, v1f = 0.
A5: If M1 >> M2, v1f = 0.

Q28 Starting from rest, a wheel rotating about a fixed axis with a constant angular acceleration turns through 2.4 rev during the first 2.0 s. What is the angular velocity at t = 2.0 s?

A1: 15 rad/s
A2: 12 rad/s
A3: 18 rad/s
A4: 10 rad/s
A5: 24 rad/s

Q29 A man, with his arms close to his body, is spinning on a light frictionless turntable. When he extends his arms horizontally,

A1: his angular momentum remains the same
A2: his angular velocity increases
A3: his angular velocity remains the same
A4: his rotational inertia decreases
A5: his rotational kinetic energy increases

Q30 A massless rope is wrapped around a uniform cylinder that has radius R and mass M, as shown in Fig. 5. Initially, the unwrapped part of the rope is vertical and the cylinder is horizontal. The linear acceleration of the cylinder is:

A1: (2/3)g
A2: (1/2)g
A3: (1/3)g
A4: (1/4)g
A5: g

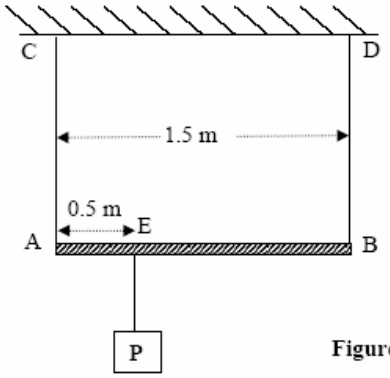


Figure-1

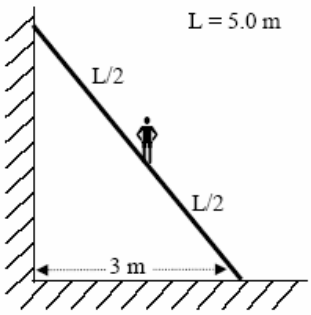


Figure-2

Figure-3

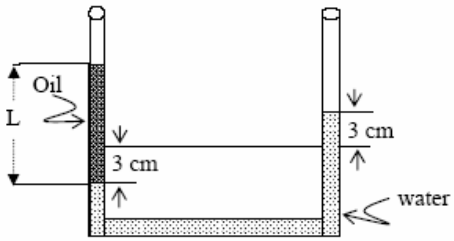
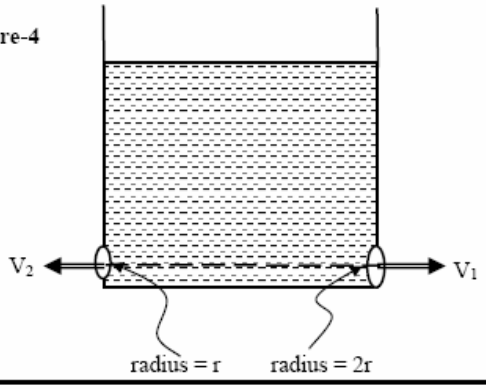


Figure-4



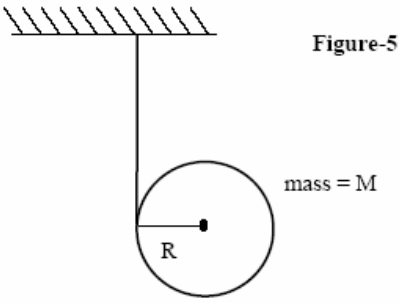


Figure-5

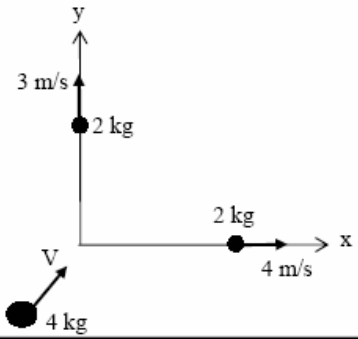


Figure-7

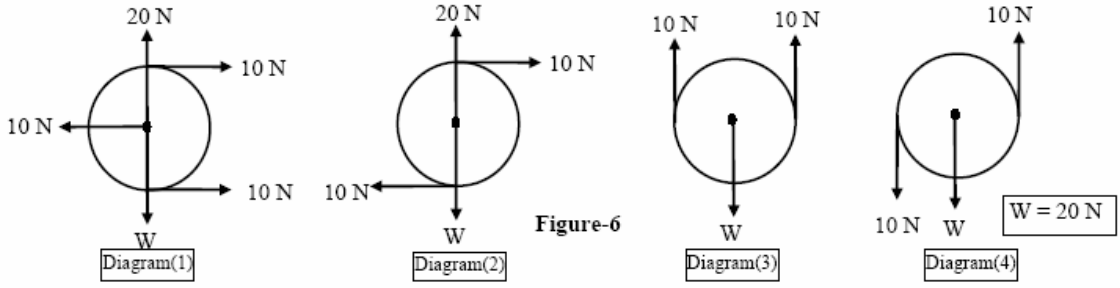


Figure-6