Exam 3-941

Q1 A 0.3-kg mass, attached to the end of a string, swings in a vertical circle, as shown in Figure 1. At the instant when theta equals 50 degrees, the tension in the string is 8.0 N. What is the magnitude of the resultant force on the mass at this instant?

A: 6.5 N
B: 4.7 N
C: 8.4 N
D: 1.4 N
E: 7.9 N

Q2 In Figure 2, the coefficient of kinetic friction between m1 and the table is 0.39. The mass m1=37 kg and the mass m2=55 kg. Assume the pulley is massless and frictionless. The magnitude of the acceleration is:

A: 4.32 m/s**2.
B: 5.07 m/s**2.
C: 4.68 m/s**2.
D: 3.51 m/s**2.
E: 5.63 m/s**2.

Q3 A 1 kg mass is attached to a light string of length 2 m to from a simple pendulum. The mass is released from rest at theta = 45 degrees. Find the tension in the string at the lowest point.

A: 15.54 N
B: 13.34 N
C: 18.16 N
D: 16.37 N
E: 12.67 N

Q4 A force F, shown as a function of x in Figure 3, acts on a 2 kg mass. If the particle starts with an initial speed of 8 m/s, find the speed of the particle at x=6 m.

A: 10.2 m/s.
B: 9.2 m/s.
C: 8.8 m/s.
D: 6.2 m/s.
E: 12.4 m/s.

Q5 A 20 kg mass is fastened to a light spring (k=300 N/m) that passes over a pulley as shown in Figure 4. The pulley is frictionless, and the mass is released from rest when the spring is unstretched. After the mass has moved downwards 0.40 m, the speed of the 20 kg mass is:

A: 2.33 m/s.
B: 1.82 m/s.
C: 2.12 m/s.
D: 4.11 m/s.
E: 3.65 m/s.

Q6 A 3 kg object moving with 8 m/s in the positive x direction has a one dimensional elastic collision with an object of mass M initially at rest. After the collision the object of the unknown mass M has a velocity of 6 m/s in the positive x direction. The mass M is:

A: 5.0 kg.
B: 9.0 kg.
C: 6.6 kg.
D: 4.0 kg.
E: 8.1 kg.

Q7 Three particles are located in the xy plane. The 40 g particle is located at (4, 3) m, and the 50 g particle is located at (-2,-2) m. Where must the 20 g particle be placed so that the center of mass of this three-particle system is at the rigin?

A: (-3.0, -1.0) m.
B: (-2.0, -0.67) m.
C: (-6.0, -2.1) m.
D: (-1.0, 1.3) m.
E: (2.1, -1.7) m.

Q8 A mass (m1=5.0 kg) is connected by a light cord that passes over a pulley, to a mass (m2=4.0 kg) which slides on a smooth surface as shown in Figure 5. The pulley (radius 0.2 m) rotates about a frictionless axle. If the acceleration of m2 is 3.5 m/s**2, then the moment of inertia of the pulley is:

A: 0.20 kg.m**2.
B: 0.42 kg.m**2.
C: 0.08 kg.m**2.
D: 0.16 kg.m**2.
E: 0.33 kg.m**2.

Q9 A thin rod of mass M and length L is free to rotate about A, the midpoint of the rod. The rod is struck at one end by a ball of clay of mass m moving with speed v, as shown in figure 6. The ball sticks to the rod. After collision, the angular momentum of the clay-rod system about A is:

A: mvL/2.
B: mvL.
C: 3mvL/2.
D: 2mvL/5.
E: 5mvL/2.

Q10 A column of fluid, is open to the atmosphere at the top, and is 9.5 m high. If the density of the fluid is 1680 kg/m**3, what is the total pressure at the bottom of this column?

A: 2.58*10**5 Pa.
B: 1.75*10**5 Pa.
C: 2.25*10**5 Pa.
D: 1.25*10**5 Pa.
E: 3.65*10**5 Pa.

Q11 The velocity of the flow of water in a pipe is 4.5 m/s. If the pipe has a diameter of 8.4 cm, what is the mass of water coming out of the pipe per second?

A: 24.9 kg/s.
B: 14.5 kg/s.
C: 29.9 kg/s.
D: 18.7 kg/s.
E: 11.3 kg/s.

Q12 A pipe carrying water from the ground floor to the fourth floor of a building which is 13 m high. At the fourth floor the pipe has a cross-sectional area of 4.1*10**-4 m**2, a pressure of 1.66*10**5 Pa and the velocity of water flow is 8.4 m/s. At the ground floor, the cross-sectional area of the pipe is 9.3*10**-4 m**2, What is the pressure in the pipe at the ground floor?

A: 3.22*10**5 Pa.
B: 2.92*10**5 Pa.
C: 3.41*10**5 Pa.
D: 2.44*10**5 Pa.
E: 4.12*10**5 Pa.

Q13 The mass of a planet is 6.00*10**24 kg. The gravitational acceleration on the surface of this planet is 12.0 m/s**2. The gravitational constant is G is 6.672*10**-11 N.m**2/kg**2. Calculate the radius of this planet.

A: 5776 km.
B: 5347 km.
C: 5002 km.
D: 5112 km.
E: 5883 km.

Q14 Find the distance from center of the earth to the center of the moon, using the fact that the moon completes an orbit in 27.3 days. (G=6.672x10**-11 N.m**2/kg**2, mass of the earth 5.98*10**24 kg).

A: 3.83*10**8 m.
B: 6.38*10**6 m.
C: 5.42*10**8 m.
D: 2.43*10**6 m.
E: 4.41*10**7 m.

Q15 A particle at the end of a spring executes simple harmonic motion with an amplitude of 4.0 cm. At what displacement (x) will its speed be equal to one half its maximum speed?

A: 3.46 cm.
B: 5.20 cm.
C: 6.93 cm.
D: 7.12 cm.
E: 4.13 cm.

Q16 A particle of mass m=0.14 kg at the end of a spring executes a simple harmonic motion according to the equation: x=0.2 cos(10t + pi/2)
Find the maximum potential energy of the spring?

A: 0.28 J.
B: 0.36 J.
C: 0.44 J.
D: 0.56 J.
E: 0.62 J.

Q17 Consider a horizontal spring-mass system. The force constant of the spring is k=360 N/m and M=1 kg is initially at rest. A bullet of mass 100 g is fired with initial speed vi= 100 m/s at the mass M, and embedded in it. Find the maximum amplitude of oscillation of the mass bullet system. (see figure 7)

A: 0.50 m.
B: 0.55 m.
C: 0.67 m.
D: 0.43 m.
E: 0.38 m.

Q18 A uniform bar of length 1.2 m and weight 120 N is supported by two ropes (see figure 8). two 400-N weights are suspended at L/3and 2L/3 from the left end. Find the tension T1 in the right hand rope.

A: 531.2 N.
B: 300.2 N.
C: 415.7 N.
D: 117.8 N.
E: 422.7 N

Q19 A uniform circular disc of mass 4 kg is rolling without slipping along a horizontal surface. The velocity of its center of mass is 5 m/s. Its total kinetic energy is:

A: 75 J.
B: 48 J.
C: 108 J.
D: 50 J.
E: 15 J.

Q20 A wheel (radius = 12 cm) is mounted on a frictionless, horizontal axle that is perpendicular to the wheel and passes through the center of mass of the wheel. A light cord wrapped around the wheel supports a mass of 0.40 kg. The mass is released from rest and the cord remains stretched. The mass is observed to fall with a downward acceleration of 3.0 m/s**2. What is the moment of inertia of the wheel?

A: 0.013 kg.m**2
B: 0.022 kg.m**2
C: 0.008 kg.m**2
D: 0.416 kg.m**2
E: 0.335 kg.m**2

Q21 A 10 g bullet is fired into a 990 g wooden block at rest on a horizontal surface that has coefficient of friction equal to 0.5. The bullet remains stuck in the wood, which slides 0.4 m before coming to rest. The speed of the bullet just before it strikes the block is:

A: 198 m/s.
B: 140 m/s.
C: 171 m/s.
D: 182 m/s.
E: 163 m/s.

Q22 How large a force is required to accelerate a 1500 kg car that is originally at rest to a speed of 20 m/s in a distance of 80 m.

A: 3750 N.
B: 8438 N.
C: 5859 N.
D: 3999 N.
E: 6865 N.

Q23 A 1000 kg car is moving with a constant velocity of 3 m/s. A constant frictional force of 400 N acts on the car. What is the power delivered by the motor of the car?

A: 1200 W.
B: 1500 W.
C:]800 W.
D: 1600 W.
E: 600 W.

Q24 A football player on another planet can have a maximum horizontal range of 20 meters if he jumps with an initial speed of 10 m/s. Find the acceleration due to gravity "g" on this planet:

A: 5.0 m/s**2.
B: 3.2 m/s**2.
C: 7.2 m/s**2.
D: 9.8 m/s**2.
E: 1.3 m/s**2.

Q25 An object moves with a constant speed in a horizontal circle of radius R. Its acceleration is 32 m/sec**2. What would its acceleration have been if it had the same speed but the circle's radius is increased to 4R?

A: 8 m/s**2.
B: 16 m/s**2.
C: 4 m/s**2.
D: 12 m/s**2.
E: 6 m/s**2.

Q26 A student jumps vertically upwards. It takes him 0.6seconds to jump up and come down to his initial position. His initial velocity and the maximum height he reached are, respectively:

A: 2.94 m/s, 0.44 m.
B: 1.96 m/s, 0.20 m.
C: 2.45 m/s, 0.31 m.
D: 3.35 m/s, 0.66 m.
E: 4.41, m/s 0.24 m.

Q27 A stone is dropped from the roof of a 60 m high building. At the same time a second stone is thrown vertically upward from the bottom of this building with an initial speed of 20 m/s. Where will the two stones meet? (Hint: they will be at the same height)

A: 15.9 m from the ground.
B: 19.4 m from the ground.
C: 17.9 m from the ground.
D: 21.3 m from the ground.
E: 11.4 m from the ground.

Q28 Two points in a plane have polar coordinates (2.5m, 30 degrees) and (3.8m, 120 degrees). Find the distance between them.

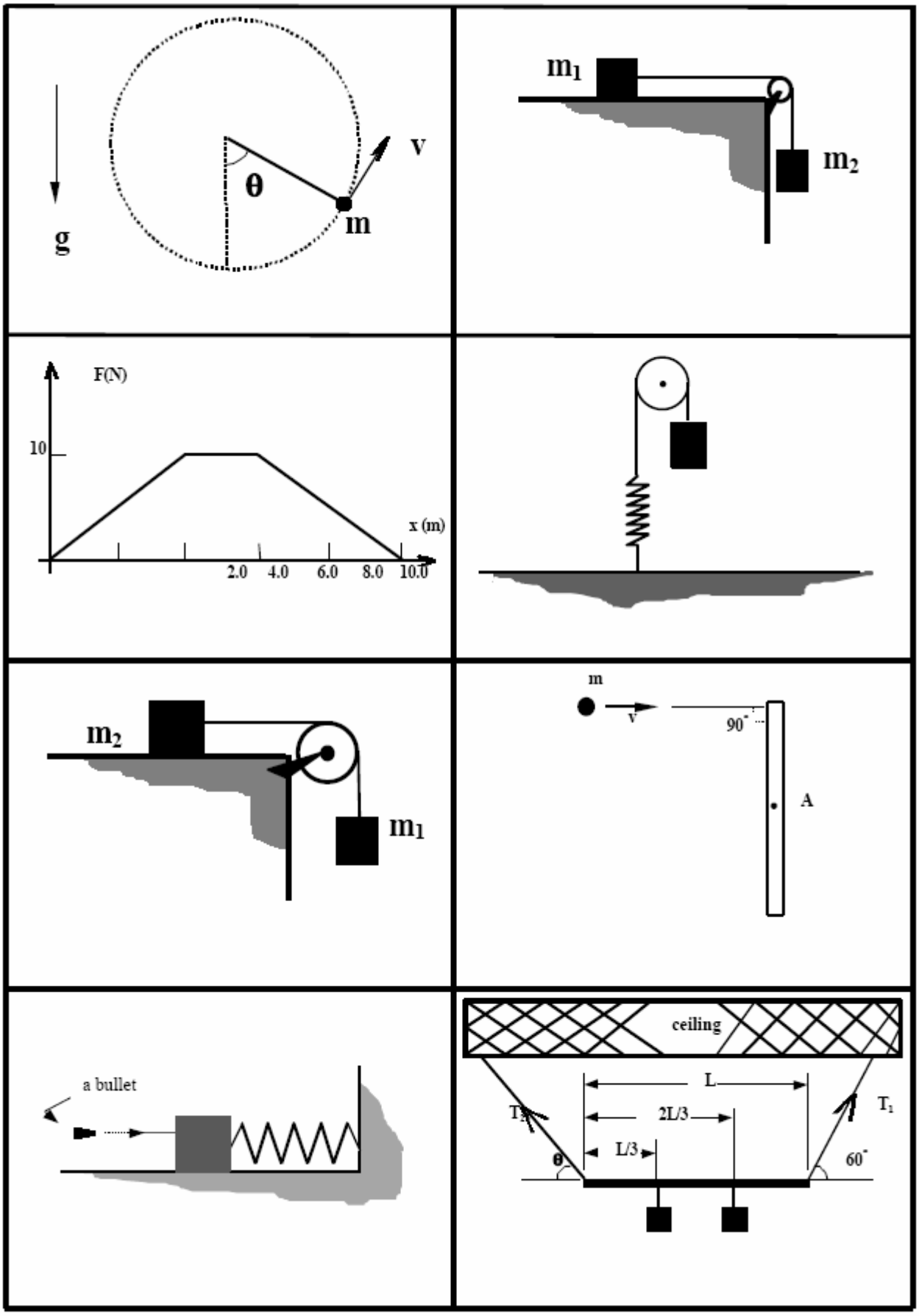
A: 4.55 m.
B: 5.17 m.
C: 5.89 m.
D: 3.79 m.
E: 4.94 m

Q29 A motorboat is heading north at 30 km/h relative to the water in a place where the water current has a velocity of 10 km/h in a direction 6degrees south of east. Find the resultant velocity of the boat.

A: 21.9 km/h, 76.8 degrees north of east.
B: 20.5 km/h, 73.0 degrees north of east.
C: 23.4 km/h, 80.2 degrees north of east.
D: 17.1 km/h, 66.1 degrees north of east.
E: 26.4 km/h, 60.0 degrees north of east.

Q30 The mass of a hollow spherical shell of inner radius 5 cm and outer radius 15, cm and of density 25 g/cm**3 is equal to:

A: 340 kg.
B: 347 kg.
C: 331 kg.
D: 362 kg.
E: 353 kg.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