QUESTION NO: 1

Consider three physical quantities L, T, and V representing length, time, and speed, respectively. Determine which one of the following arithmetic operations is physically acceptable:

A. T*V - L B. L*T - V C. L*V - T
D. T/L + V E. V/T - L

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QUESTION NO: 2

When a vehicle travels around a circular path with a constant speed, then the

A. net force is directed toward the center of the circle.
B. vehicle has zero acceleration.
C. momentum of the vehicle is zero.
D. net force on the vehicle is tangent to the curve and in the direction of motion.
E. centripetal (radial) force does work.

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QUESTION NO: 3

Which one of the following statements is CORRECT ?

A. Dimensions of torque are the same as the dimensions of energy.
B. Kinetic energy of a particle can be negative.
C. Angular momentum of a rotating pulley around an axis passing through its center of mass is zero.
D. The only condition for a solid object to be in static equilibrium is that the net force on it be zero.
E. The moon is orbiting the earth because the net force applied on it is zero.

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QUESTION NO: 4

Which one of the following statements is not correct ?

A. If the speed of a particle is doubled, its kinetic energy is doubled.
B. If the speed of a particle is doubled, its momentum is doubled.
C. The dimensions of angular momentum are equal to the dimensions of energy multiplied by the dimension of time.
D. The moment of inertia of a disk about an axis passing through the center of mass is different from its moment of inertia about an axis passing through its rim.
E. The net torque on an object rotating with a constant angular velocity is ZERO.

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QUESTION NO: 5

Which of the following statements is CORRECT ?

A. A body cannot be in equilibrium if only one external force acts on it.
B. The period, T, is the time necessary for a particle to go through four oscillations.
C. The total mechanical energy of a particle in simple harmonic motion is not constant.
D. The escape velocity of a rocket depends on its mass.
E. All collisions in nature are elastic.

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QUESTION NO: 6

Three forces F1, F2, and F3 are applied on an object. Their values are 120 N, 200 N, and 150 N, respectively. Their directions relative to the positive x-axis are zero, 60, and 225 degrees, respectively. The resultant force is:

A. 132 N, 30.4 degs. B. 141 N, 33.5 degs.
C. 115 N, 41.0 degs. D. 161 N, 55.2 degs.
E. 153 N, 49.2 degs.

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QUESTION NO: 7

A particle moves from point A (-4, 2) m to point B (5, -4) m in the x-y plane in 3 s. What is the average velocity of the particle between those two points?

A. 3 i - 2 j m/s. B. 2 i + 3 j m/s. C. - i + 2 j m/s.
D. 4 i - 9 j m/s. E. zero.

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QUESTION NO: 8

A ball is thrown vertically upward from the ground with an initial speed of 4.0 m/s. How far is the ball from the ground when its speed is 2.5 m/s ?

A. 0.5 m. B. 1.2 m. C. 2.2 m. D. 8.9 m. E. 1.9 m.

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QUESTION NO: 9

A simple pendulum has a period of 3.0 s on the earth. What would its period be on the moon where g(moon) = 1.67 m/s**2 ?

A. 7.3 s. B. 1.7 s. C. 9.8 s. D. 3.0 s. E. 1.4 s.

QUESTION NO: 10

Determine the absolute pressure at the bottom of a wide tank that is 4.0 m deep. (density of water = 1000 kg/m**3, P(atmosphere) = 1.013x10**5 Pa)

A. 1.4x10**5 Pa. B. 1.0x10**5 Pa.
C. 2.2x10**5 Pa. D. 1.1x10**4 Pa.
E. 7.4x10**4 Pa.

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QUESTION NO: 11

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A 52-kg solid cylinder of radius R = 2.0 cm is placed vertically on the floor. What pressure does the cylinder exert on the floor ?

A. 4.1x10**5 N/m**2. B. 1.0x10**5 N/m**2.
C. 3.2x10**4 N/m**2. D. 3.3x10**5 N/m**2.
E. 7.0x10**4 N/m**2.

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QUESTION NO: 12

A projectile is launched with an initial velocity of (3 i + 2 j) m/s. Neglecting air resistance, the velocity at the top of its trajectory is:

A. 3 i m/s. B. 2 i m/s.
C. 2 j m/s. D. 3 i + 2 j m/s.
E. 3 i - 2 j m/s.

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QUESTION NO: 13

A projectile is launched from the ground with an initial speed of 43 m/s and at an angle of 41 deg. with the horizontal. After traveling a horizontal distance of 20 m, the projectile reaches a height of (neglecting air resistance) :

A. 15.5 m. B. 10.8 m. C. 16.3 m.
D. 26.5 m. E. 33.7 m.

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QUESTION NO: 14

The two blocks shown in Figure 1 have masses of 2.0 kg and 3.0 kg, respectively and are connected by a massless cord. They move upward along a frictionless 30 degrees incline under the action of a 60 N force parallel to the incline and applied to the upper block. The tension in the cord is:

A. 24N. B. 31N. C. 60 N. D. 11N. E. 45 N.

****

QUESTION NO: 15

A 1000-kg car is driven at a constant speed of 15 m/s around a horizontal circular road of a radius R = 50 m. Calculate the centripetal force exerted on the car.

A. 4500 N. B. 4075 N. C. 1170 N.

D. 2750 N. E. 5100 N.

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QUESTION NO: 16

A string 1.2 m long can stand a maximum tension of 3.0 N before it breaks. The maximum speed of a 0.2 kg mass attached to its end when moved in a horizontal circle is:

A. 4.24 m/s. B. 2.50 m/s. C. 3.22 m/s.
D. 5.34 m/s. E. 6.20 m/s.

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QUESTION NO: 17

A 0.2-kg box is given an initial speed of 10 m/s on a horizontal surface. After it moves a distance of 8.0 m, its speed drops to 6.0 m/s because of friction. The coefficient of kinetic friction between the box and the surface is:

A. 0.41 B. 0.19 C. 0.67 D. 0.13 E. 0.75

****

QUESTION NO: 18

A 0.25-kg block is placed on a vertical spring of force constant k = 5000 N/m. The spring-mass system is pushed downward a total distance of d = 0.1 m from the spring's uncompressed position as shown in Figure 2. As the block is released it leaves the spring and continues to travel upward. The maximum height h, above the point of release, the block reaches is:

A.10.2 m B. 6.2 m C. 02.1 m D. 14.5 m E. 19.6 m

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QUESTION NO: 19

A 0.15-kg steel ball is dropped onto a horizontal steel plate. Its speed is 4.5 m/s just before impact and 4.2 m/s just after impact. If the ball is in contact with the plate for 0.03 sec. , the magnitude of the average force the ball exerts on the plate during impact is:

A. 44 N. B. 81 N. C. 66 N. D. 36 N. E. 3 N.

QUESTION NO: 20

A boy is running at a speed of 2.5 m/s when he jumps onto a 34 kg sled that is initially at rest on the frozen surface of a lake. If the boy-sled system begins to slide at a speed of 1.5 m/s, the mass of the boy must be:

A. 51kg. B. 41kg. C. 21kg. D. 31 kg. E. 61kg.

****

QUESTION NO: 21

A solid sphere of mass 20 kg and radius 15 cm rotates about an axis passing through its center with a constant angular speed of 5 rad/s. The rotational kinetic energy of the sphere is: (Ic (solid sphere) = (2/5)*M*R**2)

A. 2.25 J. B. 3.05 J. C. 0.15 J.
D. 1.90 J. E. 0.93 J.

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QUESTION NO: 22

A disk of radius 2 m rotates about a fixed frictionless axle passing through its center. The moment of inertia of this disk about its axis is 5 kg-m^2. A constant tension of 50 N is maintained on a rope wrapped around the rim of the disk to accelerate it. If the disk starts from rest at t = 0, the kinetic energy of the disk at t = 2 s is:

A. 4 kJ. B. 6 kJ. C. 9 kJ. D.3 kJ. E.7 kJ.

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QUESTION NO: 23

Two blocks, m1 = 1.0 kg and m2 = 2.0 kg, are connected by a light string as shown in Figure 3. If the radius of the pulley is 1.0 m and its moment of inertia about the axis of rotation is 5.0 kg*m**2, then the acceleration of the system, in terms of the gravitational acceleration g, is:

A. g/8. B. 3g/8. C. g/6. D. g/2. E. 5G/8.

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QUESTION NO: 24

A uniform ladder 2.5 m long is leaning against a smooth wall at an angle of 53 deg. above the horizontal. The weight of the ladder is 120 N. A boy weighing 350 N climbs 1.0 m up the ladder. What is the magnitude of the friction force exerted on the ladder by the floor ?

A. 151 N. B. 120 N. C. 108 N.
D. 165 N. E. 135 N.

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QUESTION NO: 25

A 4-m uniform beam of weight 150 N is supported at its lower end by a pin. The other end of the beam is elevated by a horizontal cable as shown in Figure 4. If a 250 N load is suspended from the outer end of the beam, the tension in the horizontal cable is:

A. 563 N. B. 640 N. C. 401 N.
D. 215 N. E. 345 N.

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QUESTION NO: 26

An oscillatory mass-spring system has a total mechanical energy of 1 J, an amplitude of 10 cm and a maximum speed of 1 m/s. Neglecting friction, what is the mass ?

A. 2 kg. B. 1 kg. C. 5 kg. D. 6 kg. E. 7 kg.

****

QUESTION NO: 27

A uniform rod (mass m = 1.0 kg and length L = 2.0 m) pivoted at one end oscillates in a vertical plane. If Ic (rod) = (1/12)*M*L**2, the period of oscillation is:

A. 2.3 s. B. 1.8 s. C. 3.2 s. D. 4.0 s. E. 2.0 s.

****

QUESTION NO: 28

Two masses m1 and m2 are separated by a distance of 2.0 m. Find the ratio of these two masses m1/m2 if the net force on a third mass placed between the two masses and at a distance of 0.25 m from m2 is ZERO.

A. 49. B. 36. C. 25. D. 16. E. 09.

****

QUESTION NO: 29

A point is located at a distance 2R above the surface of the earth, where R is the radius of the earth. Calculate the magnitude of the free-fall acceleration at that point.

A. 1.1 m/s**2. B. 3.7 m/s**2. C. 0.3 m/s**2.
D. 6.4 m/s**2. E. 9.8 m/s**2.

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QUESTION NO: 30

A satellite of mass m circles a planet of mass M in an orbit of radius 3R. What is the minimum energy required to change the orbit to 4R ?

A. GmM/24R B. GmM/15R C. GmM/13R
D. GmM/21R E. GmM/ 3R