Exam 3-012

Q1 Consider a simple harmonic motion, say as described by a mass-spring system. The ACCELERATION of the mass will be maximum when the:

A1: displacement of the mass is maximum
A2: velocity of the mass is maximum
A3: displacement of the mass is minimum
A4: potential energy is minimum
A5: kinetic energy is maximum

Q2 What happens to the FREQUENCY if the length of a simple pendulum is INCREASED by a factor of FOUR?

A1: it decreases by a factor of TWO.
A2: it increases by a factor of TWO.
A3: it remains constant(i.e. does not change).
A4: it increases by a factor of FOUR.
A5: it decreases by a factor of FOUR.

Q3 A particle of mass 0.10 kg is vibrating with simple harmonic motion with a period of 0.20 s and a maximum speed of 10 m/s. Find the maximum DISPLACEMENT of the particle.

A1: 0.32 m
A2: 0.12 m
A3: o.53 m
A4: 0.98 m
A5: 0.00 m

Q4 A simple harmonic oscillator is oscillating with an amplitude A. For what value of the DISPLACEMENT does the kinetic energy equal the potential energy?

A1: 0.707 * A
A2: 0.500 * A
A3: 1.414 * A
A4: 0.816 * A
A5: 1.633 * A

Q5 A 3-kg block, attached to a spring, executes simple harmonic motion on a horizontal frictionless surface according to x = 2 cos(10 t + 3.14) where x is in meters and t is in seconds. Find the magnitude of the maximum ACCELERATION.

A1: 200 m/s**2
A2: 400 m/s**2
A3: 20 m/s**2
A4: 500 m/s**2
A5: 00 m/s**2

Q6 The open vertical tube in FIGURE 1 contains two liquids of densities Rho1 = 1000 kg/m**3 and Rho2 = 600 kg/m**3, Which do not mix. Find the PRESSURE (in N/m**2) at the bottom of the tube.

A1: 1.3* 10**5
A2: 1.9* 10**4
A3: 2.1* 10**4
A4: 3.7* 10**5
A5: 0.3* 10**4

Q7 Water (density = 1.0 x 10**3 kg/m**3) flows through a horizontal pipe as shown in FIGURE 2. At the wider end its speed is 4.0 m/s and at the narrow end its speed ***Q0 is 5.0 m/s. The DIFFERENCE in pressure, P2 - P1, between
Q0 the two ends is:

A1: +4.5 x 10**3 Pa
A2: -4.5 x 10**3 Pa
A3: +7.0 x 10**2 Pa
A4: -7.0 x 10**2 Pa
A5: 0.0 Pa

Q8 A 3.20-kg block of metal measuring 15 cm X 10 cm X 10 cm is suspended from a scale and totally immersed in water Q0 as shown in FIGURE 3. What is the READING of the spring scale (in N)? (density of water = 1.0* 10**3 kg/m**3)

A1: 16.7
A2: 10.3
A3: 28.9
A4: 31.4
A5: 14.7

Q9 A block of wood floats in water with two-third of its volume submerged. Find the DENSITY of the wood (in kg/m**3). (Density of water is 1.0* 10**3 kg/m**3).

A1: 667
A2: 1500
A3: 1000
A4: 500
A5: 333

Q10 The rate of flow of water through a horizontal pipe is 2.0 m**3/minute. Determine the SPEED of flow at a point where the radius of the pipe is 5.0 cm.

A1: 4.2 m/s
A2: 2.0 m/s
A3: 6.0 m/s
A4: 5.3 m/s
A5: 7.2 m/s

Q11 Two concentric shells of uniform density having masses M1 and M2 and Radii R1 =2.0 m, R2 = 4.0 m are situated as shown in FIGURE 4. Find the gravitational FORCE on a particle of mass m placed at point B at a distance of 3.0 m from the center:

A1: (G*M1*m)/9
A2: G*(M1+M2)*m/9
A3: G*(M1+M2)*m/3
A4: (G*M2)*m/16
A5: G*(M1+M2)*m/4

Q12 Three particles with equal mass M = 2.0 kg are located at (0,0), (4,0) and (0,3) where the x and y coordinates are in meters. Find the magnitude of the gravitational fORCE exerted on the particle located at the origin by the other two particles.

A1: 3.4* 10**(-11) N
A2: 4.6* 10**(-11) N
A3: 5.2* 10**(-12) N
A4: 1.7* 10**(-10) N
A5: 2.6* 10**(-11) N

Q13 A moon is moving in a circular orbit around a planet with a period of 2.75* 10**4 s. Find the MASS of the planet if the radius of the orbit is 9.4* 10**6 m.

A1: 6.5* 10**23 kg
A2: 5.9* 10**26 kg
A3: 2.3* 10**25 kg
A4: 4.2* 10**23 kg
A5: 7.6* 10**35 kg

Q14 A 1000-kg rocket is fired vertically from Earth's surface Q0 with zero total mechanical energy. With what KINETIC energy was it fired?
(Mass of Earth = 6.0* 10**24 kg, Re = 6.4* 10**6 m)

A1: 6.3* 10**10 J
A2: 3.1* 10**10 J
A3: 5.2* 10**6 J
A4: 1.0* 10**9 J
A5: 9.8* 10**7 J

Q15 Calculate the WORK required to move an Earth satellite of mass m from a circular orbit of radius 3Re to one of radius 4Re.(Re = radius of the earth, Me = Mass of the Earth and G = Gravitational constant)

A1: (G*m*Me)/24*Re
A2: (G*m*Me)/12*Re
A3: (G*m*Me)/6*Re
A4: (G*m*Me)/8*Re
A5: (G*m*Me)/4*R

Q16 A 5.00-kg ball moving horizontally hits a wall with a speed of 5.00 m/s and rebounds with a speed of 2.00 m/s. Find the magnitude of the IMPULSE exerted on the ball by the wall.

A1: 35.0 N.s
A2: 25.0 N.s
A3: 10.0 N.s
A4: 15.0 N.s
A5: 40.0 N.s

Q17 As shown in FIGURE 5 a disk rotates about a vertical, frictionless axle with angular velocity 50 rad/s. A second identical disk, initially NOT rotating, drops ***Q0 onto the first disk and the two disks eventually reach an angular velocity W. Calculate W (in rad/s).

A1: 25
A2: 50
A3: 75
A4: 35
A5: 15

Q18 The only force acting on a 1.5-kg particle as it moves along the x-axis varies as shown in FIGURE 6. The particle was at rest at x = 0. Find the SPEED of the particle at x = 12 m.

A1: 20 m/s
A2: 30 m/s
A3: 45 m/s
A4: 15 m/s
A5: 0.0 m/s

Q19 One end of a 0.80 m string is fixed, the other end is attached to a 2.00-kg stone. The stone swings in a vertical circle, passing the bottom point at 10.0 m/s. The RADIAL acceleration of the stone at the top of the circle is:

A1: 86 m/s**2
A2: 125 m/s**2
A3: 100 m/s**2
A4: 39 m/s**2
A5: 0 m/s**2

Q20 As a particle moves along the x-axis it is acted on by a conservative force F(x). The potential energy U(x) of the particle as a function of x is shown in Figure 7. The FORCE F(x) is:

A1: +10 N
A2: -10 N
A3: +20 N
A4: -20 N
A5: 0.0 N

Q21 At time t, a 2.0-kg object has a position vector r = (3.5 + 1.6 t) i-2.7 j + 3.0 k, with r in meters and t in seconds. The LINEAR momentum of the object is Q0 (in kg.m/s):

A1: 3.2 i
A2: 7.0 i
A3: -5.4 i
A4: 7.0 i + 3.2 j
A5: 0.0

Q22 By exerting a horizontal force of 200 N a man pushes a box of weight 3000 N over a horizontal distance of 5 m along a level road. The WORK done by the man is:

A1: 1000 J
A2: 15000 J
A3: 1531 J
A4: 8000 J
A5: 7500 J

Q23 A certain wheel has a rotational inertia of 12 kg*m**2. Under Q0 the application of a certain CONSTANT torque, it turns through 5.0 revolutions and its an angular velocity increases from 5.0 rad/s to 6.0 rad/s. Find the value of the TORQUE.

A1: 2.1 N.m
A2: 5.7 N.m
A3: 3.3 N.m
A4: 1.1 N.m
A5: 3.6 N.m

Q24 Increasing the angular speed of a rotating body will not cause an increase in (Choose the CORRECT answer):

A1: the moment of inertia
A2: angular momentum
A3: linear speed
A4: rotational kinetic energy
A5: the frequency

Q25 A horizontal uniform beam of weight W = 200 N and length L = 6.0 m is supported by a hinge and a cable as shown in Figure 8. The system is in equilibrium. find the TENSION in the cable.

A1: 200 N
A2: 100 N
A3: 400 N
A4: 500 N
A5: 150 N

Q26 For two vectors A = 3i +2j and B = i - 3j, find (AXB)/(A.B).

A1: (+ 11/3) k
A2: (- 11/3) k
A3: (+ 7/9) k
A4: (- 7/9) k
A5: (+ 11/9) k

Q27 A 27.6-gram gold is in the form of a right circular cylinder of radius 2.50 micrometer and length L. Find L (Take the density of gold to be 19.32 g/cm**3).

A1: 7.3* 10**4 m
A2: 7.3* 10**8 m
A3: 1.2* 10**3 m
A4: 1.2* 10**5 m
A5: 6.4* 10**7 m

Q28 A gunner can hit a target 200 m away if he aims his gun at 55 degrees above the horizontal. At what OTHER ANGLE can he aim his gun and still hit the target?

A1: 35 degrees
A2: 15 degrees
A3: 45 degrees
A4: 75 degrees
A5: 60 degrees

Q29 Find the COEFFICIENT of kinetic friction for which a body of mass m = 2.0 kg will slide down a 10 degree inclined plane with constant velocity.

A1: 0.18
A2: 0.32
A3: 0.23
A4: 0.00
A5: 0.50

Q30 A stone is thrown vertically upward with a speed of 8.0 m/s. Find its ACCELERATION just before it hits the ground.

A1: 9.8 m/s**2 (downward)
A2: 9.8 m/s**2 (upward)
A3: 8.0 m/s**2 (downward)
A4: 8.0 m/s**2 (upward)
A5: 0.0 m/s**2