

1) What is the gravitational potential energy for a 2kg object that is at a height of 6000 km above the surface of the earth?

- A) 31.2 MJ (Million Joules)
- B) 64.5 MJ
- C) 118 MJ
- D) -64.5 MJ
- E) -31.2 MJ

2) What is the gravitational acceleration for a 2kg object that is at a height of 6000 km above the surface of the Earth?

- A) 9.81 m/s²
- B) 2.61 m/s²
- C) 19.6 m/s²
- D) 3.22 m/s²
- E) 11.1 m/s²

3) What is the weight of a 2kg object on Planet X? Planet X is a perfect sphere of radius 1000 km and mass 10^{23} kg.

- A) 13.3 N
- B) 19.6 N
- C) 2 N
- D) 5.22 N
- E) 31.2 N

4) A 2kg object is orbiting around a circle of radius 3m at a constant angular frequency of $\omega = 3.14$ rad/s. What is its period?

- A) 2 s
- B) 0.318 s
- C) 3.14 s
- D) 6.28 s
- E) 0.5 s

5) A 2kg object is attached to a horizontal spring of force constant $k = 200$ N/m, and is oscillating with an amplitude of 0.5m. What is its angular frequency?

- A) 0.5 rad/s
- B) 2 rad/s
- C) 10 rad/s
- D) 100 rad/s
- E) 0.1 rad/s

6) A 2kg object is attached to a horizontal spring of force constant $k = 200 \text{ N/m}$, and is oscillating with an amplitude of 0.5m. What is its maximum kinetic energy?

- A) 25 J
- B) 50 J
- C) 100 J
- D) 200 J
- E) 1 J

7) A 2kg object is attached to a horizontal spring and is oscillating according to the equation: $x(t) = (0.3 \text{ m}) \cos(3 \text{ rad/s } t)$. What is the object's maximum acceleration?

- A) 0.3 m/s^2
- B) 0.9 m/s^2
- C) 2.7 m/s^2
- D) 9.0 m/s^2
- E) 27 m/s^2

8) A 2kg object is attached to the bottom of a vertical spring of force constant $k = 800 \text{ N/m}$, and is oscillating vertically with an amplitude of 0.1 m. What is its frequency?

- A) 0.05 Hz
- B) 0.314 Hz
- C) 400 Hz
- D) 20 Hz
- E) 3.18 Hz

9) A 2kg object is attached to the bottom of a vertical spring of force constant $k = 800 \text{ N/m}$, and is oscillating vertically with an amplitude of 0.1 m. What is its maximum kinetic energy?

- A) 4 J
- B) 40 J
- C) 8 J
- D) 20 J
- E) 100 J

10) A 2kg object is attached to a simple pendulum of length 39.2 m, and is oscillating with an amplitude of 5 degrees. What is its period?

- A) 0.25 s
- B) 0.5 s
- C) 12.6 s
- D) 3.14 s
- E) 2 s

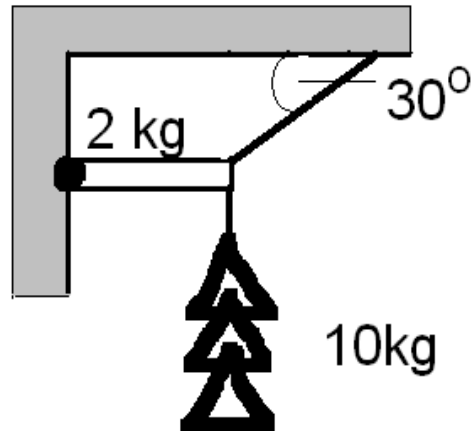
11) A 10kg projectile is fired straight up from the surface of Planet X with an initial speed of 4 km/s. Planet X is a perfect sphere of radius 1000 km and mass 10^{23} kg.

A) Calculate the projectile's initial mechanical energy.

B) Calculate the speed of the projectile when it is infinitely far away from Planet X.

C) The initial speed of 4 km/s is larger than the escape speed for this projectile. Calculate the escape speed.

12) You want to hang a holiday ornament of mass 10kg at the end of a rod that is 6m long and has 2kg mass. The rod is fixed to a wall horizontally at one end. The other end of the rod is supported by a massless string that is tied to the ceiling at 30 degree angle. See the figure below. The string is also 6m long.



A) Draw the free body diagram for the rod-ornament system.

B) Calculate the magnitude of the tension on the string.

C) Calculate the vector force exerted on the rod, by the fixture on the wall.