

Exam #1 – Practice Problems

1. A 0.2 kg ball is thrown vertically downward at 8 m/s from the top of a 10 m tall cliff. (Neglect air resistance.)

a) Find the velocity with which the ball hits the ground.

b) How long does the ball take to hit the ground from the instant it is thrown?

c) If the ball rebounds upward with a velocity of 10 m/s find the maximum height it will reach.

2. A 5 kg block sits at rest on a frictionless horizontal surface.

a) If a constant 15 N force pushes the block to the right, find the speed of the block after the force has been applied for 5 seconds.

b) Suppose that in part (a) there is a constant frictional drag force of 5 N acting on the block when pushed by the same 15 N force. Draw a carefully labeled free-body diagram of the block, and find the acceleration of the block (magnitude and direction, please).

c) Suppose a second block of mass 2 kg is placed on top of the 5 kg block in part (b) which is still being pushed by the 15 N force to the right and has the 5 N frictional drag force acting on it. Re-consider part (b) and find the net horizontal force (magnitude and direction, please) that must act on the 2 kg block in order for it to stay at rest on top of the 5 kg block. What is the origin of this force? (Hint: first consider the two blocks as one to find their acceleration)

3. A 2 kg mass attached to a vertically held spring is observed to oscillate with a period of 1.5 seconds.

a) Find the spring constant.

b) If the amplitude of the oscillation is 10 cm, find the magnitude of the maximum acceleration of the mass and state where in the oscillation of the mass this maximum acceleration occurs.

c) If the hanging mass is doubled and the amplitude is halved, find the magnitude of the maximum velocity of the new mass on the same spring and state where in the oscillation of the mass this maximum velocity occurs.

4. A 0.60 kg particle has a speed of 2.0 m/s at a point A, and a kinetic energy of 7.50 J at a point B. What are the kinetic energy of the particle at A, the speed of the particle at B, and the work done on the particle as it moves from point A to point B?