Practice Exam - Final
Physics 1401

Name:
ID#:
Section #:

Choose the best answer for each of Questions 1-18 below. Mark your answer on your scantron form using a #2 pencil.

1. A bullet is fired through a board 10.0 cm thick in such a way that the bullet's line of motion is perpendicular to the face of the board. The velocity of the bullet just before it enters the board is 400 m/s and the bullet emerges from the other side of the board with a velocity of 300 m/s. Find the magnitude of the acceleration of the bullet as it passes through the board. (Assume that the acceleration is constant.)

   a) 9.82×10^{3} m/s^2
   b) 1.75×10^{5} m/s^2
   c) 5.00×10^{2} m/s^2
   d) 6.28×10^{4} m/s^2
   e) 3.50×10^{5} m/s^2

2. You throw a baseball straight up into the air. You time the flight of the ball and find that it returns to its point of release in 3.8 s. How high is the ball (above its point of release) 2.8 s after it is released, if air resistance can be neglected?

   a) 18 m
   b) 9.2 m
   c) 22 m
   d) 14 m
   e) 5.4 m

3. A boy slides down a water slide at a swimming pool, as shown in Figure 1. When he reaches the bottom of the slide, he is 1.0 m above the water and moving horizontally, as shown in the figure. How long will it take him to hit the water after he leaves the slide? (Neglect air resistance.)

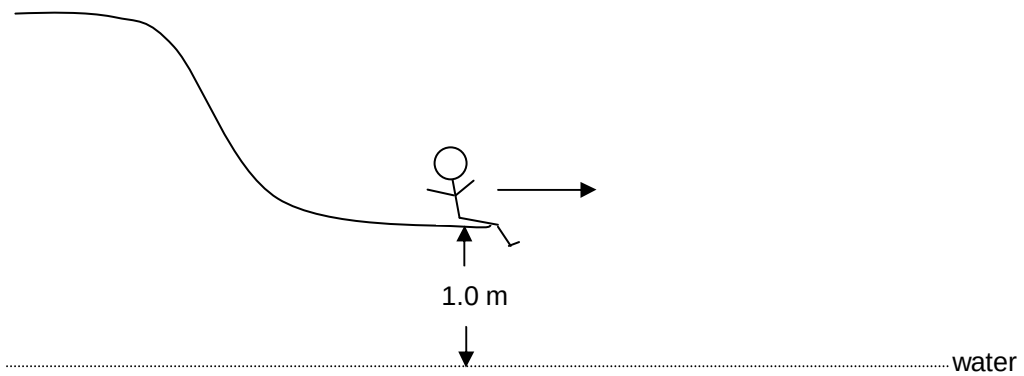

Fig. 1

   a) 0.64 s
   b) 0.45 s
   c) 2.3 s
   d) 1.4 s

e) 0.98 s

4. A 5.0-kg bucket of water is raised from a well by a rope. If the upward acceleration of the bucket is 3.0 m/s^2, find the force exerted on the bucket by the rope.

a) 49 N
b) 15 N
c) 12 N
d) 64 N
e) –34 N

5. A block of mass 2.00 kg is sliding down the inclined plane shown in Figure 2. The inclined surface makes an angle of 22.0° with the horizontal, as shown in the figure. If the block slides down the plane with constant velocity, what must be the force of kinetic friction, in newtons?

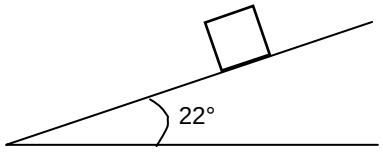

Fig. 2

a) 14.7 N
b) 0.00 N
c) 7.34 N
d) 19.6 N
e) 10.5 N

6. A vehicle is attempting to make a turn in a circular radius of 15 m on a flat road. What is the minimum required coefficient of static friction between the tires and the road in order for the vehicle to make the turn at a constant speed of 7.0 m/s without skidding?

a) 0.75
b) 0.50
c) 0.67
d) 0.25
e) 0.33

7. Tarzan is swinging from one tree to another deep in the middle of a jungle. He starts out at rest at a height of 7.0 m above the ground. Neglecting all friction forces, including air resistance, what will Tarzan's speed be at his lowest point, if he is just above the ground (i.e., essentially *at ground level*) at this lowest point?

a) 8.3 m/s
b) 3.2 m/s
c) 12 m/s
d) 6.4 m/s
e) 15 m/s

8. A 2.30-kg block slides on a horizontal, frictionless surface until it encounters a spring with spring constant k = 750 N/m. If the speed of the block just before it hits the spring is 1.10 m/s, what will be the maximum distance that the spring will be compressed? (Ignore air resistance.)

    a) 5.42 cm
    b) 2.70 cm
    c) 7.25 cm
    d) 1.09 cm
    e) 6.09 cm

9. Two spheres undergo a completely inelastic head-on collision. The first sphere is moving with a velocity of –9.0 m/s immediately before the collision. The second sphere, whose mass is four times that of the first sphere, is initially motionless. What will be the velocity of the second sphere immediately after the collision?

    a) –0.56 m/s
    b) 1.3 m/s
    c) –1.8 m/s
    d) –2.7 m/s
    e) 0.85 m/s

10. If the 0.70-kg block in Figure 3 is released from rest, what speed will it have just before it hits the floor if there is no friction at the wheel's axis? (Use conservation of energy and consider both the translational and rotational kinetic energy. Treat the wheel as a solid uniform disk.)

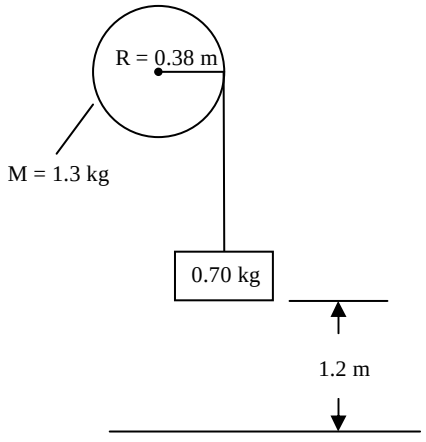

Fig. 3

    a) 5.4 m/s
    b) 2.8 m/s
    c) 7.2 m/s
    d) 3.5 m/s
    e) 2.3 m/s

11. The tub of a washer goes into its spin-dry cycle, starting from rest and reaching an angular velocity of 31.4 rad/s in 8.00 s. At this point, the person doing the laundry opens the lid, and a safety switch turns off the washer. The tub slows to rest in 12.0 s. Through what angle (in radians) does the tub turn during this 20.0-s interval? Assume constant angular acceleration while it is starting and stopping.

    a) 314 rad
    b) 628 rad
    c) 126 rad
    d) 188 rad
    e) 257 rad

12. A merry-go-round of mass 25 kg and radius 2.0 m rotates at the rate of 1.3 rad/s with an 80-kg man standing at a point 2.0 m from the axis of rotation. What is the new angular velocity, in rad/s, when the man walks to a point 1.0 m from the center? Assume that there are no external forces exerting a torque on the system composed of the merry-go-round plus the man. Treat the merry-go-round as a solid disk.

    a) 1.3 rad/s
    b) 3.7 rad/s
    c) 2.6 rad/s
    d) 4.2 rad/s
    e) 5.8 rad/s

13. A uniform 10.0-N picture frame is supported as shown in Figure 4. Find the magnitude of the force F (applied at the point P) required to hold the frame in equilibrium in the position shown.

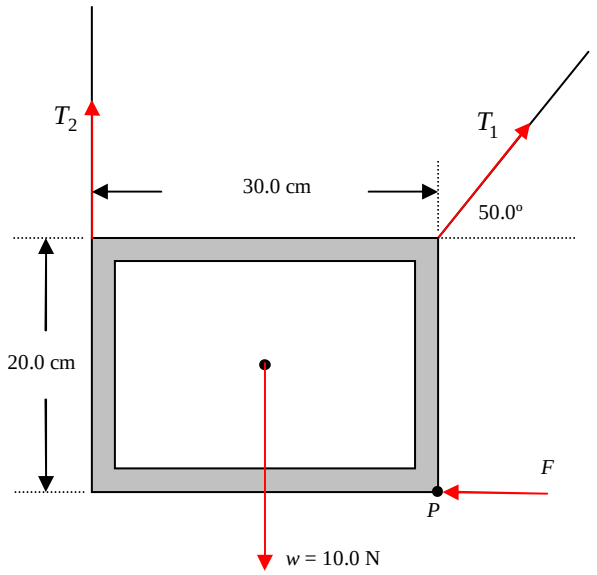

Fig. 4

a) 9.52 N
b) 10.0 N
c) 8.48 N
d) 2.67 N
e) 13.4 N

14. A communications satellite with a mass of 350 kg is in a circular orbit about the Earth. The radius of the orbit is 35,000 km as measured from the center of the Earth. What is the magnitude of the gravitational force exerted on the satellite by the Earth?

a) 350 N
b) 284 N
c) 592 N
d) 187 N
e) 114 N

15. A glider on an air track is connected by a spring to a point at one end of the track. When the glider is set in motion, it undergoes simple harmonic motion with a period of 0.84 s. What is the spring constant of the spring if the mass of the glider is measured to be 0.22 kg?

a) 6.0 N/m
b) 10 N/m
c) 12 N/m
d) 16 N/m
e) 20 N/m

16. You drive toward a railroad crossing at 15.0 m/s. As you approach the crossing, a warning bell sounds to let you know that a train is approaching. If the frequency of the bell is 1.000 kHz, what frequency do you hear?

    a) 1.04 kHz
    b) 0.956 kHz
    c) 1.00 kHz
    d) 2.00 kHz
    e) 1.15 kHz

17. What mass of water at 25.0 °C must be allowed to come to thermal equilibrium with a 3.00-kg gold bar at 100 °C in order to lower the temperature of the bar to 50.0 °C? $(c_{gold} = 129 \frac{\text{J}}{\text{kg} \cdot \text{K}})$

    a) 0.185 kg
    b) 0.222 kg
    c) 0.513 kg
    d) 0.427 kg
    e) 0.823 kg

18. A laboratory vacuum pump can reduce the pressure in a certain chamber to 1.0×10^{-7} Pa. If the volume of the chamber is $0.500\ \text{m}^3$ and the temperature is 27°C, how many molecules are left inside the chamber? (Treat the air in the chamber as an ideal gas.)

    a) 1.2×10^{13}
    b) 2.4×10^{13}
    c) 1.2×10^{12}
    d) 2.4×10^{12}
    e) 6.2×10^{13}