Review of chapters 6 – 9. Fall 2008.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

1) It is possible to spin a bucket of water in a vertical circle and have none of the water spill when the bucket is upside down. How would you explain this to members of your family?

2) Can an object be in equilibrium if it is moving? Explain. 2) _____________

3) A popular carnival ride has passengers stand with their backs against the inside wall of a cylinder. As the cylinder begins to spin, the passengers feel as if they are being pushed against the wall. Explain. 3) _____________

4) Your car is stuck on an icy side street. Some students on their way to class see your predicament and help out by sitting on the trunk of your car to increase its traction. Why does this help? 4) _____________

5) When you push a 1.80–kg book resting on a tabletop, it takes 2.25 N to start the book sliding. Once it is sliding, however, it takes only 1.50 N to keep the book moving with constant speed. What are the coefficients of static and kinetic friction between the book and the tabletop? 5) _____________

6) To move a large crate across a rough floor, you push on it with a force *F* at an angle of 21° below the horizontal, as shown in **Figure 6–21**. Find the force necessary to start the crate moving, given that the mass of the crate is 32 kg and the coefficient of static friction between the crate and the floor is 0.57. 6) _____________

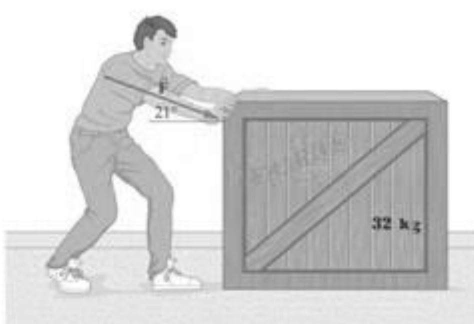

Figure 6–21

7) Pulling up on a rope, you lift a 4.25–kg bucket of water from a well with an acceleration of 1.80 m/s^2. What is the tension in the rope? 7) _____________

8) A 110–kg box is loaded into the trunk of a car. If the height of the car's bumper decreases by 13 cm, what is the force constant of its rear suspension? 8) _____________

9) A backpack full of books weighing 52.0 N rests on a table in a physics laboratory classroom. A spring with a force constant of 150 N/m is attached to the backpack and pulled horizontally, as indicated in **Figure 6–22**. **(a)** If the spring is pulled until it stretches 2.00 cm and the pack remains at rest, what is the force of friction exerted on the backpack by the table? **(b)** Does your answer to part (a) change if the mass of the backpack is doubled? Explain.

9) ____________

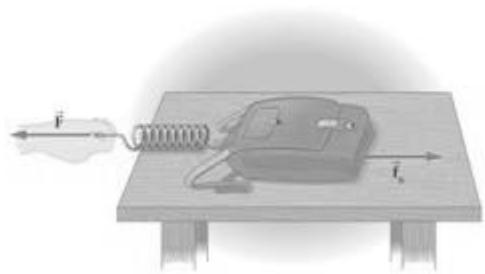

Figure 6–22

10) You want to nail a 1.6–kg board onto the wall of a barn. To position the board before nailing, you push it against the wall with a horizontal force $\vec{F}$ to keep it from sliding to the ground. (**Figure 6–30**) **(a)** If the coefficient of static friction between the board and the wall is 0.79, what is the least force you can apply and still hold the board in place? **(b)** What happens to the force of static friction if you push against the wall with a force greater than that found in part (a)?

10) ____________

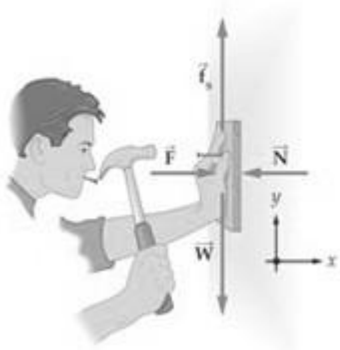

Figure 6–30

11) A 3.50–kg block on a smooth tabletop is attached by a string to a hanging block of mass 2.80 kg, as shown in **Figure 6–34**. The blocks are released from rest and allowed to move freely. **(a)** Is the tension in the string greater than, less than, or equal to the weight of the hanging mass? Find **(b)** the acceleration of the blocks and **(c)** the tension in the string. 11) ____________

Figure 6–34

12) When you take your 1200–kg car out for a spin, you go around a corner of radius 57 m with a speed of 15m/s. The coefficient of static friction between the car and the road is 0.88. Assuming your car doesn't skid, what is the force exerted on it by static friction? 12) ____________

13) You swing a 4.5–kg bucket of water in a vertical circle of radius 1.1 m. **(a)** What speed must the bucket have if it is to complete the circle without spilling any water? **(b)** How does your answer depend on the mass of the bucket? 13) ____________

14) A friend makes the statement, "Only the total force acting on an object can do work." Is this statement true or false? If it is true, state why; if it is false, give a counter example. 14) ____________

15) A friend makes the statement, "A force that is always perpendicular to the velocity of a particle does no work on the particle." Is this statement true or false? If it is true, state why; if it is false, give a counter example. 15) ____________

16) The net work done on a certain object is zero. What can you say about its speed? 16) ____________

17) The coefficient of kinetic friction between a suitcase and the floor is 0.26. If the suitcase has a mass of 70.0 kg, how far can it be pushed across the level floor with 640 J of work? 17) ____________

18) A child pulls a friend in a little red wagon with constant speed. If the child pulls with a force of 16 N for 10.0 m, and the handle of the wagon is inclined at an angle of 25° above the horizontal, how much work does the child do on the wagon? 18) ____________

19) When *Skylab* reentered the Earth's atmosphere on July 11, 1979, it broke into a myriad of pieces. One of the largest fragments was a 1770-kg lead-lined film vault, and it landed with an estimated speed of 120 m/s. What was the kinetic energy of the film vault when it landed? 19) ____________

20) A 65-kg bicyclist rides his 8.8-kg bicycle with a speed of 14 m/s. **(a)** How much work must be done by the brakes to bring the bike and rider to a stop? **(b)** How far does the bicycle travel if it takes 4.0 s to come to rest? **(c)** What is the magnitude of the braking force? 20) ____________

21) A kayaker paddles with a power output of 50.0 W to maintain a steady speed of 1.50 m/s. **(a)** Calculate the resistive force exerted by the water on the kayak. **(b)** If the kayaker doubles her power output, and the resistive force due to the water remains the same, by what factor does the kayaker''s speed change? 21) ____________

22) As an Acapulco cliff diver drops to the water from a height of 46 m, his gravitational potential energy decreases by 25,000 J. What is the diver's weight in newtons? 22) ____________

23) A player passes a 0.600-kg basketball downcourt for a fast break. The ball leaves the player's hands with a speed of 8.30 m/s and slows down to 7.10 m/s at its highest point. **(a)** Ignoring air resistance, how high above the release point is the ball when it is at its maximum height? **(b)** How would doubling the ball's mass affect the result in part (a)? Explain. 23) ____________

24) Suppose the pendulum bob in **Figure 8-22** has a mass of 0.33 kg and is moving to the right at point B with a speed of 2.4 m/s. Air resistance is negligible. **(a)** What is the change in the system's gravitational potential energy when the bob reaches point A? **(b)** What is the speed of the bob at point A? **(c)** If the mass of the bob is increased, does your answer to part (a) increase, decrease, or stay the same? Explain. **(d)** If the mass of the bob is increased, does your answer to part (b) increase, decrease, or stay the same? Explain. 24) ____________

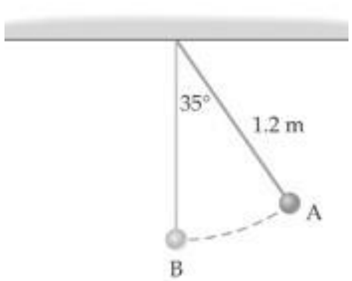

Figure 8-22

25) A 42.0–kg seal at an amusement park slides from rest down a ramp into the pool below. The top of the ramp is 1.75 m higher than the surface of the water and the ramp is inclined at an angle of 35.0° above the horizontal. If the seal reaches the water with a speed of 4.40 m/s, what is **(a)** the work done by kinetic friction and **(b)** the coefficient of kinetic friction between the seal and the ramp?

25) ____________

26) If you drop your keys, their momentum increases as they fall. Why is the momentum of the keys not conserved? Does this mean that the momentum of the universe increases as the keys fall? Explain.

26) ____________

27) An object at rest on a frictionless surface is struck by a second object. Is it possible for both objects to be at rest after the collision? Explain.

27) ____________

28) A 0.150–kg baseball is dropped from rest. If the magnitude of the baseball's momentum is 0.780 kg•m/s just before it lands on the ground, from what height was it dropped?

28) ____________

29) In a typical golf swing, the club is in contact with the ball for about 0.0010 s. If the 45–g ball acquires a speed of 67 m/s, estimate the magnitude of the force exerted by the club on the ball.

29) ____________

30) Two ice skaters stand at rest in the center of an ice rink. When they push off against one another the 45–kg skater acquires a speed of 0.62 m/s. If the speed of the other skater is 0.89 m/s, what is this skater's mass?

30) ____________

31) Two 78.0–kg hockey players skating at 5.25 m/s collide and stick together. If the angle between their initial directions was 115°, what is their speed after the collision?

31) ____________

32) The collision between a hammer and a nail can be considered to be approximately elastic. Calculate the kinetic energy acquired by a 12–g nail when it is struck by a 550–g hammer moving with an initial speed of 4.5 m/s.

32) ____________

1) This is possible because if you spin the bucket rapidly enough, the force needed to produce circular motion is grater than the force of gravity. In this case, a force in addition to gravity must act at the top of the circle to keep the water moving in its circular path. This force is provided by the bottom of the bucket. Therefore, the bottom of the bucket pushes against the water, and the water pushes back against the bucket – this keeps the water from falling out of the bucket.
2) Yes. Equilibrium simply means that the net force acting on an object is zero. Therefore, an object moving with constant velocity can be considered to be in equilibrium. In a frame of reference moving with the same velocity, the object would be at rest and would have zero net force acting on it – which is the way we usually think of equilibrium.
3) Since the passengers are moving in a circular path a centripetal force must be exerted on them. This force, which is radially inward, is supplied by the wall of the cylinder.
4) This helps because the students sitting on the trunk increases the normal force between your tires and the road. Since the force of friction is proportional to the normal force, this increases the frictional force enough (one hopes) to allow your car to move.
5) 0.127; 0.0849
6) 0.25 kN
7) 49.3 N
8) 8.3 kN/m
9) (a) 3.0 N; (b) No, the answer to (a) doesn't depend on the mass of the backpack, it only depends upon the spring force and the fact that the backpack remains at rest.
10) (a) 20 N; (b) The force of static friction would remain the same if you push with a greater force because it must exactly balance the weight.
11) (a) less; (b) 4.36 m/s^2; (c) 15.3 N
12) 4.7 kN
13) (a)3.3 m/s; (b) independent of the mass of the bucket
14) False. Any force acting on an object can do work. The work done by different forces may add to produce a greater net work, or they may cancel to some extent. It follows that the net work done on an object can be thought of in the following two equivalent ways: (i) the sum of the works done by each individual force; or (ii) the work done by the net force.
15) True. To do work on an object a force must have a nonzero component along its direction of motion.
16) If the net work done on an object is zero, it follows that its change in kinetic energy is also zero. Therefore, its speed remains the same.
17) 3.6 m
18) 150 J
19) 12.7 MJ
20) (a) –7.2 kJ; (b) 28 m; (c) 260 N
21) (a) 3.33 N; (b) double the speed
22) 540 N
23) (a) 0.942 m; (b) The height change is independent of the mass, so doubling the ball's mass would cause no change to (a).
24) (a) 0.70 J; (b) 1.2 m/s; (c) If the mass of the bob is increased the answer to part (a) will increase. The change in gravitational potential energy depends linearly on the mass. (d) If the mass of the bob is increased the answer to part (b) will stay the same. Although the change in potential energy will increase, the change kinetic energy will also increase.
25) (a) –314 J; (b) 0.305
26) The momentum of the keys increases as they fall because a net force acts on them. The momentum of the universe is unchanged because an equal and opposite force acts on the Earth.

27) No. The fact that the initial momentum of the system is nonzero means that the final momentum must also be nonzero. Thus, it is not possible for both objects to be at rest after the collision.
28) 1.38 m
29) 3000 N
30) 31 kg
31) 2.82 m/s
32) 0.46 J