Conceptual Physics: Fall, 14'
Mid-Term Review

Chapters 1 – 12

Unit One – Speed, Velocity

1. Why is physics the most basic science?
2. Express the following numbers in scientific notation:
   a. 86, 000,000,000 _____
   b. 0.00058 _____
3. State the number of significant digits in each measurement:
   a. 300, 000, 000 m/s _____
   b. 25.030 °C _____
   c. 1.00 J _____
4. What is the difference between speed and velocity?
5. What is acceleration? And how does it relate to constant velocity?
6. What is the meaning of free fall?
7. Why is it that an object can accelerate while traveling at a constant speed, but not at a constant velocity?
8. a. When a ball is thrown straight up, by how much does the speed decrease each second?
   b. After the ball reaches the top and begins its return back down, how much does it speed increase each second?
   c. Compare the times going up and coming down
9. What is the difference between a scalar and a vector?
10. Suppose that an airplane normally flying at 80 km/hr encounters wind at a right angle to its forward motion---a cross wind. Will the airplane fly faster or slower than 80 km/hr?
11. What is projectile motion?
12. What is a satellite?
13. In the absence of air resistance, why does the horizontal component of velocity for a projectile remain constant while the vertical component changes?
14. Neglecting air resistance, if you throw a ball straight up with a speed of 20 m/s, how fast will it be moving when you catch it?
15. A jumbo jet taxiing down the runway receives word that it must return to the gate to pick up an important passenger who was late to his connecting flight. The jet travels at 55.0 m/s when the pilot receives the message. What is the acceleration of the plane if it takes 6.00 s to bring the plane to a halt?

16. While driving his sports car at 25.0 m/s down a four lane highway, Mr. Physics comes up behind a slow moving dump truck driven by an ex-student, so he decides to pass it in the left lane. If Mr. Physics can accelerate at 6.00 m/s^2, how long will it take for him to reach a speed of 35.0 m/s?

18. Billy, a mountain goat, is rock climbing on his favorite slope one sunny spring morning when a rock comes hurling toward him from a ledge 55.0 m above. Billy ducks and avoids injury. How fast is the rock traveling when it passes Billy?

Unit 2 – Chapters 4 – 6

1. What is a
    a. force
    b. Friction
    c. Inertia
    d. Pressure
    e. Weight
    f. Mass
    g. Net force
    h. Normal force
    i. Air resistance
    j. Pressure

2. State Newton's first law of motion. (The law of inertia.)

3. Does a 2 kg iron block have twice as much inertia as a 1 kg block of iron? Twice as much mass? Twice as much weight when weighed in the same location?

4. What is the net force, or resultant force acting on an object in equilibrium?

5. Forces of 10 N and 15 N in the same direction act on an object. What is the net force on the object?

6. If forces of 10 N and 15 N act in opposite directions on an object, what is the net force?

7. If a car can accelerate at 2 m/s^2, what acceleration can it attain if it is towing another car of equal mass?

8. Suppose a high flying jet cruises with a constant velocity when the thrust from its engines is a constant 80000 N. What is the acceleration of the jet? What is the force of air resistance acting on the jet?

9. State Newton's 2^{nd} law of motion.

10. Suppose a cart is being moved by a certain net force. If the net force is doubled, by how much does the cart's acceleration change?

11. Distinguish between force and pressure.

12. Why do a coin and a feather in a vacuum tube fall with the same acceleration?

13. Does the moon also pull on the Earth? If so, which is stronger?

14. When the hammer exerts a force on a nail, how does the amount of force compare with that of the nail on the hammer?

15. If the action is a bowstring acting on an arrow, identify the reaction force.

16. If action equals reaction, why isn't Earth pulled into orbit around a communication satellite?

17. State Newton's third law of motion.

18. Identify the action or reaction in the following: A) Action: You pull on a wagon. Reaction: ? B) Action: ? Reaction: You pull on the Earth. C) Action: A bat pushes a ball. Reaction: ? D) Make up your own.

19. What is the relationship between force and acceleration? Mass and acceleration?

20. You have a bowling ball and a tennis ball. Which weighs more? Which has more force acting on it? If you drop both at the same time, and there is no air resistance, which hits the ground first? Explain.

21. A plane is flying at a constant velocity with 40000 N of air resistance. How much thrust do the engines provide? A crate falls through the air at a constant velocity. The crate weighs 850 N, how much air resistance is on the crate? A rocket is flying through space at a constant velocity. There is no air resistance. How much force is pushing the rocket?

Unit Three – Chapters 7-8

1. Know the definitions and units of the following:
    a. Work
    b. Power
    c. PE
    d. KE
    e. Law of Conservation of Energy
    f. Momentum
    g. Impulse

2. Know the Cannon – Cannonball System in Ch 7
3. ALWAYS REMEMBER WORK = ENERGY
    Give an example where you have done work and it has become a form of energy.
4. Increasing the time of an impulse increases or decreases the force?

5. In a car crash, why is it advantageous for an occupant to extend the time during which the collision takes place?

6. Distinguish between an elastic and an inelastic collision.

7. Auto companies frequently test the safety of automobiles by putting them through crash test to observe the integrity of the passenger compartment. If a 1500 kg car is sent toward a cement wall with a speed of 14 m/s and the impact brings it to a stop in 8.00×10^{-1} s, with what average force is it brought to rest?

8. Jamal is at the State Fair of Texas playing some games. At one booth he throws a 0.75kg ball forward with a velocity of 25.0 m/s in order to hit a 0.20 kg bottle sitting on a shelf, and when he makes contact the bottle goes flying forward at 31.0 m/s. What is the velocity of the ball after it hits the bottle?

9. Anthony and Sissy are participating in the "Roll-a-Roma" roller-skating dance championships. While 85.0 kg Anthony roller-skates backwards at 3.0 m/s, 65.0 kg Sissy jumps into his arms with a velocity of 5.0 m/s in the same direction. How fast does the pair roll backwards together?

10. Kelli, who has a mass of 50.0 kg, is driving at 23.0 m/s when she suddenly has to slam on the brakes to avoid hitting a dog crossing the road. She is wearing her seatbelt, which brings her body to a stop in 0.500 s. A) What average force did the seatbelt exert on her? B) If she had not been wearing a seatbelt, and the windshield had stopped her head in 1.5×10^{-3} s, what average force would the windshield have exerted on her?

11. Alissa does 4.2 J of work to lower the window shade in her bedroom a distance of 0.75 m. How much force must Alissa exert on the window shade? If it takes her 0.6 seconds to lower the shade, how much power does she produce?

12. A 425 kg pig is standing at the top of a muddy hill on a rainy day. The hill is 100.0 m long with a vertical drop of 25.0 m. The pig slips and begins to slide down the hill. What is the pig's speed at the bottom of the hill?

13. Blackie, a cat whose mass is 4.75 kg, is napping on top of the refrigerator when he rolls over and falls. Blackie has a KE of 85.5 J just before he lands on his feet on the floor. How tall is the refrigerator?

14. A boulder is raised above the ground so that its PE relative to the ground is 200 J. Then it is dropped. What is its KE just before it hits the ground?

15. a. If you do 100 J of work to elevate a bucket of water, what is its gravitational potential energy relative to its starting position?

    b. What would be the gravitational potential energy be if the bucket were raised twice as high?

16. Does an object with momentum always have energy? Does an object with energy always have momentum? Explain

KNOW HOW TO USE THESE EQUATIONS!

Motion

$v = d/t$ $a = \Delta v/t$ $a = (v_f - v_i)/t$ $d = \frac{1}{2} gt^2$ $v = gt$

$\Delta d = v_o \Delta t + \frac{1}{2} g \Delta t^2$ $v_f^2 = v_o^2 + 2g\Delta d$ $v_f = v_o + gt$ $t = \sqrt{2d/g}$

Force

$F = ma$ $w = mg$ $P = F/A$ (Area) $F_f = \mu F_N$

Momentum

$p = mv$ $j = Ft$ $Ft = \Delta mv$

$m_1v_1 + m_2v_2 = m_1v_{1f} + m_2v_{2f}$ $m_1v_1 + m_2v_2 = (m_1 + m_2)\, v_f$

Energy

$W = Fd$ $P = W/t$ $PE = mgh$ $KE = \frac{1}{2} mv^2$ $\Delta PE = \Delta KE$

$Fd = mgh$ $Fd = \frac{1}{2} mv^2$ $mgh + \frac{1}{2} mv^2 = mgh + \frac{1}{2} mv^2$