

## Midterm Review Sheet – Problems

- What is the acceleration of a car if its velocity changes from 24 m/s to 0 m/s in 5 seconds?  
*Answer:  $-4.8 \text{ m/s}^2$* 
  - What force is needed to cause this acceleration if the car has a mass of 1200 kg?  
*Answer:  $-5760 \text{ N}$*
- What is the displacement of a plane that is uniformly accelerated from 66 m/s to 88 m/s in 12 seconds?  
*Answer:  $924 \text{ m}$*
- A bag is dropped from a hovering helicopter. What is the bag's velocity and displacement 2 seconds later?  
*Answer:  $v = -19.6 \text{ m/s}$   
 $y = -19.6 \text{ m}$*
- A GPS receiver told you that your home was 15 km at a direction of  $40^\circ$  north of west, but the only path led directly north. If you took that path and walked 10.0 km, how far and in what direction would you then have to walk to reach your home?  
*Answer:  $11.2 \text{ km west}$*
- A stone is thrown horizontally at 15 m/s from the top of a cliff 44 m high. How far from the base of the cliff does the stone land and how fast is it moving just before it hits the ground?  
*Answer:  $x = 45.0 \text{ m}$   
 $v = 33 \text{ m/s at } 297^\circ$*
- A 62-kg person on skis produces a 250 N horizontal force with her poles. The coefficient of kinetic friction between the skis and the snow is 0.15. How fast is the skier going 5.0 seconds after starting from rest?  
*Answer:  $13 \text{ m/s}$*
- A 4500-kg helicopter accelerates upward at  $2.0 \text{ m/s}^2$ . What lift force is exerted on the propellers by the air?  
*Answer:  $5.31 \times 10^4 \text{ N}$*
- A sled of mass 50.0 kg is pulled along a flat, snow-covered ground with a coefficient of kinetic friction of 0.10. What does the sled weigh?  
*Answer:  $490 \text{ N}$* 
  - What applied force is required to accelerate the sled at  $3.0 \text{ m/s}^2$ .  
*Answer:  $199 \text{ N}$*
- A 2200-kg SUV traveling at 26 m/s can be stopped in 21 seconds by gently applying the brakes and in .22 seconds if it hits a concrete wall. What force is exerted in both cases and how much larger is the force exerted by the concrete wall?  
*Answer:  $-2723 \text{ N}$   
 $95.5 \text{ x larger}$*
- Marble A with a mass of 5-grams moves at a speed of 20.0 cm/s. It collides with marble B, mass of 10-grams, moving at 10.0 cm/s in the same direction. After the collision, marble A bounces off with a speed of 8.0 cm/s. What is the speed of marble B after the collision?  
*Answer:  $0.16 \text{ m/s}$*
- A 105-gram hockey puck is sliding across the ice. A player exerts a constant 4.5 Newton force over a distance of 0.15 m.
  - How much work is done?  
*Answer:  $0.68 \text{ J}$*
  - What is the change in energy? What type of energy does it become?  
*Answer:  $0.68 \text{ J}$*
  - If the puck was initially moving at 2 m/s, what is its final velocity?  
*Answer:  $4.1 \text{ m.s}$*

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12. In a carnival ride, the passengers travel at constant speed in a circle of radius 5.0 m. They make one complete circle in 4.0 sec. What is their acceleration? *Answer: 12.3 m/s<sup>2</sup>*
13. An elevator is lifted 9.0 meters by a force of  $1.20 \times 10^4$  N in 15.0 seconds. What is the power of the motor? *Answer: 7200 W*
14. In an accident on a slippery road, a compact car with mass of 575-kg, moving at 15 m/s, smashes into the rear end of a car with mass of 1575-kg moving at 5.0 m/s in the same direction. What is the final velocity if the wrecked cars lock together? *Answer: 7.7 m/s*  
a. How much kinetic energy was lost in the collision? *Answer:  $2.1 \times 10^4$  J*
15. A small plastic box with a mass of 0.30 kg revolves uniformly in a circle on a horizontal, frictionless surface. The box is attached by a cord 0.140 m long to a pin set in the surface at the middle of the circle. If the box moves with a velocity of 1.8 m/s, what is the force exerted on the box by the cord? *Answer: 0.69 N*
16. A 2150 kg satellite used in a cellular telephone network is in a circular orbit at a height of 780 km above the Earth's surface. What is the gravitational force on the satellite? *Answer:  $1.2 \times 10^{11}$  N*