**FPS – Unit 3 Review – Chapter 12**

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| ***Conceptual Understanding*** |
| 1. What is a force? What is it measured in? 2. Define the units that comprise the “Newton”. 3. How do we represent forces? How do you know it is a vector? 4. Define balanced and unbalanced forces. 5. What is the net force and what does it tell you about the motion? 6. What is friction? 7. List and define the 4 types of friction. 8. Which type of friction is the smallest force? 9. How does gravity act on objects? 10. Explain terminal velocity. Is it a balanced or unbalanced force? 11. Explain projectile motion. 12. What are the four common forces we consider on a free-body diagram? Define. 13. Why do we call free-body diagrams “free-body”? 14. What does a free-body diagram look like for: (a) peak of path (b) free-fall (c) coasting (d) at rest with no applied force (e) car at constant velocity (f) squirrel at terminal velocity (g) rightward acceleration. 15. Define Newton’s 3 Laws of Motion. 16. How is inertia related to mass? 17. Give the formula for Newton’s second law. 18. Give an example of an action-reaction pair. 19. How are weight and mass different? 20. What is momentum and how do we calculate it? |

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| ***Applying Concepts*** |
| 1. Two teams are playing tug of war. The rope is perfectly still. Describe the net force and what type of force is occuring. 2. You are ice skating, and then you go bowling. What types of friction are happening? Which scenario(s) has LESS friction? 3. You then go skydiving. What forces are acting on you? What happens when you reach constant velocity during your fall? 4. A projectile is shot from a cannon. What type of path does it follow? 5. You release a cannonball as a projectile from a cannon and then drop one at the same height at exactly the same moment. Which will hit the ground first? Why? 6. Three dogs pull a sled eastward with 5 newtons of force each. What is the net force? 7. You are pulling a toy away from your baby sister. She pulls with 0.5 newtons of force to the left and you pull with 6 newtons of force to the right. What is the net force? 8. How will your mass change on the moon? How about your weight? 9. Which has more inertia: you or the Shaker Heights High School building? Why? 10. Two birds with the same mass are flying, the first at 2 m/s the second at 10 m/s. Which has more momentum? Why? 11. An enormous truck is stationary while a tiny insect travels at 1 m/s. Which has more momentum? Why? 12. When you take your socks out of the dryer, two of them seem stuck together. Which of the universal forces are acting here? 13. A steel ball and a wooden ball are dropped from the same height same time. Which will reach terminal velocity first? |

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| ***Graphical and Mathematical Problems*** |
| 1. A penguin slides on his stomach down an icy hill. Ignore frictional forces. Draw the free-body diagram. 2. The penguin leaps out of the water. Draw the free-body diagram of the penguin the moment it is in the apex of its jump. (Not touching any other surfaces.) 3. Draw a free-body diagram for an object at **terminal velocity** and another for an object at **rest on the ground**. 4. Draw a free-body diagram for a car accelerating to the left. Gravity pulls with a force of 200 N and the normal  forces of the road push with 200 N as well. The car applies a force of 100 N to the right, while the rolling friction pushes back with 75 N. Label all the forces and find the net force’s magnitude and direction. 5. An 11 kg bowling ball requires what force to accelerate down an alleyway at a rate of 4 m/s2? 6. What is the mass of a free-falling rock if it produces a force of 247 N and falls at 9.8 m/s2? 7. What is the acceleration of a truck that has a mass of 2,800 kg and produces a force of 14,000 N? 8. How fast will your car accelerate if it has a mass of 2000 kg and produces a force of 5000 N? 9. What net force is required to accelerate a car at a rate of 2 m/s2? 10. What is the weight of a 56 kg orangutan on Neptune (the acceleration due to gravity on Neptune is 11.28 m/s2)? 11. What is the weight of an 80 kg man on the moon (1.6 m/s2 is the acceleration due to gravity on the moon). 12. What is the mass of an 80 kg man on the moon? 13. What is the momentum of a 12,000 kg yacht parked stationary at the dock? 14. What is the momentum of a 0.02kg insect travelling at 30 m/s? |