Physics 100 Name: \_\_**answers**

**Answers to** Newton’s Laws Textbook Questions

Use your textbook to answer these questions. Each question is preceded by a prompt telling you where to find helpful information.

**Glossary**

1. Define “force.”

**A push or a pull; any influence that tends to accelerate an object**

**Section 4.1**

2. The textbook’s author talks about what happens when a force is applied to an object. What does he mean when he says “the acceleration produced is *directly proportional* to the net force?”

**Simple answer: increasing force causes an increase in acceleration.**

**Better answer: If you double force, you double acceleration. If you triple force, you triple acceleration. In other words, increasing force causes the same type of increase in acceleration.**

**Section 4.2**

3. What does the textbook’s author mean when he says “the acceleration produced is *inversely proportional* to the mass?”

**Simple answer: increasing mass causes a decrease in acceleration.**

**Better answer: If you double mass, acceleration is cut in half. If you triple mass, acceleration is cut to one third…**

**Section 4.5**

4. Friction is a force. In which direction does friction always act?

**Friction always acts in a direction opposite to the direction of motion.**

5. What causes friction?

**It’s caused (in part) by the bumpiness of surfaces. When surfaces rub past one another, their bumps get stuck on one another.**

6. What is friction called when an object is rubbing against air?

**Air resistance**

**Section 4.5, “questions” on p.43**

7. In which of the following situations is friction actually affecting the outcome? Circle the letter. **All except C.**

1. A box is sitting a level floor. You are pushing the box sideways, but your force is too small to move the box.
2. A box is sitting a level floor. You are pushing the box sideways, causing the box to slide across the floor.
3. ~~A box is sitting motionless on a level floor. You are not touching the box.~~
4. A box is sitting motionless on a tilted floor. You are not touching the box.

8. In light of the previous question, in what types of situations does friction affect the outcome?

**Friction comes into play when something is sliding or “tending to slide.” The box that is motionless on the tilted floor is “tending” to slide, but it can’t slide, because friction is holding it in place. The untouched box on the non-tilted floor has no tendency to slide.**

**Section 4.7**

9. Weight is the force of gravity, and weight depends on mass. This means that gravity pulls more massive objects with greater force. If massive objects are pulled downward by more force, why does the acceleration of an object during free-fall not depend on the object’s mass? Why don’t more massive objects fall faster? Explain.

**More massive objects have more inertia, so even though gravity pulls them with more force, they don’t fall any faster than smaller objects. *[Note that this only applies to free-fall. In real air, heavier objects do generally fall faster.]***

**Section 4.8** *You will not be able to “find the answer” to this one. If you don’t already know the answer, read all of section 4.8 should give you the necessary understanding.*

10. Suppose you have a hollow plastic ball. Describe two fundamentally different ways to increase the ball’s terminal velocity.

**1) increase the ball’s mass without changing its size**

**2) decrease the ball’s size without changing its mass**

**3) drop the ball in air that is less dense (e.g. 24 miles above the earth)**

11. Explain why each of your methods works.

**1) This increases the force pulling the ball downward (weight)**

**2) This decreases the force pushing the ball upward (air resistance)**

**3) When the air is less dense, air resistance is reduced**

**Section 5.3**

12. Identify an action force and a reaction force in each of the situations below:

* A car drives forward **Car pushes road backward; road pushes car forward**
* A rocket blasts forward **Rocket pushes its exhaust downward; exhaust pushes rock upward**
* A ball is in free-fall, falling to the Earth. **Earth pulls ball downward; ball pulls Earth upward**

**Section 5.4**

13. When a bullet is shot from a gun, the bullet pushes the gun in one direction, and the gun pushes the bullet in the opposite direction. Newton’s 3rd Law says that actions and reactions are equal and opposite. If the bullet moves a lot, and the gun moves a little, how are the action and reaction equal??? Explain.

**The bullet has less mass and inertia, and a gun has more mass and inertia. An equal force will cause the small bullet to move much faster; it will move the heavier gun much more slowly.**

**Section 6.1**

14. What is the difference between a “vector” quantity and a “scalar” quantity?

**Scalar quantities have only a magnitude (e.g. 50N)**

**Vectors have a magnitude and a direction (e.g. 50N upward)**

15. For each of the following, tell whether it is a vector or a scalar quantity:

* Velocity **vector**
* Speed **scalar**
* Force **vector**
* Acceleration **vector**