1. What will happen to an object when a net force acts on it?

a. fall b. stop c. accelerate d. go in a circle

2. Which is Newton’s second law?

a. F= ½ ma² b. F= 2ma c. p= mv d. a= F/m

3. What is the force of gravity on an object know as?

a. centripetal force c. momentum

b. friction d. weight

4. Which of the following is NOT a type of friction?

a. static b. sliding c. centripetal d. rolling

5. What is true about an object falling toward Earth?

a. It falls faster the heavier it is c. Earth pulls on it, and it pulls on Earth

b. It falls faster the lighter it is d. It has no weight

6. Why do projectiles follow a curved path?

a. They have a horizontal and a vertical motion

b. They have centripetal force

c. They have momentum

d. They have inertia

7. What is the product of mass and velocity known as?

a. gravity b. momentum c. friction d. weight

8. Which body exerts the weakest gravitational force on Earth?

a. the Moon b. Mars c. Pluto d. Venus

9. When a leaf falls, what force opposes gravity?

a. air resistance b. terminal velocity c. friction d. weight

10. In circular motion, the centripetal force is in what direction?

a. forward b. backward c. toward the center d. toward the side

11. What is the weight on Earth of a person with mass of 65 kg?

12. Some people put chains on their tires in the winter. Why?

13. List some ways an astronaut could keep her supplies from floating away from her while she is in orbit around Earth?

14. As you in-line skate around the block, what action and reaction forces keep you moving?

15. Which one of the following would have the most momentum – a charging elephant, a jumbo jet sitting on the runway, or a baseball traveling at 100 km/h? Explain.

16. Classify the following as example of static, sliding, or rolling friction: Sledding down a hill, sitting in a chair, pushing a grocery cart, standing on a steep slope, and rowing a boat.

17. A race car is moving in a circle at a constant speed around a track. Make a drawing of the centripetal force acting on the car?

18. Suppose you stand on a scale next to a sink. What happens to the reading on the scale if you push down on the sink?

19. The following table contains data about four objects that were dropped to Earth at the same time.

**Time of Fall for Dropped Objects**

|  |  |  |
| --- | --- | --- |
| **Object** | **Mass (g)** | **Time of Falls (s)** |
| A | 5.0 | 2.0 |
| B | 5.0 | 1.0 |
| C | 30.0 | 0.5 |
| D | 35.0 | 1.5 |

1. Which object fell fastest?
2. Which object fell slowest?
3. Which object has the greatest weight?
4. Is air resistance stronger on A or B?
5. Why are the times different?

20. Tiffany learned that the acceleration of a free-falling body is 9.8 m/s². She wanted to find out what speed a sky diver reaches after several seconds. Her calculations are shown in the table below.

**Speed of a Falling Sky Diver**

|  |  |
| --- | --- |
| **Time (s)** | **Speed (m/s)** |
| 0 | 0 |
| 1 | 9.8 |
| 2 | 19.6 |
| 3 | 29.4 |
| 4 | 39.2 |
| 5 | ? |

**Study the table and answer the following questions.**

1. According to these data, about how fast will the speed of a falling sky diver be after 5 s?

1. 39.8 m/s b. 44.2 m/s c. 49.0 m/s d. 54.0 m/s

2. Which of these causes falling sky divers to accelerate?

a. gravity c. rotation of Earth on its axis

b. inertia d. the tilt of Earth on its axis

3. If Tiffany extended her table, what would the sky diver’s speed be after 14 s?

a. 107.8 m/s² b. 78.4 m/s² c.147.0 m/s² d. 137.2 m/s²

Impulse

1. What is the equation for impulse?

2. Explain why goalposts have padding around their base in terms of impulse.

3. List safety features in a car which lengthen the time during a collision in order to decrease the maximum force during that collision.

4. How can you minimize the amount of “kickback” of a rifle? Why can’t you eliminate it completely?

5. A 90 kg football player is moving at 7 m/s. Calculate the force required to stop him in 0.4 seconds. (ft = ∆mv)

6. If a rocket of mass 4000 kg expels 50 kg of gas with a speed of 1500 m/s, what will be the speed of the rocket? (m1v1 = m2v2)

7. A soccer player A, with a mass of 72 kg is running east at +4.0 m/s. Another player B whose mass is 120 kg is running west at -2.3 m/s. The players collide directly (assume elastic collision).

a. What is the momentum of player A?

b. What is the momentum of player B?

c. What is the total momentum of both players?

d. What is the velocity of the two players after the collision?

ANSWER KEY

1. What will happen to an object when a net force acts on it?

c. accelerate

2. Which is Newton’s second law?

d. a= F/m from f = ma

3. What is the force of gravity on an object know as? W = mg

d. weight

4. Which of the following is NOT a type of friction?

c. centripetal

5. What is true about an object falling toward Earth?

c. Earth pulls on it, and it pulls on Earth

6. Why do projectiles follow a curved path?

a. They have a horizontal and a vertical motion

7. What is the product of mass and velocity known as?

b. momentum

8. Which body exerts the weakest gravitational force on Earth?

c. Pluto force is inversely proportional to distance (Pluto is farthest away)

9. When a leaf falls, what force opposes gravity?

a. air resistance

10. In circular motion, the centripetal force is in what direction?

c. toward the center

11. What is the weight on Earth of a person with mass of 65 kg?

*W = mg = 10 m/s/s x 65 kg = 650 N*

12. Some people put chains on their tires in the winter. Why?

*To increase friction*

13. List some ways an astronaut could keep her supplies from floating away from her while she is in orbit around Earth?

*As long as there is no outside force, objects will stay in the same place you put them based on inertia (Newton’s 1st law).*

14. As you in-line skate around the block, what action and reaction forces keep you moving?

*The wheels pushing against the ground and the ground pushes against the skates. There is centripetal force pulling the skates inward, while inertia pushes the skates outward.*

15. Which one of the following would have the most momentum – a charging elephant, a jumbo jet sitting on the runway, or a baseball traveling at 100 km/h? Explain.

*The jumbo jet has no momentum because it is not moving. The charging elephant has great mass compared to a baseball and therefore, its momentum will be much greater. The baseball will do much less damage than a baseball (both will hurt, however)*

16. Classify the following as example of static, sliding, or rolling friction: Sledding down a hill (sliding), sitting in a chair (static), pushing a grocery cart (rolling), standing on a steep slope (static), and rowing a boat (sliding/fluid).

17. A race car is moving in a circle at a constant speed around a track. Make a drawing of the centripetal force acting on the car?

18. Suppose you stand on a scale next to a sink. What happens to the reading on the scale if you push down on the sink?

*You would weigh less because pushing on the sink reduces the gravitational pull.*

19. The following table contains data about four objects that were dropped to Earth at the same time.

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| **Object** | **Mass (g)** | **Time of Falls (s)** |
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| C | 30.0 | 0.5 |
| D | 35.0 | 1.5 |

a. Which object fell fastest? C

b. Which object fell slowest? A

c. Which object has the greatest weight? D

d. Is air resistance stronger on A or B? A

e. Why are the times different? *Air resistance*

20. Tiffany learned that the acceleration of a free-falling body is 9.8 m/s². She wanted to find out what speed a sky diver reaches after several seconds. Her calculations are shown in the table below.

**Speed of a Falling Sky Diver**

|  |  |
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**Study the table and answer the following questions.**

1. According to these data, about how fast will the speed of a falling sky diver be after 5 s?

c. 49.0 m/s

2. Which of these causes falling sky divers to accelerate?

a. gravity

3. If Tiffany extended her table, what would the sky diver’s speed be after 14 s?

d. 137.2 m/s²

Impulse

1. What is the equation for impulse? ft = ∆mv

*Force x time = change in momentum*

2. Explain why goalposts have padding around their base in terms of impulse.

*Padding increases the time of collision and therefore, lowers the impact force.*

3. List safety features in a car which lengthen the time during a collision in order to decrease the maximum force during that collision.

*Air bags, seat belts, cushioned seats*

4. How can you minimize the amount of “kickback” of a rifle? Why can’t you eliminate it completely?

* + *Place the gun butt tight to the shooting shoulder*
  + *Hold the gun in a different spot (bend your arm rather than keep it straight)*
  + *If the rifle had no momentum, then neither would the bullet (action/reaction)*

5. A 90 kg football player is moving at 7 m/s. Calculate the force required to stop him in 0.4 seconds. (ft = ∆mv)

p = mv (90 kg)(7 m/s) = 630 kg m/s

since ft = ∆mv , then f = ∆mv / t = 630 kg m/s / 0.4 s = 1575 N

6. If a rocket of mass 4000 kg expels 50 kg of gas with a speed of 1500 m/s, what will be the speed of the rocket? (m1v1 = m2v2)

4000 kg

m1v1 = m2v2 …. v2 is the speed of the rocket:

v2 = m1v1 / m2 = (50 kg)(1500 m/s) / 4000 kg = 18 m/s

50 kg

1500 m/s

7. A soccer player A, with a mass of 72 kg is running east at +4.0 m/s. Another player B whose mass is 120 kg is running west at -2.3 m/s. The players collide directly (assume elastic collision).

a. What is the momentum of player A?

p = mv = (72 kg)(+4 m/s) = 288 kg m/s

b. What is the momentum of player B?

p = mv = (120 kg)(-2.3 m/s) = -276 kg m/s

c. What is the total momentum of both players?

p1 – p2 = 288 kg m/s + (-276 kg m/s) = 12 kg m/s

d. What is the velocity of the two players after the collision?

ptotal = mtotalvtotal therefore, v = p / m = (12 kg m/s) / 192 kg = 0.06 m/s

p

m

v