**Newton’s First Law of Motion**

****

**Name**:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**What do you think?**

**Brainstorm**

Why do objects fall downwards?

***Diagnostic Assessment***

1. Imagine a place in the cosmos far from all gravitational and frictional influences. Suppose that you visit that place (just suppose) and throw a rock. The rock will…
	1. Gradually stop.
	2. Continue in motion in the same direction at a constant speed.
2. Mac and Tosh are arguing in the cafeteria. Mac says that if he flings the custard with a greater speed it will have a greater inertia. Tosh argues that inertia does not depend upon speed, but rather upon mass. Who do you agree with?
	1. Mac
	2. Tosh
3. Supposing you were in space in a weightless environment, would it require a force to set an object in motion?
	1. Yes
	2. No
4. Fred spends most Sunday afternoons at rest on the sofa, watching pro football games and consuming large quantities of food. What affect (if any) does this practice have upon his inertia? Explain.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. A book is pushed across a very smooth table. After sliding for 3 metres, the book comes to a stop. What was the cause for it to stop?
	1. The force applied to the book needed to be stronger to prevent it from stopping.
	2. The mass of the book was too much to continue to travel any further.
	3. The book had another force being applied to it, causing it to stop.

**Introduction**

1. First we need to define the word \_\_\_\_\_\_\_\_\_\_\_\_:
	1. Definition: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (what causes objects to move)
	2. ![MCj01052040000[1]]()Two types of forces
		* \_\_\_\_\_\_\_\_\_\_\_\_\_
		* \_\_\_\_\_\_\_\_\_\_\_\_\_
2. Forces may be **balanced** or **unbalanced**

**Tug of War**

* 1. **Balanced forces** – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		+ There is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| http://sites.wff.nasa.gov/code810/images/edu_newton_balforce.gif | http://falconsscience.files.wordpress.com/2007/10/balancedforces.gif |

* 1. **Unbalanced forces** – one or more forces acting on an object are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		+ There is \_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| http://www.bbc.co.uk/bitesize/ks3/science/images/unbalancedforces.gif | http://education-portal.com/cimages/multimages/16/tug_of_war_unbalanced_1.jpg |

* 1. **A NET FORCE -** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ acting on an object.

**1st Law (Part A)**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by a force. [push or pull]
2. Newton described this tendency as \_\_\_\_\_\_\_\_\_\_\_\_\_.
3. **Inertia** can be described as the tendency of an object to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Mass & Inertia Relationship**

1. **Mass** is the amount of matter in an object.
2. The more **MASS** an object has, the more \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. **Conclusion:** Bigger objects are harder to \_\_\_\_\_\_\_\_\_\_ & \_\_\_\_\_\_\_\_\_\_\_
4. Which has more ***inertia*** in the following pictures?

|  |  |  |  |
| --- | --- | --- | --- |
| **Answer** | **Image 1** | **Vs.** | **Image 2** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | http://www.i2clipart.com/cliparts/b/3/d/3/clipart-mouse-b3d3.png | Vs. | http://3.bp.blogspot.com/-Wne-xZs4rvQ/UvpGYbCOX0I/AAAAAAAAAQM/n2NvA0_mr2o/s1600/auto+clipart+7.png |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | http://en.clipart-fr.com/data/icons/set_01/icones_00243.png | Vs. | http://iconbug.com/data/b4/256/4ece97792658df143eb693c23bb991f3.png |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | http://png-2.findicons.com/files/icons/1242/somatic_rebirth_extras/256/sandwich.png | Vs. | http://www.aperfectworld.org/clipart/academic/pencil01a.gif |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | http://thumbs3.ebaystatic.com/d/l225/m/mwCXGGYJ9oQUnZuDIdwnp1w.jpg | Vs. | http://www.clker.com/cliparts/7/1/d/3/119498577810047030key_juliane_krug_01.svg.med.png |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | http://www.clker.com/cliparts/e/3/B/B/b/Q/racquets-hi.png | Vs. | http://www.big5sportinggoods.com/photos/product/giant/4782420S175835/-/size-18.jpg |

**1st Law (Part B)**

1. What about objects that are already in motion?
2. Newton stated that objects in motion . . . \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Summary: Newton’s 1st Law**

* 1. Also known as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. Says that a moving object moves in a straight line with constant speed unless \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	3. Says an object at rest will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and an object in motion will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ unless acted upon by an unbalanced force.
1. **Objects do not change their \_\_\_\_\_\_\_\_\_\_\_ unless a force acts on them**

**Revision Quiz**

1. What causes motion and what are the two movements associated with motion? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Forces are either balanced or unbalanced. Which one has normally “no motion”? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What is a net force? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Write a definition of inertia. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. What is the relationship of Mass and Inertia? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Complete the sentence. “An object in motion tends to . . . \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Reasoning A (Easy)**

1. Many automobile passengers have suffered neck injuries when struck by cars from behind.
* How does Newton's law of inertia apply here? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* How do headrests help to guard against this type of injury? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Reasoning B (Difficult)**

1. An elephant and a mouse both have the same weight - zero - in “gravitation-free” space. If they were moving toward you with the same speed, would they bump into you with the same effect? EXPLAIN! \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Newtons First Law Concept Questions**

1. Does the law of inertia pertain to moving objects, objects at rest or both?

**h**

2. If you were in a spaceship and fired a cannonball into frictionless space, how much force would have to be exerted on the ball to keep it moving once it has left the spaceship?

**None**

3. An elephant and a mouse both have the same weight - zero - in “gravitation-free” space. If they were moving toward you with the same speed, would they bump into you with the same effect? Explain.

4. In the cabin of a jetliner that cruises at 600 km/h, a pillow drops from an overhead rack.

Does a passenger walking up the aisle have to worry about the pillow slamming into her and knocking her over? Explain.

 **NO. Since both are in**

5. Many automobile passengers have suffered neck injuries when struck by cars from behind. How does Newton's law of inertia apply here? How do headrests help to guard against this type of injury?

**When**

6. Suppose you place a ball in the middle of a wagon, and then accelerate the wagon forward. Describe the motion of the ball relative to the ground?

**The ball maintains its position.**

 - Describe its motion relative to the wagon?

**The ball rolls to the back of the wagon.**

7. If an elephant were chasing you, its enormous mass would be most threatening. But if you zigzagged, its mass would be to your advantage. Why?

**Its large mass**

8. Two closed containers look the same, but one is packed with lead and the other with a few feathers. How could you determine which has more mass if you and the containers were orbiting in a weightless condition in outer space?

9. If suddenly the force of gravity of the sun stopped acting on the planets, in what kind of path would the planets move?

10. A helium balloon is held by its string in a car with the windows rolled up. The car, initially at rest, accelerates forward. Which direction does the balloon move? Explain.

**Newtons First Law Concept Questions (ANSWERS)**

1. Does the law of inertia pertain to moving objects, objects at rest or both?

**both**

2. If you were in a spaceship and fired a cannonball into frictionless space, how much force would have to be exerted on the ball to keep it moving once it has left the spaceship?

**None**

3. An elephant and a mouse both have the same weight - zero - in “gravitation-free” space. If they were moving toward you with the same speed, would they bump into you with the same effect? Explain.

**NO! The larger mass of the elephant means it has a larger inertia. This means it will “run” you over.**

4. In the cabin of a jetliner that cruises at 600 km/h, a pillow drops from an overhead rack.

Does a passenger walking up the aisle have to worry about the pillow slamming into her and knocking her over? Explain.

 **NO. Since both are in the “same” relative motion, the pillow will simply fall to the floor.**

5. Many automobile passengers have suffered neck injuries when struck by cars from behind. How does Newton's law of inertia apply here? How do headrests help to guard against this type of injury?

**When hit from behind, the car accelerates forward as does the body since it is pushed by the seat. The head however, unless there is a headrest, tries to “stay put.” This results in the head “snapping back”.**

6. Suppose you place a ball in the middle of a wagon, and then accelerate the wagon forward. Describe the motion of the ball relative to the ground?

**The ball maintains its position.**

 - Describe its motion relative to the wagon?

**The ball rolls to the back of the wagon.**

7. If an elephant were chasing you, its enormous mass would be most threatening. But if you zigzagged, its mass would be to your advantage. Why?



**Its large mass means it has large inertia resulting in the elephant having a difficult time changing its direction.**

8. Two closed containers look the same, but one is packed with lead and the other with a few feathers. How could you determine which has more mass if you and the containers were orbiting in a weightless condition in outer space?

**Shake them.**

9. If suddenly the force of gravity of the sun stopped acting on the planets, in what kind of path would the planets move?

**Straight lines.**

10. A helium balloon is held by its string in a car with the windows rolled up. The car, initially at rest, accelerates forward. Which direction does the balloon move? Explain.

**It does not actually move, It appears to move backwards but this is only because the car is moving forward. This explains the law of intertia says that an object at rest will remain at rest unless an unbalance force acts on it. Because there is no force applied to the balloon at initial acceleration, the balloon remains in its original spot.**