

Shedding Light on Motion Episode 6: Newton's First Law of Motion Question Sheet

Name: _____

Part B Part A

1. In order for something to accelerate, a _____ needs to be applied to it.
2. Newton's First Law of Motion states:

3. If a car stops suddenly, we get "thrown forward". "Thrown forward" is a perfectly good expression, but what actually happens?

4. If a stationary bus accelerates suddenly, we feel as if we are being forced backwards. Why is this?

5. How do headrests (also called head restraints) on car seats help prevent injuries?

6. When a car suddenly turns to the left, it seems from the frame of reference of the car that we are forced to the right. But what really happens?

7. When you are standing on the floor, gravity is pulling you downwards. Why don't you accelerate downwards?



Part C

8. A 2 kg box and a 1 kg box are at rest on a table. Draw in the forces acting on the boxes. Make sure the arrows are to scale and that they start from each box's **centre of mass**.

9. Why does a puck sliding across a wooden floor slow down after it is struck?

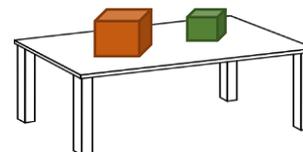
10. List and briefly describe three factors that affect the amount of friction between two surfaces.
(a) _____

(b) _____

(c) _____

11. What is a lubricant? _____

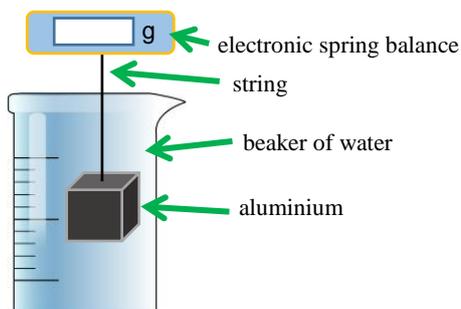
12. What is air resistance and how is it affected by an object's speed?



13. The upwards force caused by air flow over an aeroplane's wings is called _____, and the forwards force provided by the plane's engines is called _____. Air resistance, which opposes the motion of a moving aeroplane is often called _____.
14. (a) What is buoyancy?

(b) What does Archimedes Principle tell us?

15. A small block of aluminium has a volume of 20 cm^3 and a mass of 54 grams.



- (a) When the aluminium block is suspended from the electronic spring balance in air, the scales read _____ grams.
- (b) The aluminium block has a volume of _____ cm^3 .
- (c) It will therefore displace _____ cm^3 of water (when it is immersed in water).
- (d) This amount of water displaced (_____ cm^3 , from 14c) has a mass of _____ grams, since water has a density of _____ g/cm^3 .
- (e) The aluminium block will therefore experience an upwards force, because of buoyancy, equal to _____ grams.
- (f) The aluminium block will therefore seem _____ grams lighter in water than it is normally (in air).
- (g) Therefore, when the aluminium block is immersed in water, the scales will read _____ grams.

16. An object will float in water if its density is less than / greater than the density of water.
17. An object will sink in water if its density is less than / greater than the density of water.

- Part D** 18. A cyclist riding a bike typically experiences 4 forces: gravity; the normal force; thrust; and friction (which for the purposes of this exercise will include air resistance). Draw in the forces acting on the cyclist (and the bike) in the following situations. Make sure the arrows are drawn to scale and that they originate at the centre of mass of the cyclist.

cyclist accelerating	cyclist reaches a constant speed	cyclist stops pedalling and begins to slow down

19. Draw free-body diagrams (showing all the forces acting) for the following situations.

plane in the air flying level but accelerating	rocket accelerating upwards	helicopter hovering