Kirkcaldy High School

BGE Science

Sports Science

Forces

Name:_____

Class:_____

Teacher:_____

Expectations and Outcomes Learner Evaluation

Topic: Forces

Experience and Outcomes	Date Completed (dd/mm/yy)	Evaluation How happy are you with it? (☺ ? ☹)
I can state what force is and give examples		
I can describe the effects and applications of some forces.		
I can describe how forces are measured.		
I can measure forces with a force meter.		
I can state the difference between mass and weight		
I can measure the weight of an object.		
I can investigate the relationship between mass and weight.		
I can explain how objects can travel at constant speed when balanced forces are acting upon them.		
I can state using a force diagram if a force is balanced or unbalanced.		
I can state the meaning of the term 'friction'		
I can investigate friction using a hovercraft.		
I can investigate friction on different surfaces		
I can investigate air resistance and drag.		
I can explain why objects sink or float.		

Date: _____

Forces

Starter

What is a force?

_____

_____

Learning Intentions

- To understand what a force is.
- To investigate the effects and applications of forces.

Tick me at the end if ***you can*** …

Success Criteria

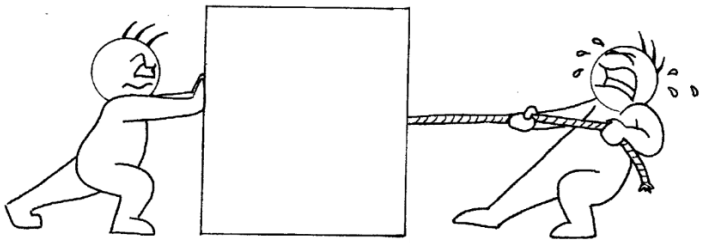
☐ I can state what force is and give examples

☐ I can describe the effects and applications of some forces.

What is a force?

A force is a _____

or a _____



A force can change the _____, _____or _____of an object.

Contact Forces

Some forces <u>need to touch</u> an object to affect it.

Examples of these forces are _____, _____and _____.

Non-contact Forces

Some forces <u>do not need to have contact</u> to affect an object.

Examples of these forces are _____, _____and _____ _____.

Forces: think about it …

A book sitting on a table does not move.

- Are there any forces acting on it?
- What might these forces be?
  (Compare it to a person on a trampoline…)

If you pushed the book…

- what forces are acting?
  (think about making it move, or trying to stop it)

Discuss in your group before writing a short summary of your thoughts.

_____

_____

_____

_____

_____

_____

Date: _____

Measuring forces

Starter

1. What is a force?

_____

2. What can a force do to an object?

_____

3. Name 3 different forces.

_____

Learning Intentions

- To describe how forces are measured with a force meter.

Success Criteria

Tick me at the end if ***you can*** …

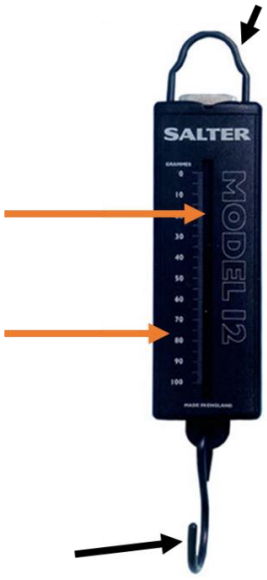
☐ I can describe how forces are measured.

☐ I can measure forces with a force meter.

Measuring forces with a newton balance

We can measure a force using a _____ balance or _____ _____.

The unit of measurement for force is the _____ (____).



Measuring forces experiment

Aim: To estimate, and measure, the forces required to move different objects.

Results:

Object	Estimate of force needed (N)	Actual force needed (N)
Lift a bag		
Open the door		
Pull a stool across floor		

Conclusion:

_____

_____

_____

Date: _____

Mass and weight

Starter

Why does a newton balance (force meter) contain a **SPRING** and not an **ELASTIC BAND**?

_____

_____

Learning Intentions

- To understand the difference between mass and weight

Success Criteria

Tick me at the end if ***you can*** …

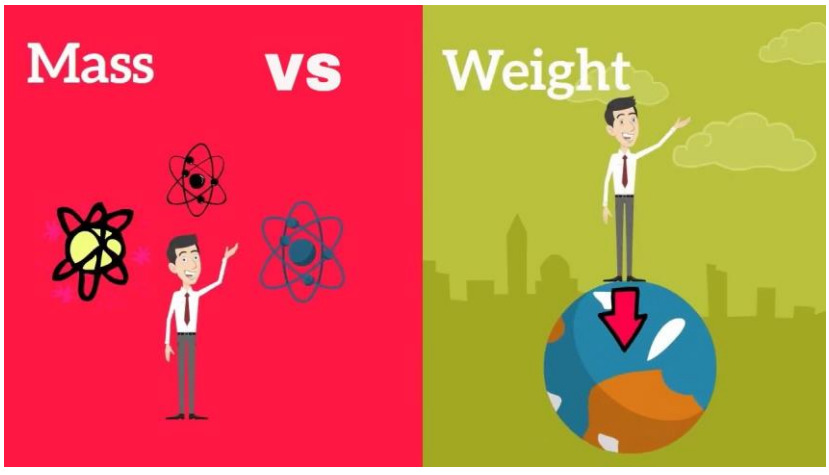
- ☐ I can state the difference between mass and weight
- ☐ I can measure the weight of an object.
- ☐ I can investigate the relationship between mass and weight.

What is mass and weight?

The mass of an object is a measure of the _____ of _____ in the object. _____ is measured in _____ (kg).

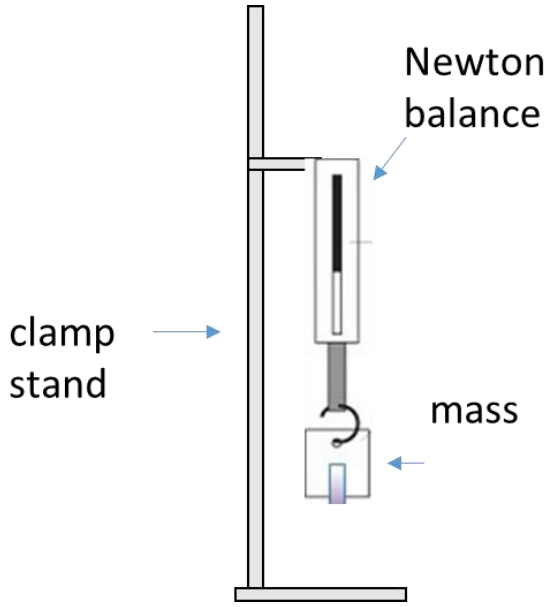
The weight of an object is a measure of the _____ exerted on the object due to _____.

Weight is measured in _____ (N).



Aim: To investigate the relationship between mass and weight.

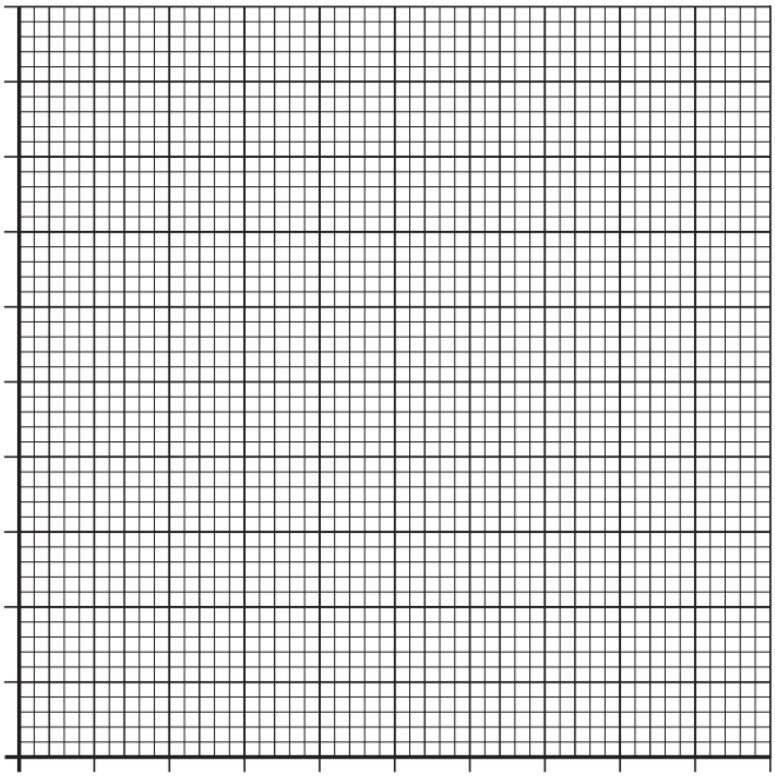
Method:



Results:

Mass (kg)	Weight (N)
0·1	
0·2	
0·3	
0·4	
0·5	
0·6	
0·7	
0·8	
0·9	
1·0	

Draw a line graph of your results.



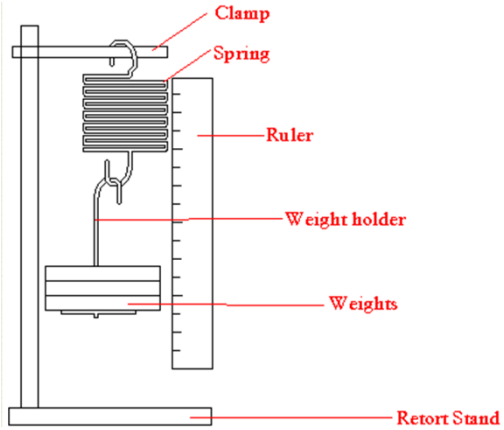
Conclusion:

_____

Spring investigation (Optional)

Aim: To investigate the relationship between force and stretch for a spring.

Method:



Results:

Force (N)	Spring Length (cm)	Extension (cm)
0		
1		
2		
3		
4		
5		

Draw a line graph of your results.

Conclusion:

_____

Date: _____

Calculating mass and weight

Starter

Explain the difference between mass and weight.

_____

_____

Learning Intentions

- To calculate the weight of given objects

Success Criteria

☐ I can calculate the weight of given objects

Tick me at the end if ***you can*** …

Mass and weight

The Earth's gravitational field strength is 10 N/kg.

weight =

W = m x g

- W: newtons (N)
- m: kilograms (kg)
- g: newtons per kilogram (N/kg)

On the Earth, **g = 10 N/kg**, so the formula becomes

W = m x 10

Gravity is the _____ pulling objects towards the Earth's centre.

Example of how to layout calculations:

What would be the weight of an 800 kg elephant?

$$W = m\ g$$

Write out the equation (relationship)

W = ?

m = 800 kg

g = 10 N/kg

$$W = 800 \times 10$$

Substitute in what you know

$$W = 8000\ N$$

Write out what you know from the question and what you are being asked to find.

Write the answer with units

Calculate the weight of the following in the space below:

SHOW ALL OF YOUR WORKING

1. A pupil whose mass is 35 kg
2. A car whose mass is 600 kg
3. A 5 kg bag of potatoes
4. A 0.5 kg bag of rice
5. A 0.1 kg bar of chocolate

Gravitational field strength

The gravitational field strength is different in space and on different planets.

1. What is the value of gravity on the Earth's Moon?

_____

2. What happens to your weight when you travel from the Earth to the Moon?

_____

3. What happens to your mass when you travel from the Earth to the Moon?

_____

4. Astronauts walking on the Moon appear to "bounce" rather than walk. Explain why this is the case

_____

Mass and weight summary

	Unit	**What does it measure/**	**Is it always the same?**	**What makes it change?**
Mass			yes	nothing
Weight	Newton (N)	The force downwards caused by a planet		

Date: _____

Balanced and unbalanced forces

Starter

1. What will happen if both teams in a tug of war both pull each other with exactly the same force?

_____

2. What will happen if the team on the right pull with a larger force than the team on the left?

_____

Learning Intentions

- To explain how objects can travel at constant speed when balanced forces are acting upon them.
- To state using a force diagram if a force is balanced or unbalanced.

Success Criteria

☐ I can explain how objects can travel at constant speed when balanced forces are acting upon them.

☐ I can state using a force diagram if a force is balanced or unbalanced.

Balancing Forces

A balanced force is when you have _____ forces but in _____directions.
Balanced forces cause an object to stay still or travel at a constant speed.

An unbalanced force is when there is one or more force, but the overall force in one _____is _____.
Unbalanced forces cause a change in speed – this is called _____.

Describe a scenario in sport where you have:

Balanced forces	Unbalanced forces
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

1. Are these forces balanced or unbalanced?

_____

2. What direction is the car travelling in?

_____

Draw the free body diagram for the above diagram:

Balanced or unbalanced

From the board, write where the free body diagram shows a balanced or unbalanced system.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

Space for worksheet answers

Date: _____

Friction

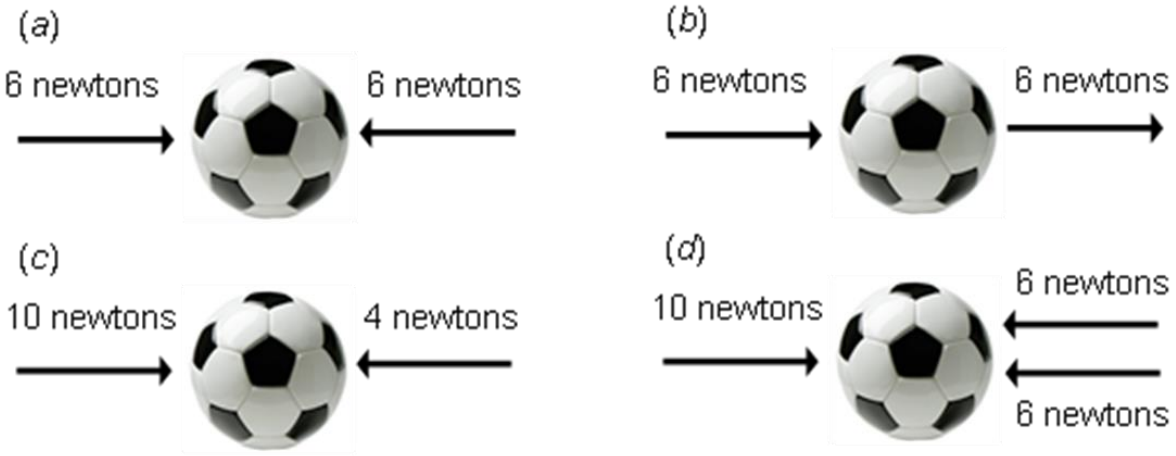
Starter

1. State whether the footballs shown below will remain stationary or will move.

   a. _____ b. _____c. _____d. _____

2. Calculate the resultant force.

   a. _____ b. _____c. _____d. _____



Learning Intentions

- To describe the term ‘friction’
- To investigate the force of friction

Success Criteria

☐ I can state the meaning of the term ‘friction’

☐ I can investigate friction using a hovercraft.

What is friction?

Friction is a force which _____ motion.

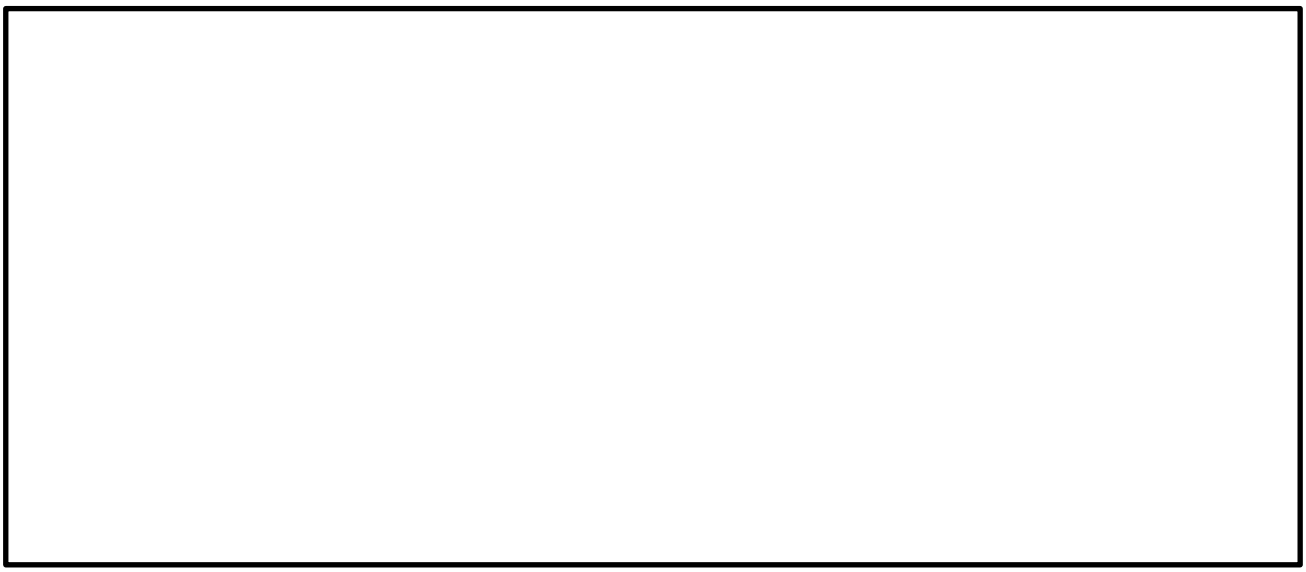
A large frictional force causes an object to _____ _____ _____ than a small frictional force.

Hovercraft

Aim: _____

_____

Method:



Results:

_____

_____

_____

Conclusion:

_____

_____

_____

Date: _____

Friction: Changing surfaces

Starter

1. What is friction?

_____

2. Where do you need friction on a bike?

_____

3. List 3 other sporting activities which need friction.

_____

Learning Intentions

- To investigate the force of friction on different surfaces

Success Criteria

☐ I can investigate friction on different surfaces

Friction

Friction is a force measured in _____.

Friction is a force between two or more objects. It happens when _____objects are in _____with each other.

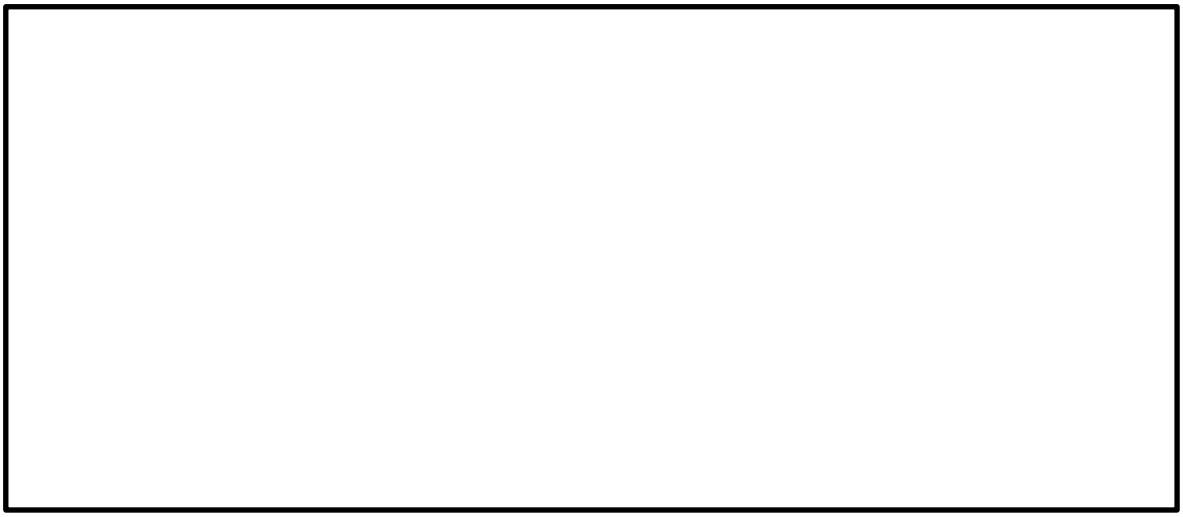
Friction acts in the _____ direction to movement.

Friction Investigation 1

Aim: _____

_____

Method:



Results: *(draw a graph of your data on the follow page)*

Type of surface	Force needed to pull shoe (N)
Desk	
Carpet	
Cardboard	
Wood	
Plastic	
linoleum	

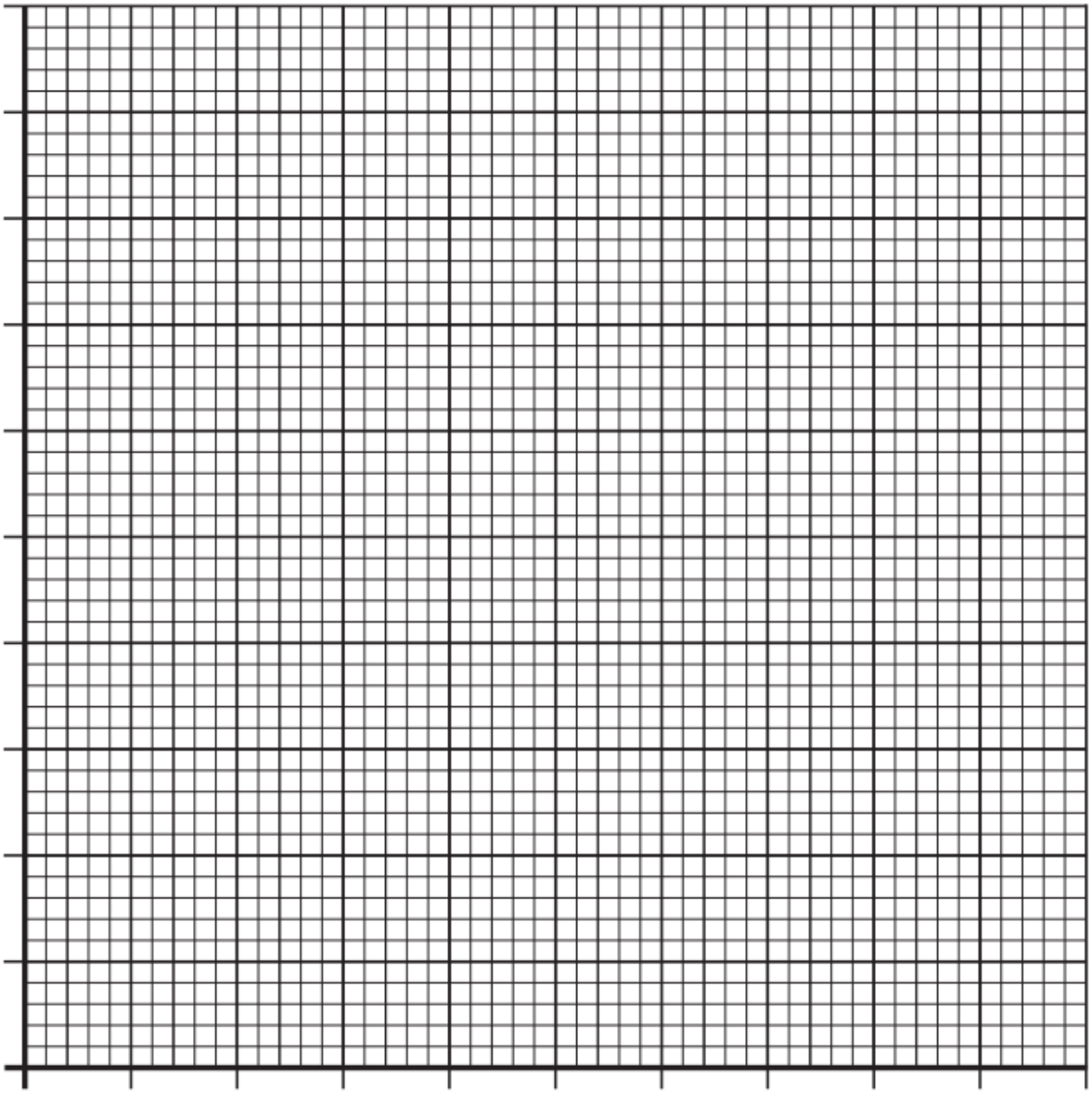
Conclusion:

_____

_____

_____

Draw a bar chart using your data.



Summary

Smoother surfaces have _____ **friction** than _____surfaces.

On _____ **surfaces** less force is needed to make the surfaces slide across each other.

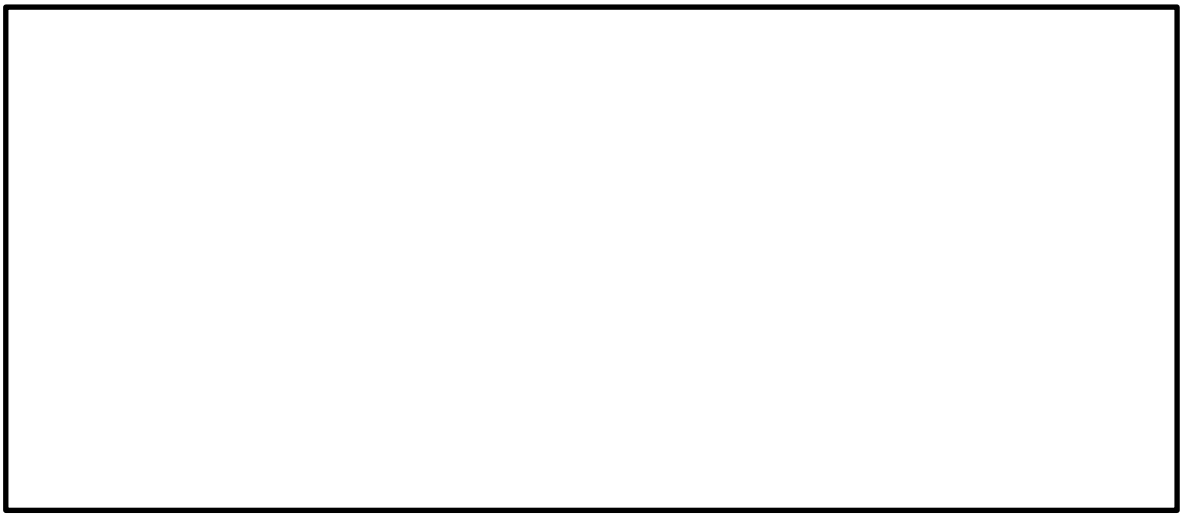
On _____ **surfaces** greater force is needed to make the surfaces slide across each other.

Friction investigation 2 (optional)

Aim: _____

_____

Method:



Results: *(draw a graph of your data on the follow page)*

Mass in shoe (kg)	Force needed to pull shoe (N)
0.2	
0.4	
0.6	
0.8	
1.0	
1.2	

Conclusion:

_____

_____

_____

Date: _____

Air resistance and drag

Starter

Is friction being *increased* or *decreased*?

1. Putting oil in car engine

   _____

2. Wearing tight fitting swimwear

   _____

3. Using a off road bike with wider tyres.

   _____

Learning Intentions

- To investigate air resistance and drag.

Success Criteria

☐ I can investigate air resistance and drag.

Drag

Drag is the name given to the force of _____when objects travel through _____or _____.

Drag is caused by the _____of the object trying to _____ _____ the liquid or gas.

_____a shape means an object meets less air/liquid and will have lower frictional forces.

Objects _____ _____.

Investigating drag

Aim: _____

_____

Method:

Results: *(draw a graph of your data on the follow page)*

Shape of Plasticine	Time taken to fall (s)			
	1	2	3	Average

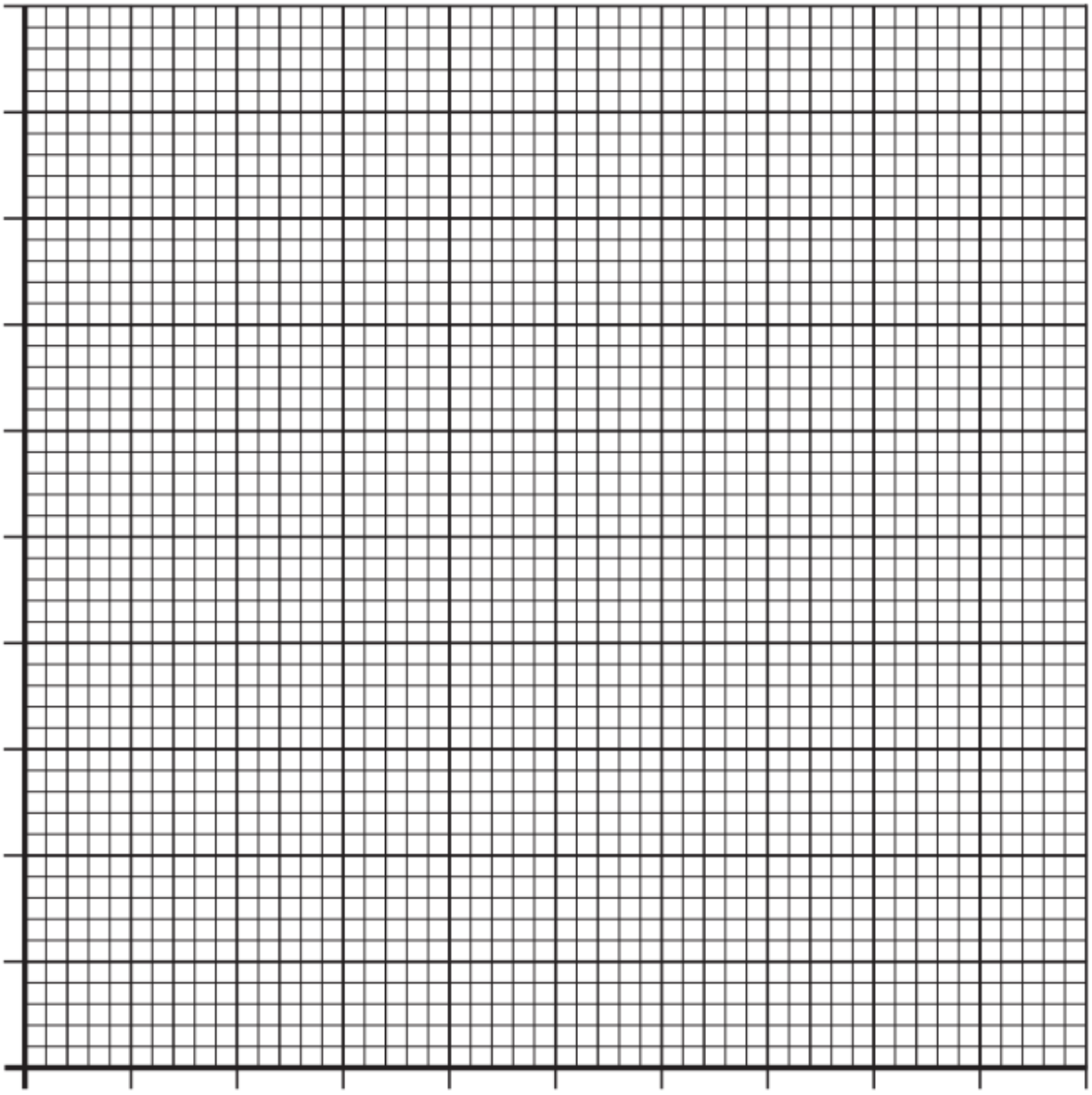
Conclusion:

_____

_____

_____

Draw a bar chart using your data.



Air Resistance

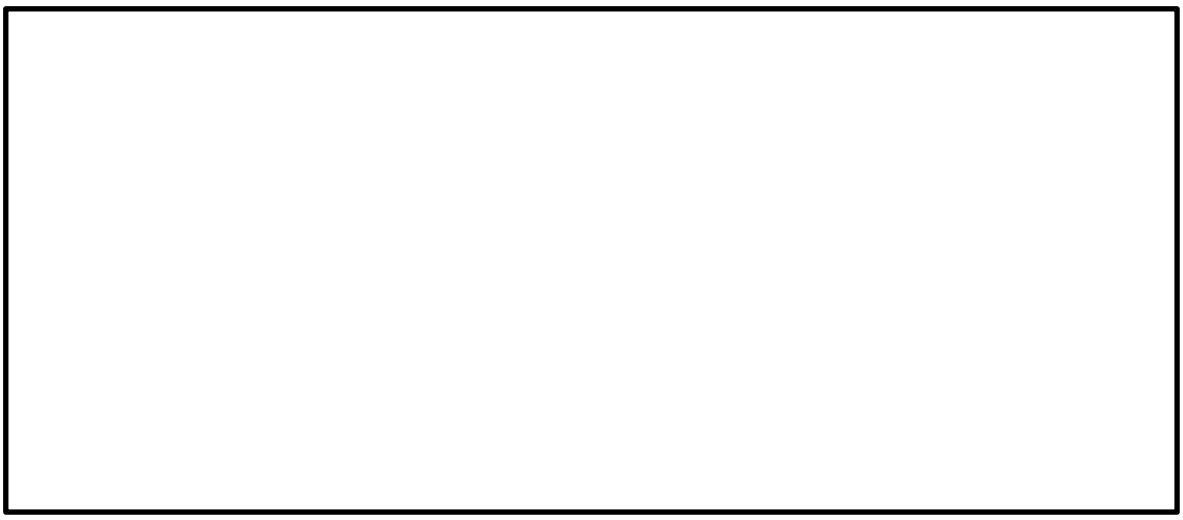
Air resistance is the name given to the force of friction when objects travel _____ _____**.**

Investigating drag

Aim: _____

_____

Method:



Results: *(draw a graph of your data on the follow page)*

Area of parachute (cm^2)	Time taken to fall (s)			
	1	2	3	Average
100				
625				
900				

Conclusion:

_____

_____

_____

Date: _____

Density

Starter

Do you think these objects will sink or float? *(from the board)*

1. _____ 2. _____ 3. _____

4. _____ 5. _____ 6. _____

7. _____ 8. _____

Learning Intentions

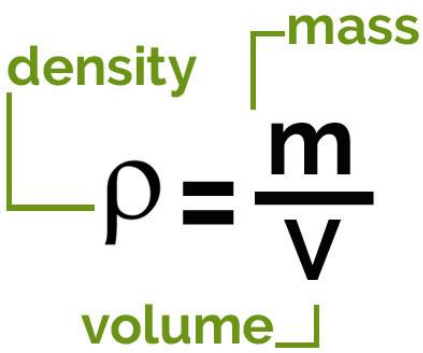
- To explain why objects sink or float.

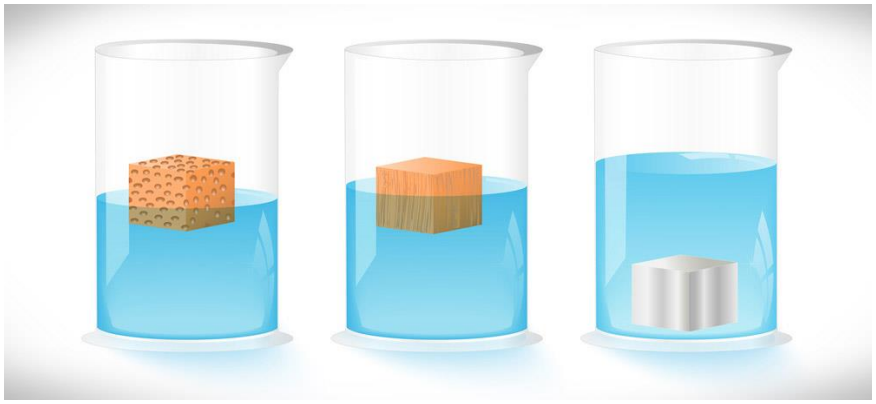
Success Criteria

☐ I can explain why objects sink or float.

Density

The **density** of an object will determine whether it will _____ or _____.





Measuring density part 1 - Solids

Aim: _____

_____

Method:

Results: *(draw a graph of your data on the follow page)*

Object	Mass (g)	Volume (cm^3)	Density (g/cm^3)

Measuring density part 2 - liquids

Method:

Results: *(draw a graph of your data on the follow page)*

Liquid	Mass of empty measuring cylinder (g)	Mass of measuring cylinder with liquid (g)	Mass of liquid (g)	Volume (cm^3)	Density (g/cm^3)

Measuring density part 3 – floating and sinking

Aim: _____

_____

Method:

Results:

Solid	Density (g/cm^3)	Liquid	Density (g/cm^3)	Is the solid more dense than the liquid?	Does the solid sink or float?	

Conclusion:

_____

_____

_____

Extension Tasks

Word Search

Forces

I	I	Y	F	R	I	C	T	I	O	N	T	T	A
I	N	R	A	I	N	S	W	G	A	R	D	G	K
T	R	R	K	T	E	A	O	R	D	B	O	R	I
E	E	C	E	O	W	T	E	M	A	S	S	A	L
C	I	E	T	U	T	F	A	S	A	N	C	V	O
N	T	E	L	R	O	E	O	P	A	C	D	I	G
A	A	R	N	A	N	S	N	R	R	N	T	T	R
T	O	W	I	M	S	E	R	I	C	N	B	Y	A
S	L	E	M	N	C	T	F	N	T	E	G	C	M
I	F	I	T	I	Y	A	I	G	S	I	S	E	S
S	G	G	C	O	N	T	A	C	T	C	N	T	R
E	B	H	T	U	N	B	A	L	A	N	C	E	D
R	D	T	S	S	I	N	K	Y	A	U	N	N	A
S	D	E	N	S	I	T	Y	R	I	R	O	R	N

GRAVITY
NEWTONS
MASS
FLOAT
UNBALANCED
FRICTION
DENSITY
FORCES
ELASTIC
SINK
CONTACT
KILOGRAMS
RESISTANCE
SPRING
DRAG
WEIGHT

Draw a comic strip on one of the topics. Ask your teacher for ideas.

.

Extra Questions

1. What is a force, and how can it affect an object's motion?

_____

_____

2. What is the difference between balanced and unbalanced forces?

_____

_____

3. Can an object be in motion if the forces acting on it are balanced? Explain your answer.

_____

_____

4. What is friction, and how does it affect the movement of objects?

_____

_____

5. How does the surface type influence the amount of friction between two objects?

_____

_____

6. What are two ways to reduce friction between two surfaces?

_____

_____

7. What is air resistance, and how does it affect objects moving through the air?

_____

_____

8. How does an object's shape and speed influence the amount of air resistance it experiences?

_____

_____

9. Explain how a parachute uses air resistance to slow down a person's descent.

_____

_____

10. What is gravity, and how does it affect objects on Earth?

_____

_____

11. How does gravity influence the weight of an object?

_____

_____

12. What would happen if there were no friction or air resistance acting on a moving object?

_____

_____

13. Why do objects fall at the same rate due to gravity, regardless of their mass, in the absence of air resistance?

_____

_____

14. How do balanced and unbalanced forces play a role in everyday activities, such as walking or riding a bike

_____

_____