THE DUSTON SCHOOL
Knowledge itself is power
4-19

Year 10 Science Knowledge Booklet

Term 4

Name:	Class:

Year 10 CGP Workbook Deadlines	
03/03/2025	B4
17/03/2025	C9
31/03/2025	P2

Science Homework 1

Complete the section of the homework workbook identified on the front of this Knowledge organiser and learn the key knowledge questions and answers ready for the knowledge quiz.

Big questions:

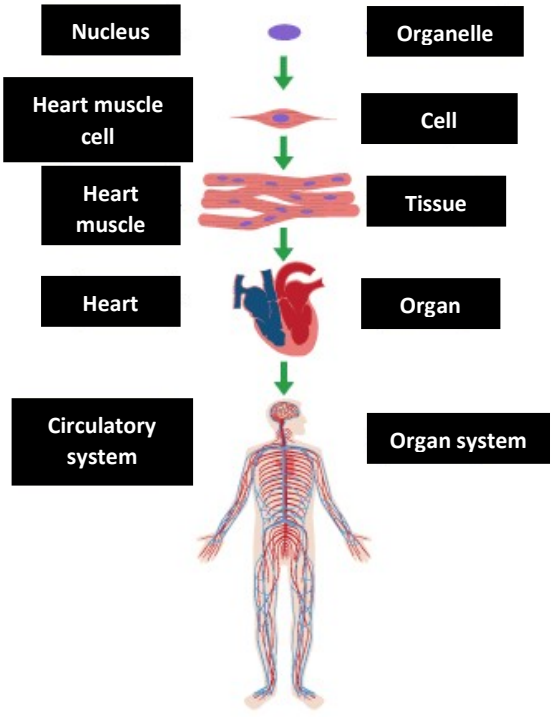
- **How is an organism arranged?**
- **What is the function of the digestive system?**
- **How do we test for biological molecules?**
- **Why are enzymes important?**
- **How can the rate of enzyme reactions be affected?**
- **What are some of the key enzymes?**
- **How are the lungs adapted for their function?**
- **How is the heart adapted for their function?**
- **How are blood vessels adapted for their function?**
- **What is the function of blood?**
- **How does life style affect non-communicable diseases?**
- **How is a plant structured?**
- **What is the function of stomata?**
- **What is translocation?**
- **What is transpiration?**

Key vocabulary

Active site	Region of an enzyme where specific substrate molecules bind and undergo a chemical reaction.
Alveolus **Alveoli (plural)**	A tiny air sac in the lungs, where gas exchange occurs
Amylase	Enzyme that catalyses the breakdown of starch into sugars.
Benign	Normally slow growing tumours that do not spread to other parts of the body.
Blood	Tissue which transports substances around the body in the circulatory system.
Blood vessels	Structures specially adapted to carry blood around the body
Denature	An enzyme's active site permanently changes shape and the enzyme is no longer able to function (substrate no longer fits)
Enzyme	Protein molecule that catalyses (speeds up) chemical reactions inside cells and the body.
Malignant	Tumour that can spread through the body for example via the blood stream (metastasise).

Non-communicable disease	A disease that cannot be transferred from organism to organism.
Organ	Group of similar tissues working together to perform a particular function.
Organ System	Group of organs working together to perform a particular function.
Pacemaker	Group of cells located in the right atria of the heart that regulates the heart rate.
Risk Factor	Something that increases a chance of developing a disease. Risk factors can be caused by lifestyle factors or substances in a person's body or their environment.
Statin	Drug used to reduce cholesterol in the blood. Can be used to treat CHD
Stent	Metal or plastic tubes used to widen the coronary arteries if they have been blocked due to CHD.
Stoma	Pore on the underside of a leaf.
Substrate	The molecule that fits into the active site of an enzyme.
Tissue	Group of similar cells working together to perform a particular function.
Translocation	Movement of sugar produced in photosynthesis to all other parts of the plant for respiration and other processes. Occurs in phloem cells.
Transpiration	Evaporation of water at the surfaces of the spongy mesophyll cells in leaves, followed by loss of water vapour through the stomata.

How is an organism arranged?



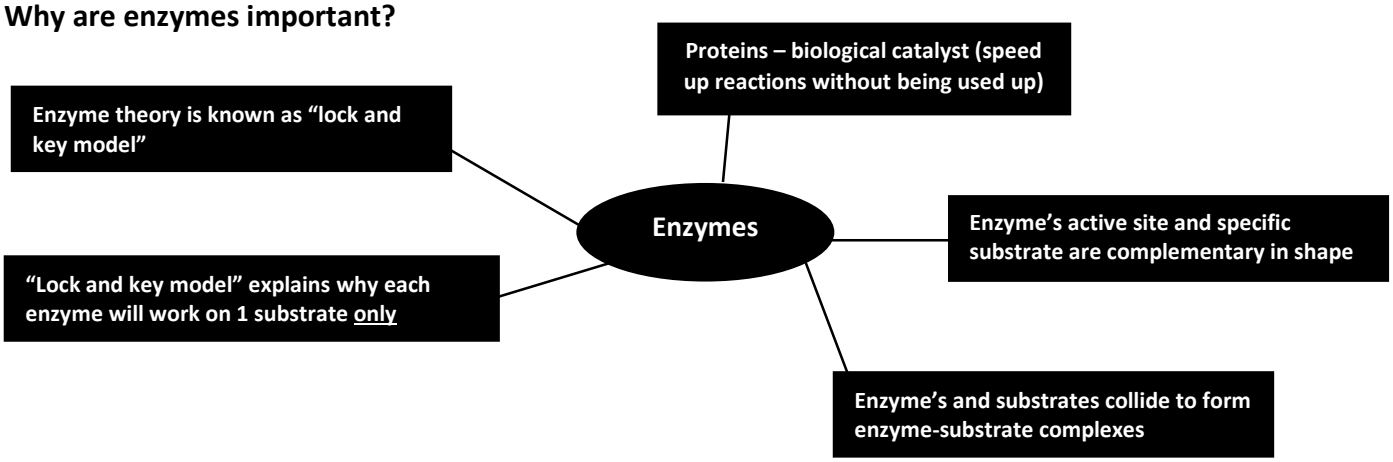
What is the function of the digestive system?

Structure	Function
Mouth	Where food enters the alimentary canal and digestion begins
Salivary glands	Produce saliva containing amylase
Oesophagus	Muscular tube which moves ingested food to the stomach
Stomach	Muscular organ where digestion continues
Pancreas	Produces digestive enzymes
Liver	Produces bile
Gall bladder	Stores bile before releasing it into the duodenum
Gall bladder	Stores bile before releasing it into the duodenum
Small intestine - duodenum	Where food is mixed with digestive enzymes and bile
Small intestine - ileum	Where digested food is absorbed into the blood and lymph
Large intestine - colon	Where water is reabsorbed
Large intestine - rectum	Where faeces are stored

How do we test for biological molecules?

Food sample	Reagent	Method	Initial colour	Colour of positive result
Reducing sugar	Benedict's	Add Benedict's reagent to the food and boil in a water bath.	Blue	Brick red precipitate
Starch	Iodine	Add iodine reagent to the food.	Yellow-brown	Blue-black
Protein/amino acids	Biuret	Add Biuret reagent to the food.	Blue	Lilac/purple
Fat	Ethanol	Add ethanol to the food to dissolve the fat then add water.	Colourless	White emulsion

Why are enzymes important?

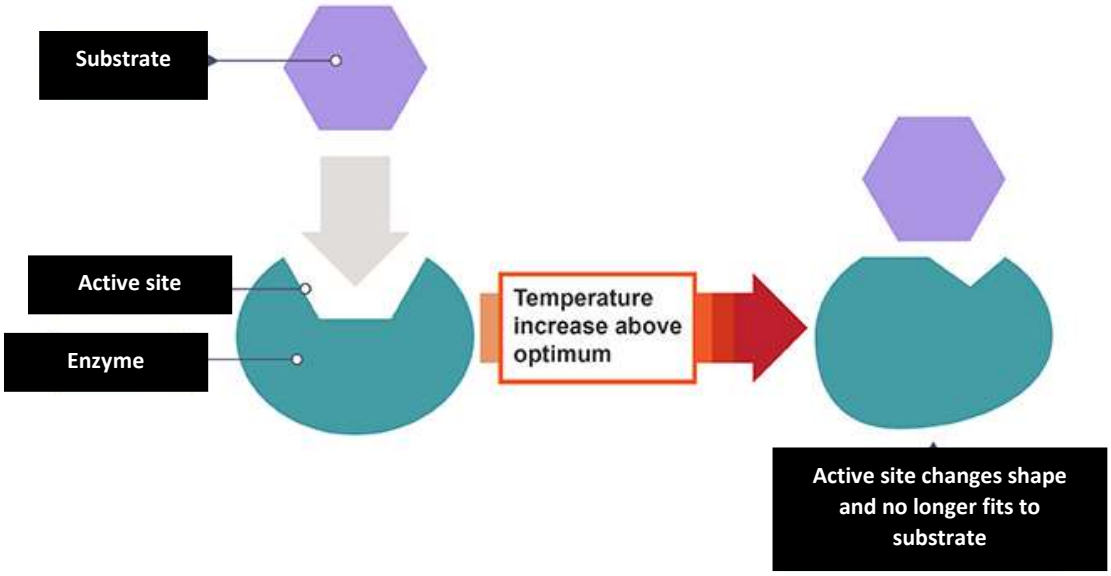


How can the rate of enzyme reactions be affected?

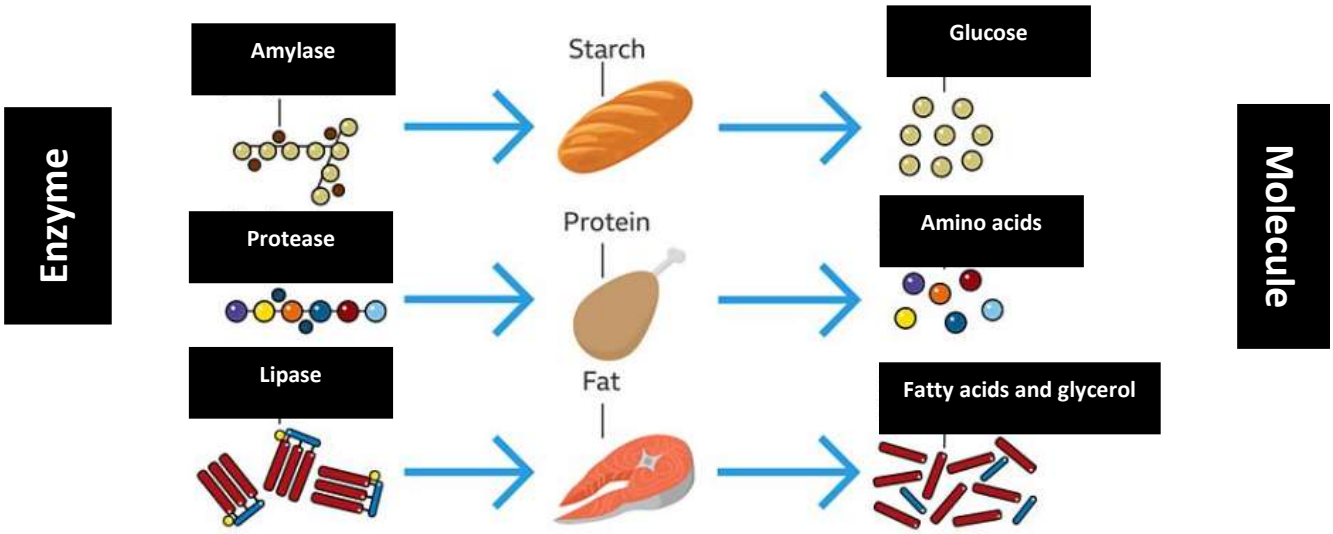
pH	Deviating from the optimum pH (too high or too low) causes the enzyme's active site to become denatured and the active site loses its important shape. It can no longer form enzyme-substrate complexes, leading to a decrease in enzyme activity.
Enzyme concentration	The higher the enzyme concentration, the more enzymes there are to form enzyme-substrate complexes, leading to an increase in enzyme activity. This happens up to a certain point. Enzyme activity then levels off (plateaus) as there are not enough substrate molecules to react with the extra enzymes.
Substrate concentration	The higher the substrate concentration, the more substrate there is to form enzyme-substrate complexes, leading to an increase in enzyme activity.

Temperature	As temperature increases to the optimum, the kinetic energy of the enzyme and substrate increases, causing more collisions between the enzyme and substrate**.** This causes the formation of more enzyme-substrate complexes, leading to an increase in enzyme activity. An increase in temperature beyond the optimum causes the enzyme's active site to become <u>denatured.</u>

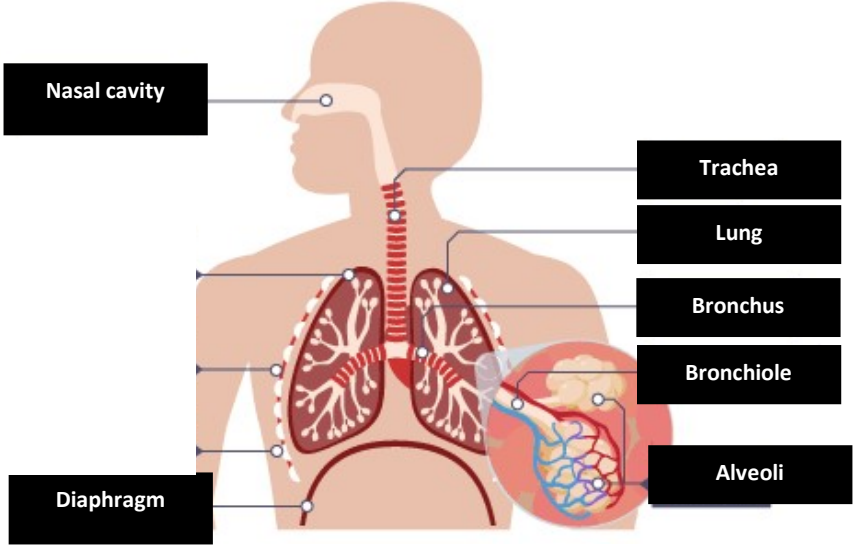
Denaturation



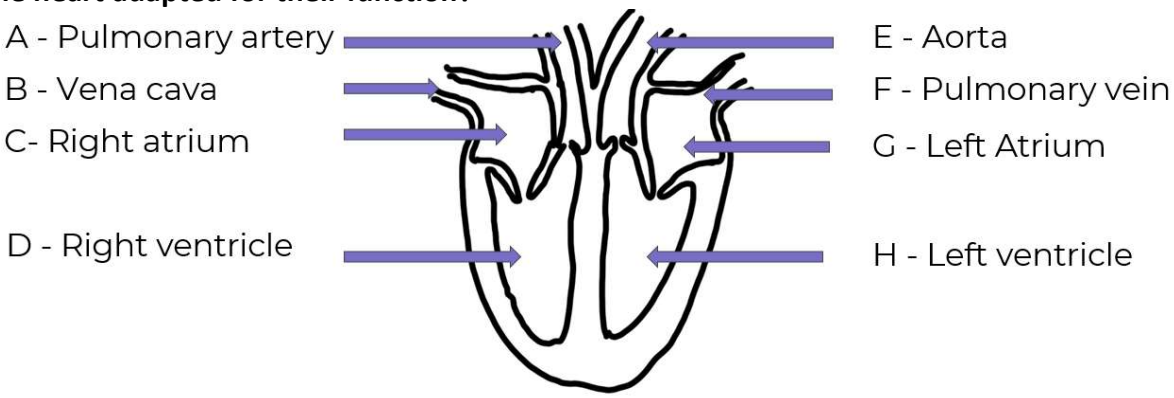
What are some of the key enzymes?



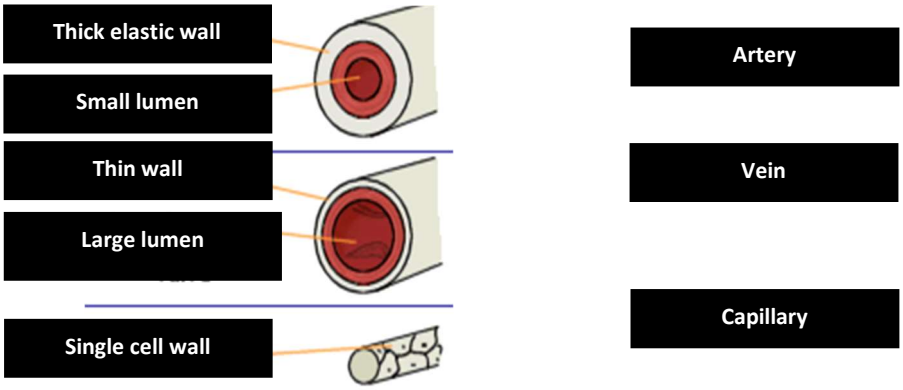
How are the lungs adapted for their function?



How is the heart adapted for their function?



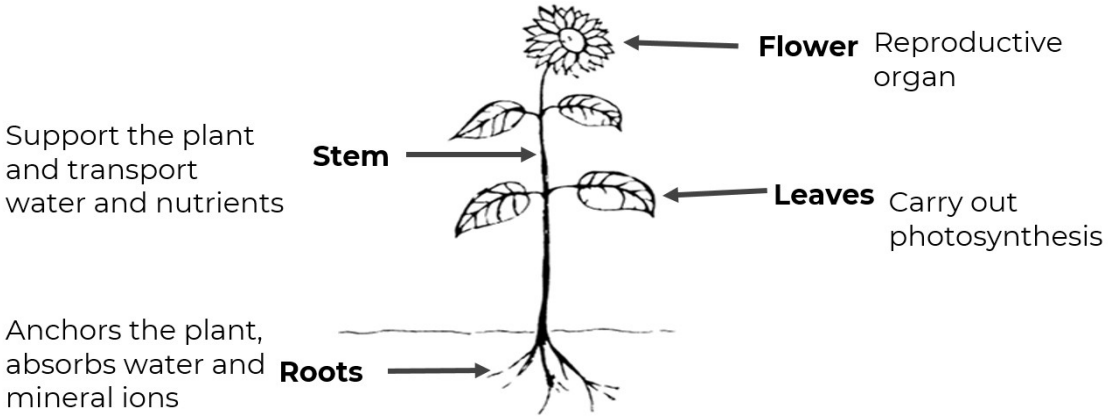
How are blood vessels adapted for their function?



What is the function of blood?

Blood Component	Function
Red Blood Cells	Carries oxygen around the body
White blood cell	Defend the body against pathogens
Platelets	Involved in blood clotting
Red Blood Cells	Carries oxygen around the body

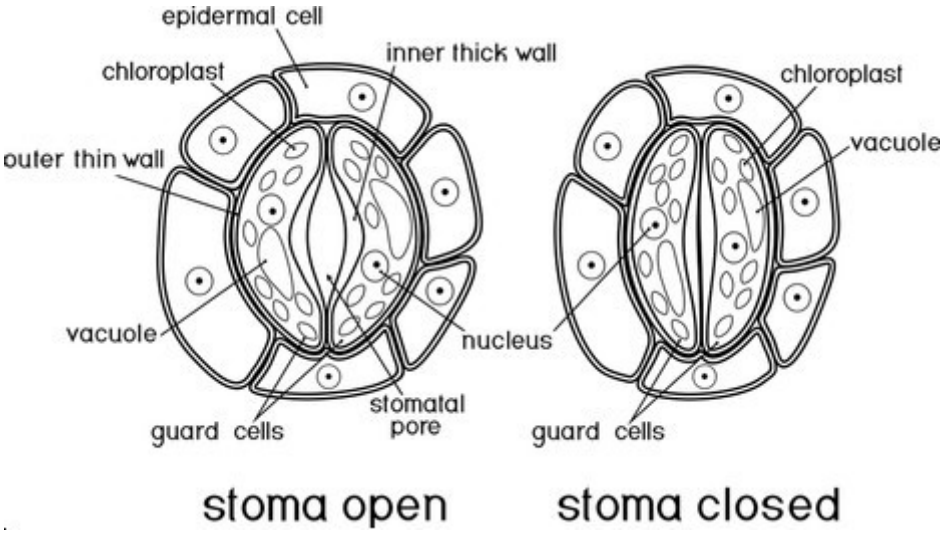
How is a plant structured?



Epidermis	**Cover** the **surfaces** of the leaf; lets **light penetrate**.59	**Palisade mesophyll**	Where **most photosynthesis** takes place. Cells contain **many chloroplasts**. **Absorbs light**.
Xylem	**Carries water** and **minerals** from the roots around the plant.	**Spongy mesophyll**	**Some photosynthesis**. Has **air spaces** for **diffusion** of CO_2 and O_2.
Phloem	**Carries dissolved sugars** made through photosynthesis around the plant. 6	**Guard cells**	Cells that **open** and **close stomata**.

What is the function of stomata?

Stoma	Opening that allows CO_2 and O_2 to diffuse in and out of the leaf.



What are translocation and transpiration?

Transpiration	Translocation
Movement of water through the stomata	Movement of sugars and nutrients from leaves to other plant parts
Water is transported	Sucrose is transported
Water moves upwards only in the xylem	Movement any direction by phloem
Involves dead cells	Involves living cells

Science Homework 2

Complete the final section of the homework workbook identified on the front and learn the key knowledge questions and answers for all of the areas covered in this knowledge organiser ready for the end of term test.

Key knowledge question	Answer
Where is the enzyme amylase made and what does is do?	Made in the salivary glands, pancreas and small intestine -> Amylase digests (breaks down) starch into sugar (glucose)
Where is the enzyme protease made and what does is do?	Made in the stomach, pancreas and small intestine -> Protease digests (breaks down) protein into amino acids
Where is the enzyme lipase made and what does is do?	Made in the pancreas and small intestine -> Lipase digests (breaks down) fats into fatty acids and glycerol
What is the purpose of digestion?	Break down of large insoluble molecules into small soluble molecules so that they can be absorbed into the bloodstream.
What are the products of digestion used for?	To build new molecules and glucose is used in respiration
State the function of arteries and describe their adaptations	Arteries, carry blood away from the heart, thick elastic and muscular walls to withstand high pressure
State the function of veins and describe their adaptations	Veins, carry blood towards the heart, contain valves to prevent back flow
State the function of capillaries and describe their adaptations	Capillaries, exchange of substances, one cell thick (short diffusion path)
What is the function of red blood cells and how are they adapted?	Red blood cells, transport oxygen -> contain haemoglobin, biconcave in shape, no nucleus
What is transpiration?	The movement of water through a plant from the roots to the leaves

P5 Forces

Big questions:

What are forces and how do we describe them?
How can we find the resultant force on an object?
How do we calculate the weight of an object?
How do we calculate the work done by a force?
How do forces change the shape of things?
How can we investigate the relationship between force and extension?
How can we calculate the energy stored in a spring?
How is velocity different from speed?
What does a distance-time graph show us?
What is acceleration and how is it calculated?
What does a velocity-time graph show us?
What are Newton's first and second laws of motion?
What factors affect the acceleration of an object?
What is Newton's third law of motion and what does it tell us?
What affects the stopping distance of a car?
How do we find the momentum of an object?

Key vocabulary

Contact force	A force that only occurs when two objects are touching. e.g. friction, air/water resistance, normal contact force etc.
Non-contact force	A force that occurs between two objects that are not touching e.g. gravitational force, magnetic force, electric force
Scalar quantity	A scalar quantity only has magnitude (size). e.g. distance, speed, mass.
Vector quantity	A vector quantity has magnitude and direction. e.g. displacement, velocity, force
Resultant force	The overall force on an object taking the direction of all the forces into account.
Work done	Energy transferred by a force. Work done = force x distance moved
Velocity	Speed in a given direction.
Acceleration	Change in speed per unit time.
Directly proportional	If one variable doubles, the other variable doubles.
Inversely proportional	If one variable doubles, the other variable halves.
Stopping distance	The distance travelled between seeing a hazard and coming to a stop. Stopping distance = thinking distance + braking distance
Thinking distance	The distance travelled between seeing a hazard and pressing the brakes.
Braking distance	The distance travelled between pressing the brakes and coming to a stop
Momentum	The tendency for an object to keep moving with the same velocity.

What are forces and how do we describe them?

Forces are an interaction between two objects. We can describe forces using the phrase "the _____ force of the _____ on the _____"

e.g. The gravitational force of the Earth on the book.

Contact forces - A force that only occurs when two objects are touching. e.g. friction, air/water resistance, normal contact force etc.

Non-contact force - A force that occurs between two objects that are not touching e.g. gravitational force, magnetic force, electric force

How can we find the resultant force on an object?

The resultant force is the overall force taking the direction of all the forces into account e.g. if a car has a forward force of 50N and a friction force of 20N the resultant will be 50-20 = 30N forwards.

How do we calculate the weight of an object?

Weight = mass x gravitational field strength W = mg

g = 9.8 N/kg on Earth.

How do we calculate the work done by a force?

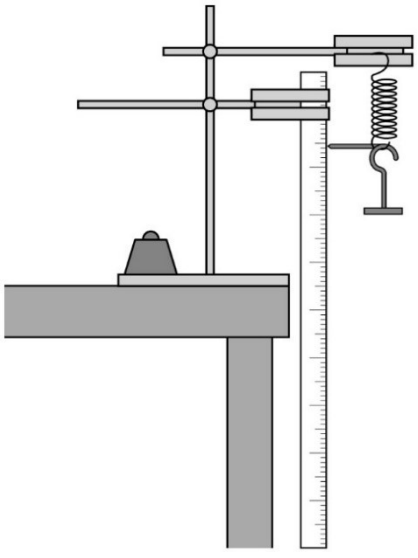
Work done = Force x distance W = Fs

How do forces change the shape of things?

Hooke's law: the force on a spring is directly proportional to the extension of the sprint up to the limit of proportionality.

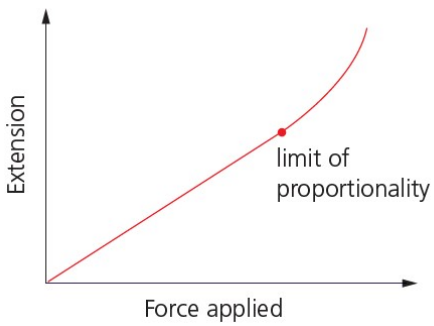
Force = spring constant x extension F = ke

How can we investigate the relationship between force and extension?



1) the original length of the spring with no mass on it.
2) Add a mass and measure the new length.
3) Calculate the force = mass x gravitational field strength
4) Calculate the extension = new length – original length.
5) Repeat steps 2 and 3 for a range of masses

Plot a graph for extension vs force. The graph should be a straight line through 0,0 (directly proportional) up to the limit of proportionality where the graph starts to curve.



Science Homework 3

Complete the section of the homework workbook identified on the front of this Knowledge organiser and learn the key knowledge questions and answers ready for the knowledge quiz.

How can we calculate the energy stored in a spring?

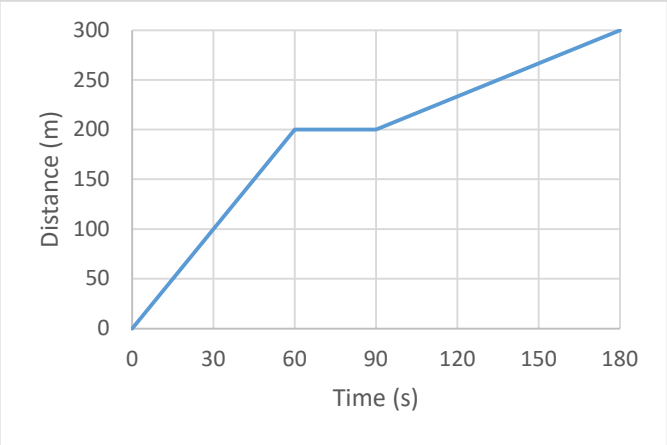
Elastic potential energy = 0.5 x mass x (extension)^2 $E_e = ½ ke^2$

How is velocity different from speed?

Velocity is speed in a given direction.

Speed = $\frac{\text{distance}}{\text{time}}$ velocity = $\frac{\text{displacement}}{\text{time}}$ average speed = $\frac{\text{total distance}}{\text{total time}}$

What does a distance-time graph show us?



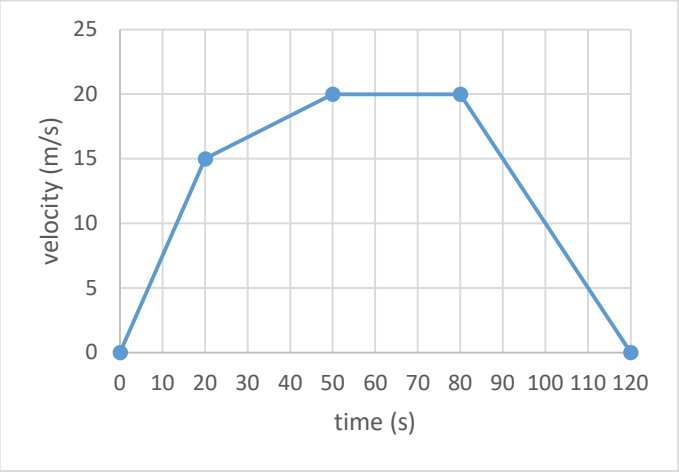
- horizontal line = stationary
- gradient = velocity (or speed)
- the steeper the gradient the faster the object
- A curved line means the object is accelerating or decelerating

What is acceleration and how is it calculated?

Acceleration = = $\frac{\text{change in speed}}{\text{time}}$ $a = \frac{v-u}{t}$

Where v is final velocity and u is initial velocity

What does a velocity-time graph show us?



- horizontal line = constant velocity (speed)
- gradient = acceleration
- the steeper the gradient the greater the acceleration
- negative gradient = deceleration (slowing down)
- area under graph = displacement

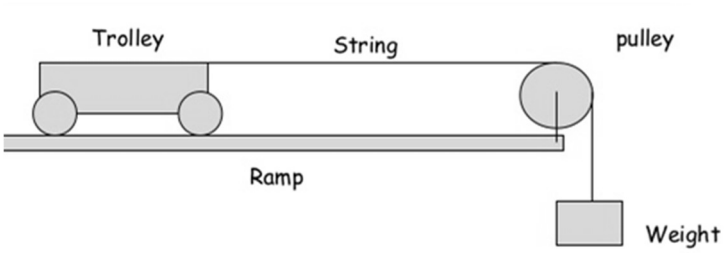
What are Newton's first and second laws of motion?

Newton's First Law: if the resultant force on an object is zero, the object will remain stationary or moving at constant velocity

Newton's Second Law: the acceleration of an object is directly proportional to the resultant force on the object and inversely proportional to the mass of the object.

Force = mass x acceleration F = ma

What factors affect the acceleration of an object?



Newton's Second Law can be investigated by:

- Changing the force pulling a trolley and measuring the time for the trolley to travel 1m.
- Adding mass on top of the trolley and measuring the time for the trolley to travel 1m.
- The shorter the time, the greater the acceleration.

What is Newton's third law of motion and what does it tell us?

Forces always come in pairs as an interaction between two objects.

Newton's Third Law: If object A exerts a force on object B, object B exerts an equal and opposite force on object A.

What affects the stopping distance of a car?

Stopping distance	The distance travelled between seeing a hazard and coming to a stop. Stopping distance = thinking distance + braking distance
Thinking distance	The distance travelled between seeing a hazard and pressing the brakes.
Braking distance	The distance travelled between pressing the brakes and coming to a stop

Stopping distance is the distance travelled between seeing a hazard and coming to a stop.

Stopping distance = thinking distance + braking distance

Thinking distance is the distance travelled between seeing a hazard and pressing the brakes.

Thinking distance is related to the driver's reactions times which is affected by: age, tiredness, alcohol or drugs, distractions. The speed of the car also affects thinking distance.

Braking distance is the distance travelled between pressing the brakes and coming to a stop.

Braking distance is affected by: the road condition (e.g. wet, icy), the condition of the tyres and brakes, the speed of the car, the mass of the car.

How do we find the momentum of an object?

Momentum = mass x velocity $p = mv$

The total momentum before a collision is equal to the total momentum after the collision.

Key knowledge question	Answer
What is a scalar quantity?	a quantity with magnitude only
What is a vector quantity?	a quantity with magnitude and direction
Write the equation that links weight, mass and gravitational field strength	W = mg weight = mass x gravitational field strength
Write the equation that links force, spring constant and extension	F = ke Force = spring constant x extension
Write the equation that links speed, distance and time	speed = distance / time
Write the equation for acceleration	a = (v-u) / t acceleration = change in speed / time or acceleration = (final velocity - initial velocity) / time
What does a horizontal line on a distance-time graph mean?	the object is stationary
What does a straight diagonal line on a distance-time graph mean?	the object is moving at constant speed
What does a horizontal line on a speed-time graph mean?	the object is moving at constant speed
What does a diagonal line on a speed-time graph mean?	the object is accelerating at a constant rate
Describe the forces when a falling object reaches terminal velocity	weight = (-) drag
Complete Newton's first law: If the resultant force on an object is zero it will remain _____ or travelling at _____.	stationary, constant velocity (in that order)
Complete Newton's second law: the acceleration of an object is directly proportional to the _____ on the object and inversely proportional to the _____ of the object.	force, mass (in that order)
Complete Newton's third law: if object A exerts a force on object B, object B exerts an _____ and _____ force on object A.	equal, opposite (in either order)
Write the equation that links force, mass and acceleration	Force = mass x acceleration
Write the equation that links stopping distance, thinking distance and braking distance	stopping distance = thinking distance + braking distance
Define thinking distance	The distance travelled between seeing a hazard and pressing the brakes
Define braking distance	The distance travelled between pressing the brakes and coming to a stop
Define stopping distance	Thinking distance + braking distance
State 2 factors that affect thinking distance	tiredness, age, influence of drugs/alcohol, distractions, speed of the car
State 2 factors that affect stopping distance	condition of tyres, condition of brakes, road surface, ice/water on the road, speed of the car
Write the equation that links momentum, mass and velocity	p = mv momentum = mass x velocity

Wider reading

How to get the most out of your knowledge organiser:

- To get the most use out of the knowledge organisers you should be learning sections and then self-testing.

- There are several different things you can do
  - Look, cover, write, check, correct
  - Read through the organisers
  - Mind maps
  - Key spellings
  - Make a glossary
  - Missing out key words
  - Questions/answers answers/questions
  - Flash cards
  - Revision clock learning
  - Mnemonics

Science Learning Tools and wider study:

The Oak Academy – Online Science lessons
BBC Bitesize science
<u>You tube channels:</u>
Fuse school
Ted talks
Free science lessons
Primrose Kitten
<u>Shows on Netfilx</u>
Our planet
Tiny creatures
A life on our planet