Knowledge Revision

AQA Entry Level Certificate in Science

Physics Topic 5 – Energy and Forces

You **need to master** and be able to recall the facts so that you can make progress and complete the external assignments to the best of your ability.

You can use Google or revision guides to help you. You can email me any questions or use Zoom if you'd like some immediate face to face help.

You will need to use Zoom when we complete the assignments.

Email: jdixon@desc.herts.sch.uk

Zoom:

- Download 'Zoom' app
- Sign up for an account
- Select 'Meet & Chat' on the bottom bar
- Select 'Join' – blue + symbol at the top of the screen
- Enter meeting ID: **960 412 5303**

Name …….

P5.1 Changes in energy storage

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Energy is stored in different forms.			
There are eight energy stores – gravitational potential, elastic, magnetic, nuclear, internal (thermal), chemical, kinetic, electrostatic.			
Energy can be transferred from one store to another. This is usually by one of four processes – electrically, by radiation, thermally or mechanically.			
Energy is never created or destroyed. This means that the amount of energy you put into a system will be the same as the amount of energy at the end. However, the energy may have changed where it is stored or how it is stored.			
When energy is transferred some of it gets transferred to the surroundings, usually as heat. This is un-useful energy and we say it has been dissipated.			
Energy is never wasted or lost.			

Essential Questions

1. When is energy trasnferred?
2. What happens to energy that does not successfully make it from one store to another?
3. Why is energy so difficult to describe?
4. In these examples describe what happens to different energy stores and how energy moves between one store and another:
    - START: bungee jumper leaps off a high bridge → END: bungee cord reaches its full stretch.
    - START: circuit linked to a battery is switched on → END: light bulb in the circuit lights up.

STRENGTHEN

- 100 joules of energy is used to make a light bulb work. This comes from the electricity supply. Some of the energy is transferred to the surroundings as heat. How much total energy will there be in the system after ten minutes?
- Think of a word or picture to help you remember the eight energy stores.

EXTEND

- Are all energy transfers useful?
- ***Describe*** the energy changes that take place in a simple system such as a kettle boiling and person riding a bicycle uphill.

You should be able to give definitions for the following words:

Key word	Definition
Chemical energy	
Elastic potential energy	
Energy	
Energy store	
Energy resource	
Gravitational potential energy (GPE)	
Kinetic energy (KE)	
Thermal (internal) energy	

P5.2 Energy transfers and efficiency

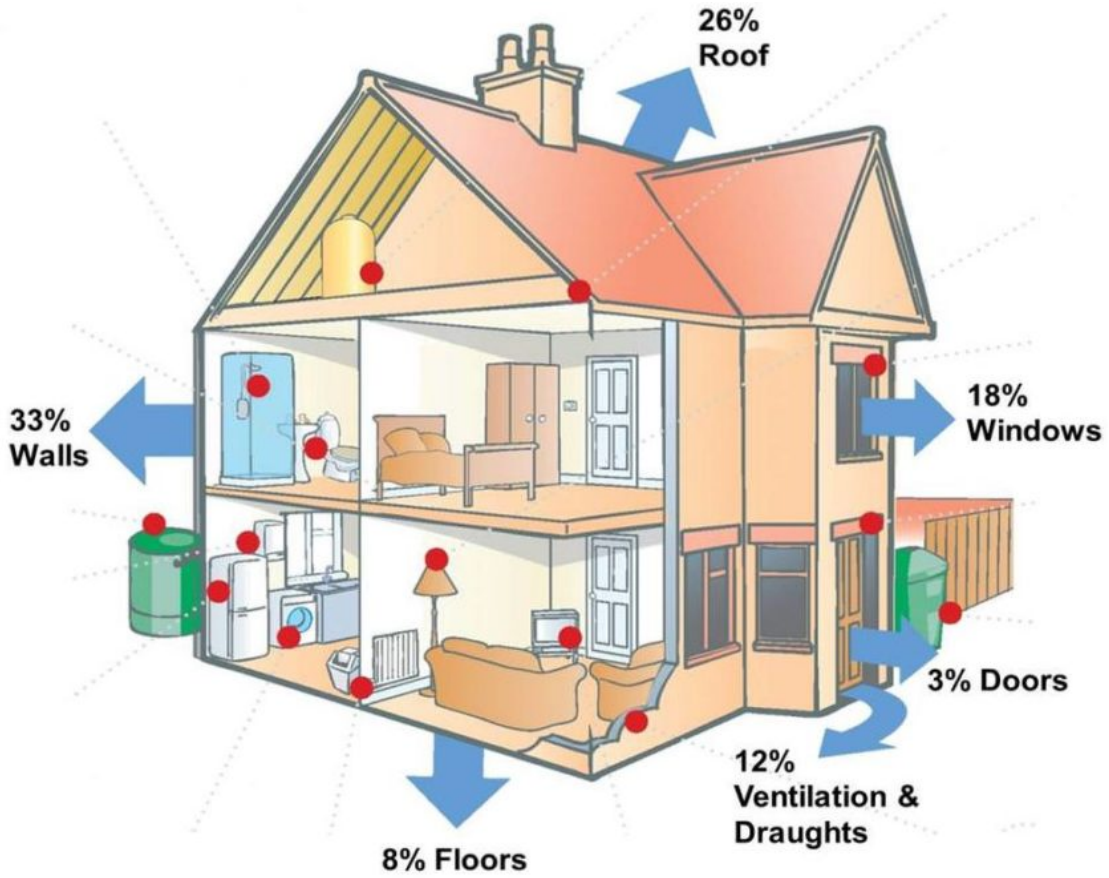
KEY LEARNING POINTS – Assess as you go!

	R	A	G
Energy cannot be created or destroyed but can be transferred and transformed.			
Not all energy is transferred usefully. Usefully means the energy is doing the job we intended it to do.			
Efficiency explains the idea of useful energy transfers. The more energy is transferred in a useful way, the more efficient the system (machine) is.			
Many machines carry out un-useful energy transfers due to rubbing parts creating friction and releasing thermal energy.			
These unwanted energy transfers can be reduced by reducing friction through lubrication or by trapping the thermal energy using insulation.			
Materials that let thermal energy pass through them easily are called thermal conductors.			
Materials with high thermal conductivity allow heat to pass across them quickly.			
Walls with thicker buildings usually have a low thermal conductivity – they are slower to lose thermal energy.			

Essential Questions

1. Four walls are painted different colours. A bright light is shined on the wall. Put them in order of which surface heats up the quickest:
    a. Dull, black
    b. Dull, white
    c. Shiny, white
    d. Shiny, black

2. What is the difference between a conductor and an insulator?
3. How does thermal energy travel from the Sun to Earth?
4. What makes some machines more efficient than others?
5. In the UK it is important to insulate your home to keep it worm. Add notes and further illustrations to the digram on the next page to show how this might be done. The numbers on the diagram show how much thermal energy is being lost in each area.



CORE

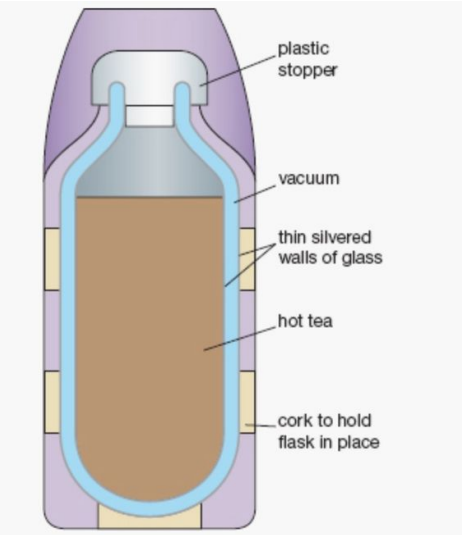
1. Which direction does thermal energy move? Is it from cold to hot, or from hot to cold? Think of an example to convince the teacher.

2. Which of these materials are good conductors of heat (also known as thermal conductors)? What do the other materials have in common?
    a. Wood
    b. Steel
    c. Copper
    d. Brick
    e. Paper
    f. Pencil graphite
    g. Plastic

EXTEND

1. ***Explain*** why marathon runners who has just completed the race are often wrapped in a foil blanket.

2. ***Explain*** how the thermos flask, like the one shown in the picture, keeps a hot drink hot.



You should be able to give definitions for the following words:

Key word	Definition
Absorber	
Conductivity	
Dissipated	
Efficiency	
Emitter	
Insulation	
Lubrication	
Matt	
Radiation	
Shiny	
Thermostat	

P5.3 Energy resources

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Energy resources are used for generating electricity, releasing heat or as fuel.			
Energy resources include fossil fuels – coal, oil and natural gas. These substances formed millions of years ago from dead organisms.			
Some energy resources are renewable, e.g. bio-fuel, wind, hydroelectricity, geothermal, the tides, the sun and water waves.			
Some energy resources are non-renewable; once they are used, they are gone forever. This includes fossil fuels and nuclear fuel.			
In a power station a fuel is often used to heat water until it changes into steam. The steam turns a turbine linked to a generator.			

Essential Questions

1. What are the main energy resources available on Earth, that are used for generating electricity.
2. What is the difference between a renewable and non-renewable energy resource?
3. Complete the table about renewable resources:

Resource	***How does it work?***
Biofuel, e.g. straw, ethanol from sugar cane	
Water in hydroelectricity	
Wind (turbines)	
Solar	
Geothermal – natural heat from inside the Earth	
Tides – natural rise and fall of water	

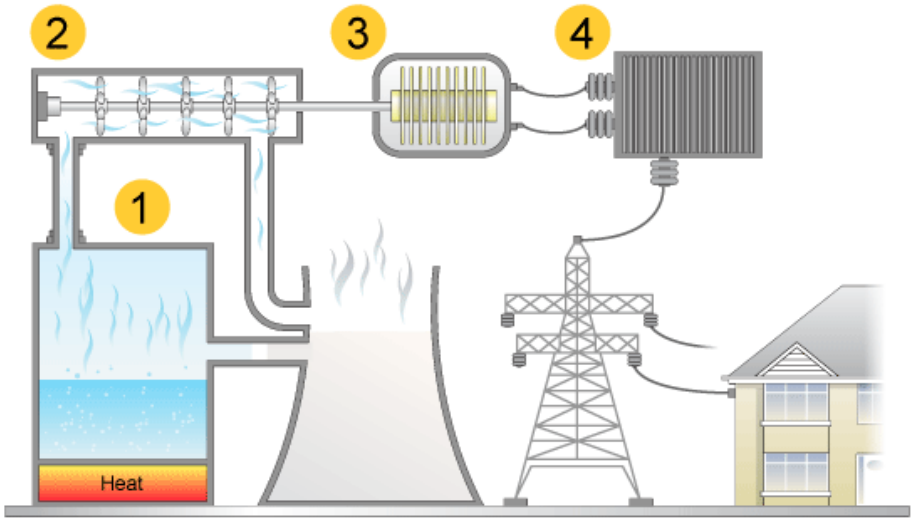
CORE

Name three non-renewable and three renewable energy resources.

For each one give an advantage and a disadvantage.

EXTEND

Use the diagram to explain how electricity is generated using fossil fuels.



You should be able to give definitions for the following words:

Key word	Definition
Fossil fuel	
Generator	
Geothermal	
Hydroelectric	
Nuclear reactor	
Power station	
Radioactive	
Renewable	
Solar cell	
Turbine	

P5.4 Types of forces

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Forces are pushes, pulls, bends and twists.			
Forces act on objects and can bring about changes such as speed, direction and shape.			
Forces are either contact forces when objects are touching, or non-contact forces when objects are not touching.			
Some forces have names, e.g. friction, gravity, magnetic and electrostatic.			

Essential Questions

1. Name two contact forces and two non-contact forces. How are they different?
2. When does friction occur?
3. What is tension?

CORE

Think of a named force. Write a sentence describing this force as a push or a pull and as a contact or non-contact force.

EXTEND

Explain how communication satellites stay in orbit around the planet.

Explain why a skydiver falls towards the planet.

You should be able to give definitions for the following words:

Key word	Definition
Air resistance	
Electrostatic force	
Force	
Friction	
Gravitational force	
Magnetic force	

P5.5 The effect of forces

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Forces can cause an object to move and the distance moved can be measured. In science this is describing 'work'.			
Friction will make it more difficult for an object to move when a force is applied.			
Friction (rubbing) will cause the temperature of the object to go up.			

Essential Questions

1. Describe two examples that show work is being done. (You will need to name the object, the type of force and the distance moved)
2. Why do moving objects, such as a drill bit, get hot.

CORE

Complete the sentences:

The bigger the _____, the more work is done. The bigger the distance an object is moved by a force, the more _____ is done.

EXTEND

Friction can cause a temperature increase. Give one example of where this increase in temperature is useful. Give one example of where this increase in temperature is not useful.

You should be able to give definitions for the following words:

Key word	Definition
Work	
Newtons	

P5.6 Speed

KEY LEARNING POINTS – Assess as you go!

	R	A	G
To measure speed, you must know the distance travelled and the time it took.			
Average speed = distance / time			
Speed units includes meters per second, kilometres per hour and miles per hour.			

Essential Questions

1. What is speed?
2. Use the equation: speed = distance / time. You MUST show your working out.
    a. What is the speed of a plane travelling 2000 km in 4 hours?
    b. What is the speed of a car travelling 10 km in 30 minutes?
    c. What is the speed of a sprinter covering 100 metres in 9.95 seconds?

STRENGTHEN

How would you carry out an experiment to find out the fastest 100 m sprinter in your class?

What is the best way to analyse the data and present the findings to the group?

EXTEND

How would you carry out an experiment to investigate the impact of speed on car safety? You can use model toy cars in your tests.

You should be able to give definitions for the following words:

Key word	Definition
Speed	

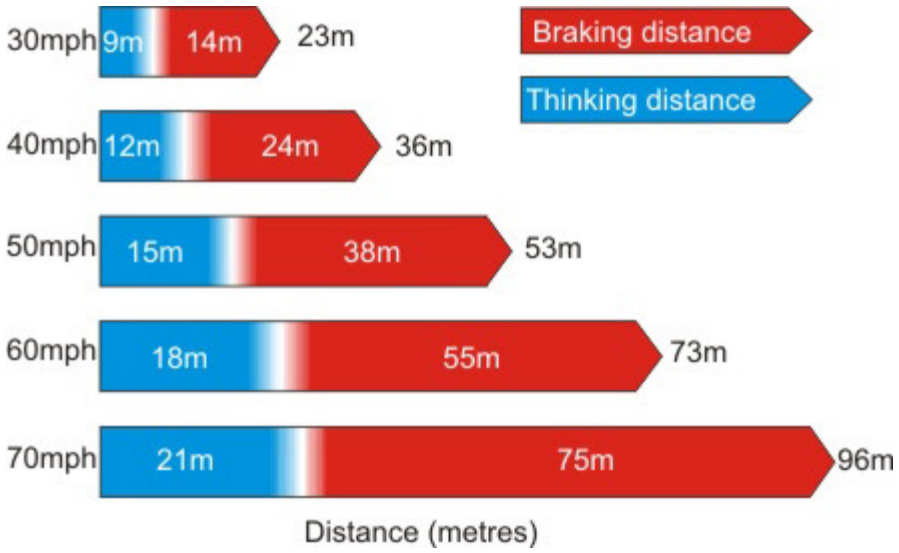
P5.7 Stopping distances

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Thinking distance is the distance travelled by a car whilst you are reacting.			
Braking distance is the distance travelled by a car once the brake is used.			
Stopping distance = thinking distance + braking distance			
The faster a car is travelling, the longer the stopping distance.			

Essential Questions

1. What factors are likley to make thinking distance longer?
2. What factors are likely to make braking distance longer?
3. Use this diagram from The Highway Code to answer the following questions:
    a. What is the braking distance for a car travelling at 30 mph?
    b. What is the thinking distance for a car travelling at 50 mph?
    c. What is the overall stopping distance for a car travelling at 70 mph?
    d. At approximately what speed is a car travelling at if it takes 70 m to come to a full stop?



CORE

Icy road conditions can increase the stopping distance of a family car by double. Using data from The Highway Code diagram on the previous page, ***suggest*** how to drive safely on an icy day.

EXTEND

Using information from The Highway Code diagram on the previous page, ***suggest*** why the speed limit outside schools is often 30 mph and sometimes 20 mph.

You should be able to give definitions for the following words:

Key word	Definition
Braking distance	
Braking force	
Stopping distance	
Thinking distance	

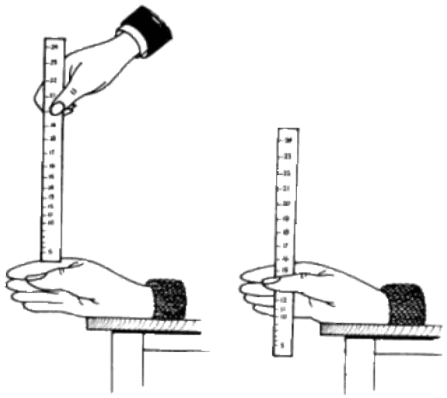
P5.8 Reactions times and stopping distances

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Different people have different reaction times. They range from about 0.2 s to 0.9 s.			
A driver's reaction time will be increased (longer) if they are tired or have been drinking alcohol.			
Reaction time can also increase when a driver is distracted, such as when using a mobile phone.			
A simple ruler-drop experiment can be used to measure reaction time.			

Essential Questions

1. Name three things that might make your reaction time slower?
2. Describe how to carry out a ruler-drop experiment to find out the reaction time of two different students. Include the following information:
    - Method – instructions on how to carry out the experiment
    - How many times you will repeat the ruler drop and why?
    - What you will measure.
    - What you will do if the rsults for one person are very different.
    - What you will do with the results.



STRENGTHEN

What happens to a persons' reactions if the reaction time increases?

EXTEND

1. ***Suggest*** what will happen in the ruler-drop experiment if you measure reaction time before and after drinking a caffeinated drink.

2. A second group of students investigate reaction time using a computer generated test. Which investigation do you think will produce the most accurate data? Why?

You should be able to give definitions for the following words:

Key word	Definition
Reaction	
Reaction time	

P5.9 Weather conditions and braking distances

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Braking distance is the distance travelled by a car once the brake is used.			
Braking distance increases in adverse road and weather conditions, e.g. if the road is poorly looked after and in ice and rain.			
Tyre condition can also change braking distance.			

Essential Questions

1. Which two factors make up overall stopping distance?
2. Give examples of the type of conditions that increase braking distance?
3. Why is braking distance longer in wet conditions?
4. What two parts of a car need to be maintained for good braking?

CORE

Describe the dangers of driving too quickly on a wet day.

EXTEND

Explain how the depth of tread on a car's tyre is important in road safety.

You should be able to give definitions for the following words:

Key word	Definition
Tread	

P5.10 Radioactivity

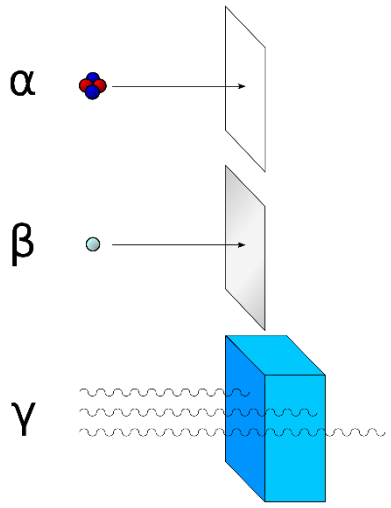
KEY LEARNING POINTS – Assess as you go!

	R	A	G
The nucleus of an atom gives out ionising radiation in a process called radioactive decay.			
There are three types of ionising radiation: - Alpha particles - Beta particles - Gamma rays			
Radiation can be stopped by materials of various thicknesses.			

Essential Questions

1. What is nuclear radiation?
2. The different types of ionising radiation have different penetrating power. Complete the table.

Radiation	***Symbol***	***Blocked by:***
Alpha		
Beta		
Gamma		



CORE

Each type of nuclear radiation can be used safely but also has its dangers. Complete the table:

Type	***Uses***	***Dangers***
Alpha		
Beta		
Gamma		

EXTEND

Using information from the table above, ***evaluate*** the use of gamma rays to treat cancerous cells.

You should be able to give definitions for the following words:

Key word	Definition
Alpha particle	
Beta particle	
Emit	
Gamma ray	
Ionising radiation	
Nucleus	
Penetration	
Radioactivity	
Range	