Year 7 Term 1 Science

Home Learning

Name ____________________

Teacher ____________________

Class ____________________

Year 7 Home Learning Booklet – Term 1

Instructions:

- Complete 1 section per week
- Bring this booklet to the lesson specified by your teacher for them to check
- Your work will either be self-assessed or marked by your teacher

Home Learning Number	Day & Date to Hand In	Week	Period	Checked by Teacher
1		A B		
2		A B		
3		A B		
4		A B		
5		A B		
6		A B		

Periodic Table and GCSE Physics Equations are on pages 2 and 3

The Periodic Table

Key

relative atomic mass **atomic symbol** name atomic (proton) number

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	[285] **Cn** copernicium 112	[286] **Uut** ununtrium 113	[289] **Fl** flerovium 114	[289] **Uup** ununpentium 115	[293] **Lv** livermorium 116	[294] **Uus** ununseptium 117	[294] **Uuo** ununoctium 118

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

GCSE Physics Equations 1

HT = Higher Tier only equations

kinetic energy = 0.5 × mass × (speed)^2	$E_k = \frac{1}{2}\ m\ v^2$
elastic potential energy = 0.5 × spring constant × (extension)^2	$E_e = \frac{1}{2}\ k\ e^2$
gravitational potential energy = mass × gravitational field strength × height	$E_p = m\ g\ h$
change in thermal energy = mass × specific heat capacity × temperature change	$\Delta E = m\ c\ \Delta\theta$
power = $\frac{\text{energy transferred}}{\text{time}}$	$P = \frac{E}{t}$
power = $\frac{\text{work done}}{\text{time}}$	$P = \frac{W}{t}$
efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$	
efficiency = $\frac{\text{useful power output}}{\text{total power input}}$	
charge flow = current × time	$Q = I\ t$
potential difference = current × resistance	$V = I\ R$
power = potential difference × current	$P = V\ I$
power = (current)^2 × resistance	$P = I^2\ R$
energy transferred = power × time	$E = P\ t$

GCSE Physics Equations 2

	energy transferred = charge flow × potential difference	$E = Q\,V$
HT	**potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil**	$\boldsymbol{V_p\,I_p = V_s\,I_s}$
	density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
	thermal energy for a change of state = mass × specific latent heat	$E = m\,L$
	weight = mass × gravitational field strength	$W = m\,g$
	work done = force × distance (along the line of action of the force)	$W = F\,s$
	force = spring constant × extension	$F = k\,e$
	distance travelled = speed × time	$s = v\,t$
	acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{\Delta v}{t}$
	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2\,a\,s$
	resultant force = mass × acceleration	$F = m\,a$
HT	**momentum = mass × velocity**	$\boldsymbol{p = m\,v}$
	period = $\frac{1}{\text{frequency}}$	$T = \frac{1}{f}$
	wave speed = frequency × wavelength	$v = f\,\lambda$
HT	**force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density × current × length**	$\boldsymbol{F = B\,I\,l}$

Week 1 – Scientific Skills

1. Choose the correct word to describe what the table shows:

a)

Mass (g)	Speed (m/s)
1	10
2	8
3	6
4	4
5	2

As the mass increases, the speed **increases/decreases.**

b)

Length (cm)	Volume (cm^3)
10	50
20	100
30	150
40	200
50	250

As the **length/mass** increases, the volume **increases/decreases.**

c)

Time (s)	Speed (m/s)
5	3
10	6
15	10
20	14
25	20

As the time increases, the **speed/mass** increases.

Volume of Water (cm^3)	Height of Plant (cm)
5	3
10	6
15	8
20	10
25	13

2. Describe what this table shows:

____

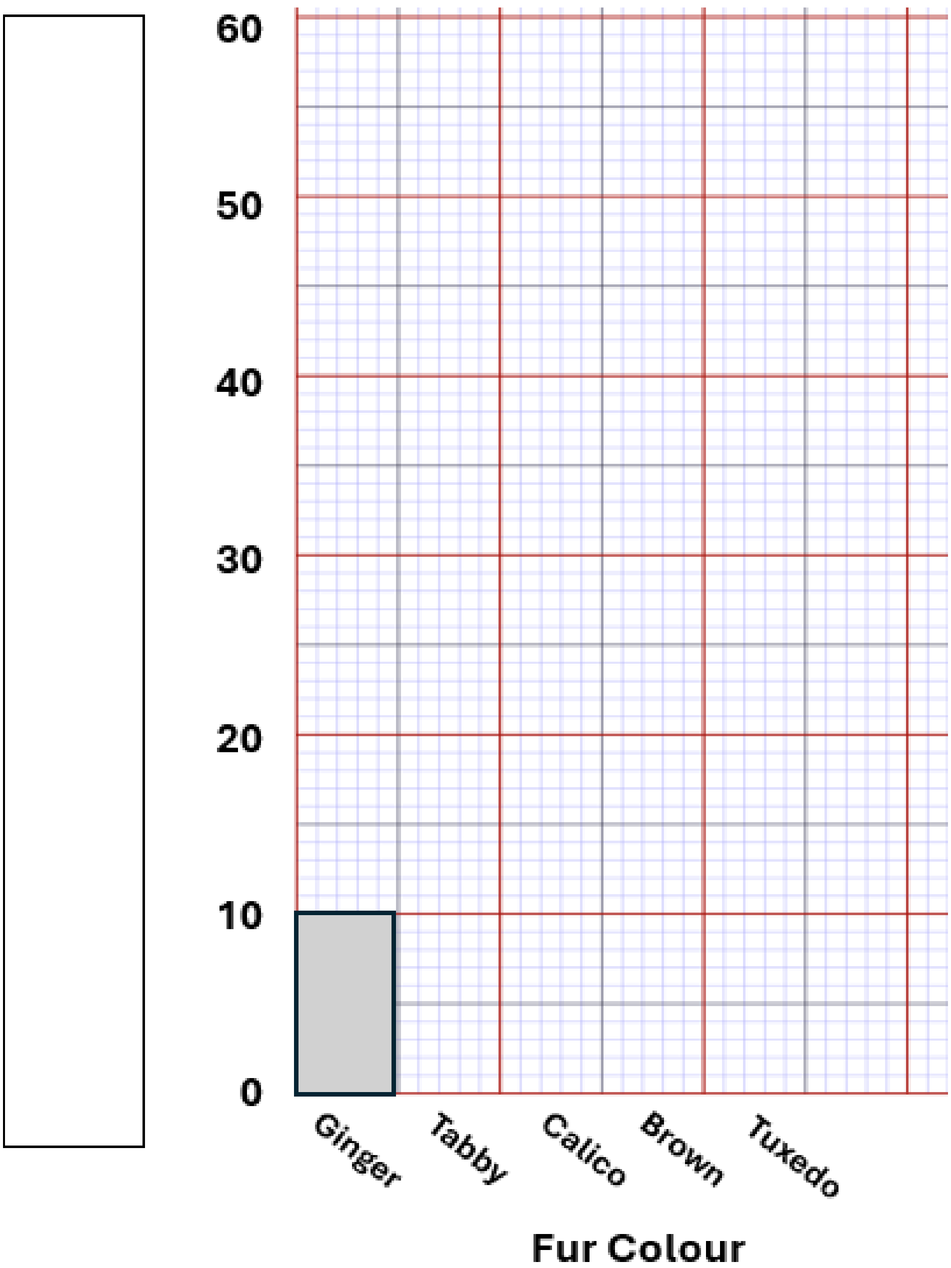
____

____

3. Label the y-axis of the graph with the dependent variable.

4. Plot the data from the table into the graph. The first one has been done for you.

Fur Colour	Number of Cats
Ginger	10
Tabby	30
Calico	40
Brown	35
Tuxedo	55



Week 2 – Energy Stores

Energy is not a physical thing that we can see or touch. Different objects **store** energy in different ways. These are called **energy stores** and are listed below:

Name of store	Description of energy store	Examples of each energy store
Thermal	Any object with a **temperature** has a thermal energy store. The higher the temperature of an object, the more energy in the thermal energy store.	A hot cup of tea, hot bath water, a hot radiator.
Kinetic	Any object that is **moving** has a kinetic energy store. The faster the movement, the more energy in the kinetic energy store.	Cars/trains moving, somebody walking/running.
Gravitational potential	Objects at a **height above the ground** have a gravitational potential energy store. The larger the height above the ground, the more energy in the gravitational potential energy store.	A book on a high shelf, a bird standing on a high branch of a tree.
Elastic potential	When objects such as a spring or elastic band are **stretched** or **compressed** they store elastic potential energy. The larger the extension or compression, the larger the elastic potential energy store.	A stretched elastic band/spring/hair tie.
Chemical	Different **chemicals** store energy in their chemical energy store.	Food, fuel, batteries.
Nuclear	Energy that is stored in the **nucleus** of an atom is in the nuclear energy store.	Fuel in nuclear power plants. For example, uranium or plutonium.
Magnetic potential	When two **magnets** are held close together, they have a magnetic potential energy store.	Two magnets near each other.
Electrostatic potential	When **charges** are close together, they have an electric potential energy store.	Protons, electrons, any charged particle.

Q1. A helicopter is stationary and hovering above the ground. State the energy store that the helicopter has.

....

Q2. The helicopter now starts to move forwards. State another energy store that the helicopter now has.

....

Q3. While flying, the engine of the helicopter becomes warm. State the energy store that the engine of the helicopter has.

....

Q4. The helicopter uses a fuel called kerosene (similar to petrol). State the energy store that kerosene has.

....

Q5. Somebody is bungee jumping and jumps off a bridge. State what happens to their gravitational potential energy store as they fall.

....

Q6. As the person bungee jumps, they accelerate and get faster. State what happens to their kinetic energy store.

....

Q7. When the person gets to the bottom of their bungee jump, the bungee cord stretches. State what happens to its elastic potential energy store.

....

Q8. A remote controlled car has a battery that powers it. State the energy store that the battery has.

....

Q9. The remote controlled car accelerates forwards. State the energy store that it now has.

....

Q10. The battery of the remote controlled car becomes hot as it is being used. State which energy store has increased.

....

Q11. State the energy store that two charged particles close to each other have.

....

Q12. State the energy store that uranium fuel in a nuclear power plant has.

....

Q13. State the energy store that a chocolate bar has.

....

Week 3 – Energy Transfers

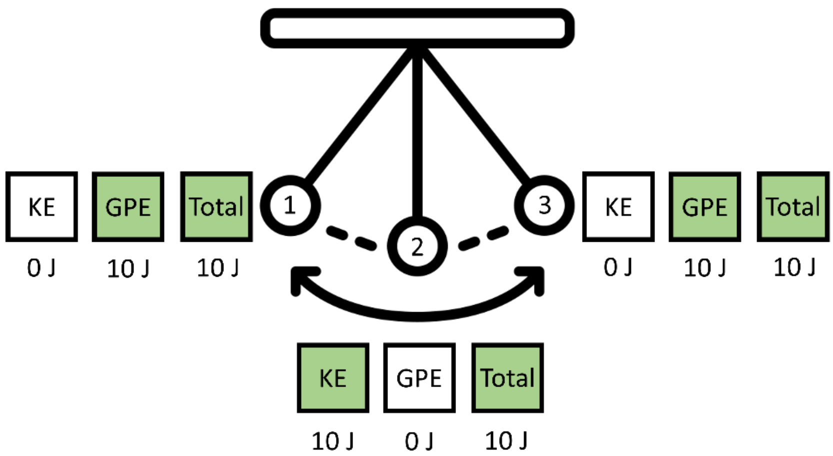
The **principle of conservation of energy** tells us that energy is never created or destroyed; it is only transferred from one energy store to another.

Energy has units of **Joules (J)**.

There are four **pathways** for energy to be transferred from one store to another:

1. **Mechanically**. Mechanical work is done on an object when a force is applied over a distance.
2. **Electrically**. Electrical work is done when charges move through a circuit.
3. By **heating**. The transfer of energy from a hotter object to a cooler object.
4. By **radiation**. This includes energy transferred by light (or any electromagnetic wave) and sound.

Note that the phrase "work" has been used in some of the pathways. "Work done" is just another way of saying energy transferred from one store to another.



The diagram to the right shows a pendulum swinging from side to side.

In position 1, the pendulum is at its maximum height and it has a gravitational potential energy (GPE) store of 10 J.

As the pendulum falls into position 2, gravity does mechanical work on the pendulum. The pendulum speeds up and becomes lower in height. Its GPE store empties, and its kinetic energy (KE) store fills to 10 J. Note how the overall amount of energy is the same, due to the principle of conservation of energy.

The pendulum then continues swinging to position 3. As it does so, its KE store empties and its GPE store fills back to the original 10 J. The pendulum is stationary at position 3 so it has no KE. It is also at its maximum height, so it has maximum GPE. The total energy is still unchanged.

The pendulum will eventually come to a stop, though. This is primarily due to air resistance. Generally, energy transfers are not 100% **efficient**. Energy is "wasted" by raising the thermal energy store of the surroundings. The temperature of the pendulum itself and of the nearby air will be raised slightly.

Q1. Describe the principle of conservation of energy.

Q2. Describe what it means when we say that work is done on an object.

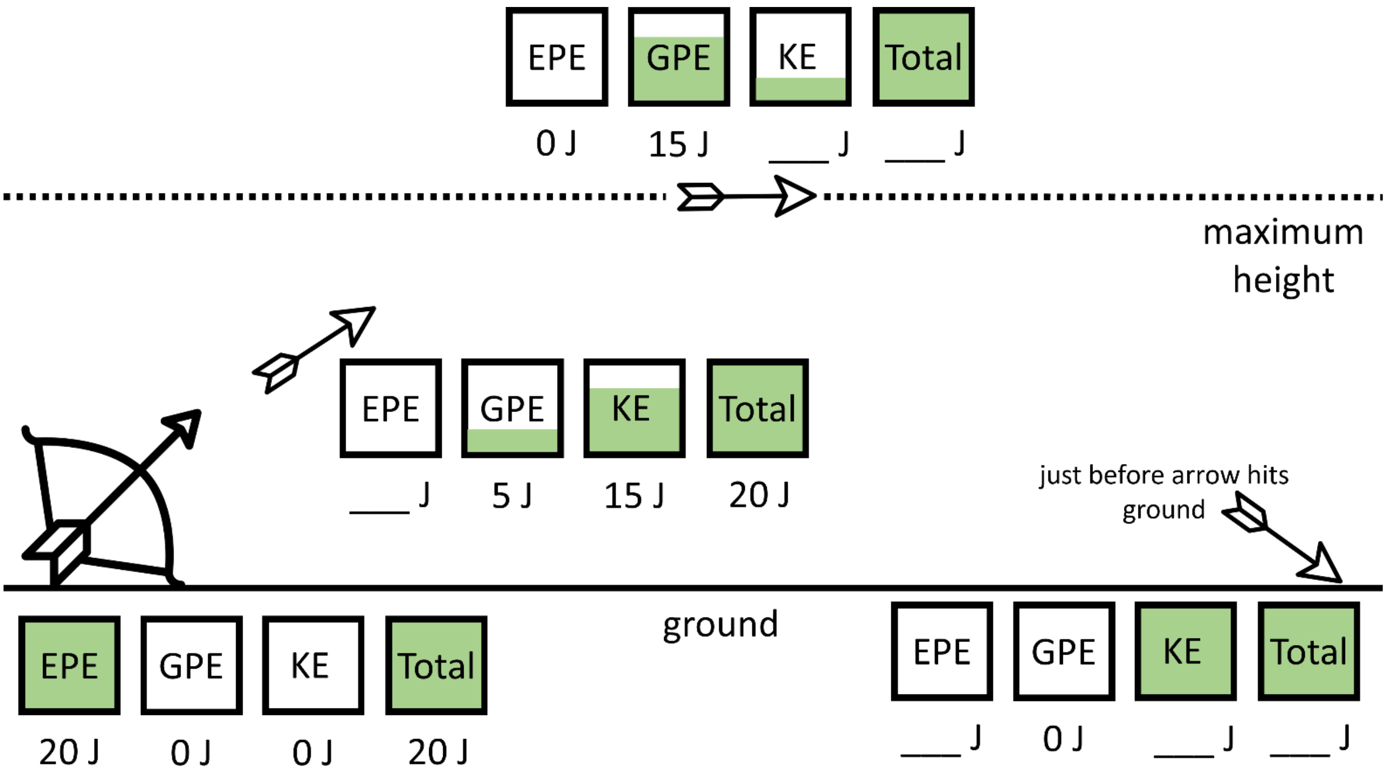
Q3. State the unit of energy.

Q4. A book is on a shelf and has an initial gravitational potential energy store of 30 J. It then falls off the shelf. State how much energy is in the kinetic energy store by the time the book reaches the ground.

Q5. In practice, the amount of energy in the kinetic energy store will be less than your answer to Q4. Describe why.

Q6. State the four pathways for energy transfer.

Q7. The diagram below shows the different energy stores involved in firing an arrow from a bow. The before the arrow is released, there is 20 J of energy in the elastic potential energy (EPE) store. Complete the missing energies after the arrow has been fired.



Week 4 – Power

Power is defined as the rate at which energy is transferred. Power has units of **watts (W)**.

There is an equation that relates power, energy and time:

Power = energy ÷ time or in symbols **$P = E \div t$**

Remember that energy has units of joules (J) and time has units of seconds (s).

We can also rearrange this equation to give:

Energy = power × time or in symbols **$E = P \times t$**

Example question 1:

A torch has a power of 5 W and is used for a time of 30 s. Calculate the energy used by the torch.

Step 1. Write down equation: **$E = P \times t$**

Step 2. Put variables into equation: **$= 5 \times 30$**

Step 3. Calculate answer. Remember units: **= 150 J**

Example question 2:

A toaster uses 20 000 J of energy in a time of 100 s. Calculate the power of the toaster

Step 1. Write down equation: **$P = E \div t$**

Step 2. Put variables into equation: **$= 20\,000 \div 100$**

Step 3. Calculate answer. Remember units: **= 2000 W**

Sometimes power is given in units of **kilowatts (kW)**. One kilowatt is equal to one thousand watts.

To convert from kilowatts to watts you need to multiply the number of kilowatts by one thousand: **kW → W × 1000**

To convert from watts to kilowatts you need to divide the number of watts by one thousand: **W → kW ÷ 1000**

Q1. State the equation that links power, energy and time.

....

Q2. State the unit of power.

....

Q3. A lamp uses an energy of 2400 J in a time of 40 s. Calculate the power of the lamp

P = E ÷ t

= 2400 J ÷ 40 s

= ____________ W

Q4. The electric motor in a radio controlled car uses an energy of 4000 J in a time of 200 s. Calculate the power of the electric motor.

__ = __ ÷ __

= ____ __ ÷ ____ __

= ____________ __

Q5. A microwave has a power of 900 W. Calculate how much energy it will use in a time of 15 s.

E = P × t

= ____ __ × ____ __

= ____________ J

Q6. A microwave has a power of 900 W. Calculate how much energy it will use in a time of 15 s.

__ = __ × __

= ____ __ × ____ __

= ____________ __

Q7. State how many watts are in one kilowatt.

....

Q8. Practise converting between watts and kilowatts by filling in each of the blank powers below.

5 kW = _____ W	1.5 kW = _____ W	2000 W = ____ kW	800 W = ____ kW	0.2 kW = _____ W

Q9. A washing machine has a power of 2.2 kW. Calculate how much energy it uses in 20 minutes. You will need to convert kilowatts into watts and minutes into seconds.

....

....

Week 5 – Energy Resources

We generate electricity through two categories of energy resource: those that are **non-renewable** and those that are **renewable**.

A non-renewable resource is one which cannot be replaced once it has been used. One day, non-renewable resources will run out.

The most common non-renewable resources are the three **fossil fuels** (oil, coal and gas) and **nuclear power**.

As well as being used in power plants, fossil fuels can be used for **transport** and **heating**. In particular, petrol and diesel (which are both made from oil) are used in cars. Gas is also commonly used in central heating systems, and coal is burnt in some fireplaces.

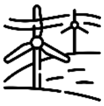
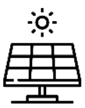
The main advantage of using non-renewable resource in a power plant is that they all produce a **reliable** output.

However, the main disadvantage is that burning fossil fuels increases the amount of carbon dioxide (CO_2) in the atmosphere. Carbon dioxide is a **greenhouse gas**. Greenhouse gases are responsible for **global warming** (a raising of the average temperature of Earth).

Burning coal and oil also produces **sulphur dioxide** which contributes to **acid rain**.

Nuclear power plants do not have carbon dioxide or sulphur dioxide emissions but they do produce **radioactive waste** which is difficult to safely dispose of. However, they do generate a reliable and large output.

A renewable energy resource will not run out. Three renewable resources are listed below:

<table>
<tr><th>Resource</th><th>Advantage</th><th>Disadvantage</th></tr>
<tr><td>Wind </td><td rowspan="3">No carbon dioxide emissions, so they do not contribute to global warming.
Once built, no fuel costs and so are cheap to run.</td><td>It is not always windy, so the output is unreliable. Noisy & spoils the view.</td></tr>
<tr><td>Hydro-electric </td><td>Requires the flooding of a valley with a dam. This causes a loss of habitat.</td></tr>
<tr><td>Solar </td><td>Only work in direct sunlight, so do not generate electricity at night.</td></tr>
</table>

We are turning to more renewable resources for generating electricity. Recently, there has been an "energy crisis" due to shortages of oil and gas. This shortage has increased the price of electricity. Renewable resources can help reduce our reliance on fossil fuels.

Q1. Describe what a non-renewable resource is.

....

....

Q2. State the three fossil fuels.

....

Q3. Describe what a renewable resource is.

....

....

Q4. State three renewable resources.

....

Q5. The following statements are either true or false. State which are true and which are false.

a) Nuclear power is a renewable resource.

....

b) Wind power has an unreliable output.

....

c) Solar power generates electricity at night.

....

Q6. Describe a disadvantage of burning fossil fuels.

....

....

Q7. Other than their use in power plants, state two uses of fossil fuels.

....

Q8. Describe general advantages of using renewable energy resources.

....

....

Q9. Hydroelectric power involves storing water at a height behind a dam. The water is then allowed to fall. State the initial energy store that the water has, and what it is transferred to as it falls.

....

Q10. State which fossil fuels produce sulphur dioxide emissions. Include what sulphur dioxide emissions lead to.

....

Q11. State the advantage of burning fossil fuels in a power plant.

....

Week 6 – Electricity Bills

We have already learnt that one unit of energy is the **joule (J)**. Two other units of energy are:

1. The **kilojoule (kJ)**. One kilojoule is equal to one thousand joules.
2. The **kilowatt hour (kWh)**. One kilowatt hour is equivalent to an electrical device with a power of 1 kW (equal to 1000 W) being used for a time of one hour. As there are 3600 seconds in one hour, one kilowatt hour is therefore equal to 3 600 000 J of energy.

We use kilowatt hours when it comes to electricity bills. This is because electrical devices in the average UK household transfer over 10 billion joules of energy a year. It's more convenient to use kilowatt hours as this brings the numbers down to a more manageable amount.

Electrical devices in the average UK household transfer 3000 kWh of energy each year.

To calculate the amount of energy in kWh that a device transfers you need to multiply the power of the device (in kW) by the time that it is used for (in hours):

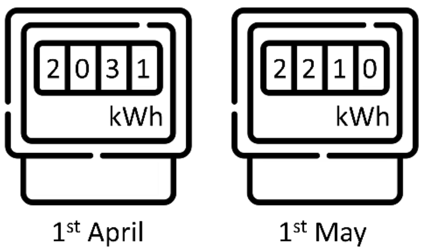
Energy (in kWh) = Power (in kW) × time used (in h)

As of April 2022, the price for each kWh in the UK was 28p. To calculate the cost of an electricity bill we use the equation:

Total cost (in pence) = Energy transferred (in kWh) × price per kWh (in pence)

Example question:

Using the meter readings to the right, calculate the cost of the monthly electricity bill. The price of each kWh is 28p.



Step 1. Calculate the total number of kWh used.

To do this, we need to look at the difference in meter readings:

2210 – 2031 = 179 kWh

Step 2. Calculate cost by multiplying total number of kWh by cost per kWh.

179 × 28 = 5012 p

There are 100p in a pound. To convert from pence to pounds you need to divide the number of pence by one hundred: **p → £ ÷ 100**.

In other words, the 5012 p we calculated is equal to £50.12.

Q1. State how many joules are in a kilojoule.

Q2. State how many seconds are in an hour.

Q3. State how many joules are in a kilowatt hour.

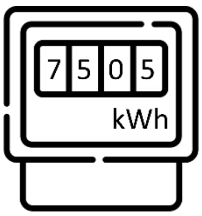
Q4. An electric oven has a power of 2.2 kW and is used for a time of one hour. Calculate how much energy is used in kWh.

Q5. A television has a power of 0.2 kW and is used for a time of 8 hours. Calculate how much energy is used in kWh.

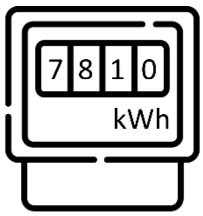
Q6. A hairdryer has a power of 1.8 kW and is used for a time of 30 minutes. Calculate how much energy is used in kWh.

Q7. State the equation that we can use to calculate cost of an electricity bill.

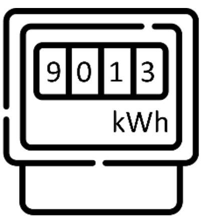
Q8. Using the meter readings to the right, calculate the cost (in pence) of the monthly electricity bill. The price of each kWh is 30p.



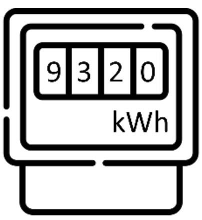
1st November



1st December



1st June



1st July

Q9. Using the meter readings to the left, calculate the cost (in pence) of the monthly electricity bill. The price of each kWh is 25p.