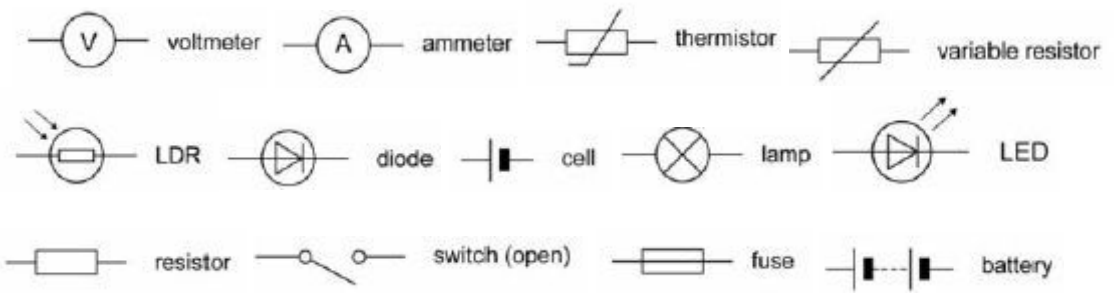
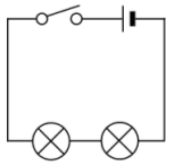
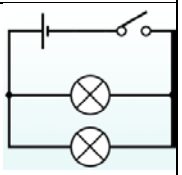
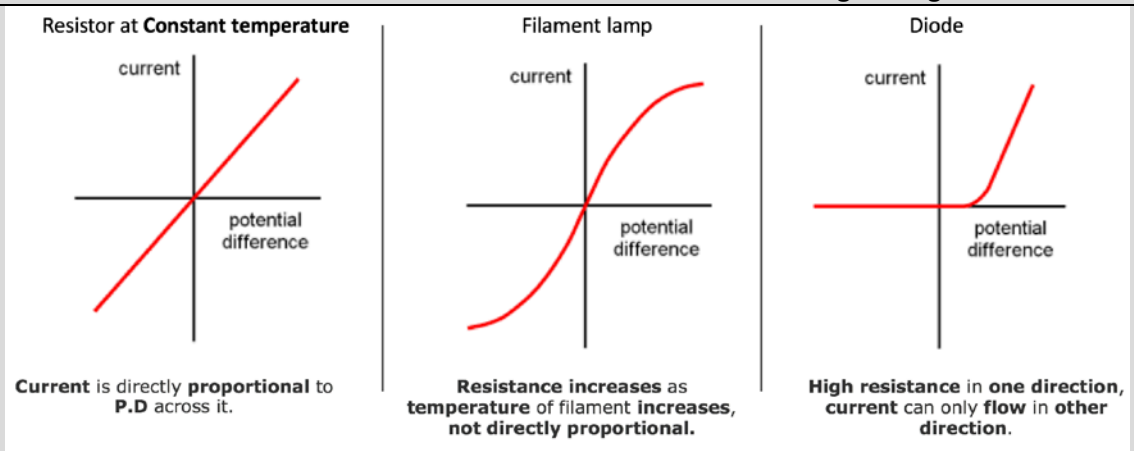
P2 Electricity

1	**Circuit components**	
2	**Current**	Current = **flow of electric charge** (electrons), measured in **amps, A**. Can be **direct** (one direction, D/C) **or alternating** (A/C). Measured using an **ammeter** connected in series. The greater the **resistance** of a component the smaller the **current across a component.**
3	**Potential difference**	**P.D ((voltage) is difference** in **energy transferred between any 2 points** of circuit. **(volts, V).** Measured using a **voltmeter** connected in parallel between two points of a circuit.
4	**Series circuits** V = I x R	 Components **joined** by **one length of wire.** If one component stops working all of the components will fail current not able to flow. **Current** is the **same** at all points and through each component. **Total P.D** of battery or power pack is **shared** through the circuit components. **Total resistance** in series circuit = **sum of resistance** of each component **($R_{total} = R_1 + R_2$)** **Resistors add together** because current has to pass through every resistor in the circuit. Current, resistance and potential difference can be calculated for each component using (V=IR).
5	**Parallel circuits**	 Components **not** joined by single length of wire, has **branches.** If one component stops each branch will still work as electrons can flow. Total **current** is **sum** of current through **all branches.** **P.d** across **each branch is the same** as the **p.d across the cell** / battery. **Total resistance** of **two resistors** in **parallel** is **less** than the resistance of the **smallest** individual resistor – two pathways for current to take so less resistance in circuit.
6	**Resistance** V = I x R	The **larger the resistance** the **harder** it is for **current to flow** through a circuit (lower current). Resistance is affected by **temperature** of wire, **type of material** wire is made from, l**ength** and **thickness of a wire,** (Measured in ohms, Ω). **Resistance** is **increased** when **electrons collide** with **ions** whilst moving through a material.
7	**Current / potential difference graphs**	
8	**Mains electricity**	**Mains electricity** is alternating current **(A/C),** with a P.D of **230V** and a frequency of **50Hz.** **Direct current / p.d =** flows in **one direction.** Straight line on graph. **Alternating current / p.d =** constantly **changes direction.** Oscillating (up & down) line on graph.

9	**3 Pin plug**	**Cable** contains **3 wires** = **live** wire (**br**own), **neutral** (**bl**ue) and **earth** (green and yellow), cable **is insulated** to reduce risk of electrocution. Connected to a 3-pin plug. **Pins** made from **hard brass** to avoid bending. **Bl**ue = bottom left, **br**own = bottom right and earth = top. Contains a **fuse** to control amount of current in live wire (will melt, stopping current flow if current is too high). Has **plastic case** to reduce risk of electrocution. **Live wire = carries alternating p.d** from the supply. **230V** **Neutral wire =completes the circuit** (allows current to flow). **0V** **Earth wire = safety** wire, **carries current away** if there is fault, stops appliance becoming live. **0V**
10	**Double insulation**	These appliances have plastic cases or designed in a way that the live wire cannot touch the casing so cannot give an electric shock.
11	**Power (electrical)** $P = E / t$ $P = I \times V$ $P = I^2 \times R$	The power of an appliance is **rate (speed)** at which it **transfers energy,** measured in **watts (W).** **Power saving** bulbs **waste less energy** through heat loss, they are **more efficient**. Time must be in **seconds for P = E/ t** equation.
12	**Energy transfers** $E = P \times t$ $E = Q \text{ v } V$	Energy cannot be created or destroyed (it is conserved), only transferred to other forms. E.g electrical fan: Electrical energy → kinetic energy of motor (useful) + sound + heat of motor (wasted). **Total energy in = total energy ou**t. Efficiency = $\frac{total\ useful\ energy}{total\ input\ energy}$ Amount of **energy transferred** depends on: **time appliance switched on** & **power** of appliance. Some **energy** is **always wasted** when energy is transferred. The wasted energy is normally **transferred to the surroundings as heat** which causes them to **become warmer.**
13	**National grid**	Series of **transformers, cables and pylons** that transport electrical energy from power station to homes and offices. Electricity is transported at **high voltage**, **low current** to **reduce energy lost as heat in the wires**. Voltage must be decreased before entering homes so that it is safe to use.
14	**Transformers** **Higher**	**Step-up** transformers **increase voltage**, decrease current. **Step down** transformers **decrease voltage,** increase current. Power stays the same (P=IV).
15	**Power cables**	Part of the **national grid**, carry **electricity** at **high voltage** from power stations to homes. There are two types and both have advantages/ disadvantages over each other. **Overhead**: **Advantages**: cheaper to install, easier to repair, cooled by the air. **Disadvantages**: Spoil landscape, damaged by weather, greater risk of fatal electric shock. **Underground:** **Advantages:** Cannot be seen, unlikely to be damaged by weather, reduced risk of shock. **Disadvantages:** Repairs more expensive/ difficult, difficult to access, very expensive to install, cooling systems required, need more insulation, land is disrupted to lay them.
16	**Static electricity** **Physics only**	**Electrons** (-) are **transferred** due to friction between insulators. Object that **gains** electrons have a **negative (-) charge**, object **losing** electrons will have a **positive (+) charge**. Opposite charges will **repel**, like charge will **attract.** As more electrons are transferred charge cannot flow away so remains static, **potential difference (voltage) builds up**, if gets high enough can cause a **spark**, could lead to fires if around flammable objects. **Van de Graff generator** – hair stands on end as electrons are transferred into the body, all of the hairs gain a negative charge, like charges repel so they are pushed away from each other (stand on end).

Where marks are lost		
17	**Converting units**	**Distance** is measured in **meters** (must convert if in cm (divide by 100) or Km (x by 000). **Kilo = 1000**. Anything **except Kg** that has **K** in front of its unit (e.g. KJ, kilojoules) must be converted to its standard unit, by **multiplying the number by 1000.** **Time** is measured in **seconds**. This is often given as minutes or hours and must be converted. **Minutes x 60**, **hours x 60 x 60**.