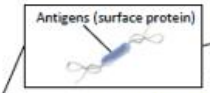
Health and immunity L45-59

Phagocytes	*Phagocytosis*	Phagocytes engulf the pathogens and digest them.
Lymphocytes	*Antibody production*	Specific antibodies destroy the pathogen. This takes time so an infection can occur. If a person is infected again by the same pathogen, the lymphocytes make antibodies much faster.
	Antitoxin production	Antitoxin is a type of antibody produced to counteract the toxins produced by bacteria.



Pathogens are identified by white blood cells by the different proteins on their surfaces **ANTIGENS.**

White blood cells are part of the immune system

Immune system

Non-specific defence systems

The human body has several non specific ways of defending itself from pathogens getting in

	*Nose*	Nasal hairs, sticky mucus and cilia prevent pathogens entering through the nostrils.
	*Trachea and bronchus (respiratory system)*	Lined with mucus to trap dust and pathogens. Cilia move the mucus upwards to be swallowed.
	*Stomach acid*	Stomach acid (pH1) kills most ingested pathogens.
	*Skin*	Hard to penetrate waterproof barrier. Glands secrete oil which kill microbes

AQA GCSE INFECTION AND RESPONSE part 1

Human defence systems

Plants have several ways of defending themselves from pathogens and animals

Physical	*Mechanical*
Thick waxy layers, cell walls stop pathogen entry	Thorns, curling up leaves to prevent being eaten
Chemical	
Antibacterial and toxins made by plant	

Detection and identification of plant diseases (bio only)	
Detection	**Identification**
Stunted growth	Reference using gardening manual or website, laboratory test for pathogens, testing kit using monoclonal antibodies.
Spots on leaves	
Area of decay	
growths	
Malformed stem/leaves	
Discolouration	
Presence of pests	

Nitrate ions needed for protein synthesis – lack of nitrate = stunted growth.

Magnesium ions needed to make chlorophyll – not enough leads to chlorosis – leaves turn yellow.

Pathogens may infect plants or animals and can be spread by direct contact, water or air

Pathogen	*Disease*	Symptoms	Method of transmission	Control of spread
Virus	*Measles*	Fever, red skin rash.	Droplet infection from sneezes and coughs.	Vaccination as a child.
Virus	*HIV*	Initially flu like systems, serious damage to immune system.	Sexual contact and exchange of body fluids.	Anti-retroviral drugs and use of condoms.
Virus	*Tobacco mosaic virus*	Mosaic pattern on leaves.	Enters via wounds in epidermis caused by pests.	Remove infected leaves and control pests that damage the leaves.
Bacteria	*Salmonella*	Fever, cramp, vomiting, diarrhoea.	Food prepared in unhygienic conditions or not cooked properly.	Improve food hygiene, wash hands, vaccinate poultry, cook food thoroughly.
Bacteria	*Gonorrhoea*	Green discharge from penis or vagina.	Direct sexual contact or exchange of body fluids.	Use condoms. Treatment using antibiotics.
Protists	*Malaria*	Recurrent fever.	By an animal vector (mosquitoes).	Prevent breeding of mosquitoes. Use of nets to prevent bites.
Fungus	*Rose black spot*	Purple black spots on leaves.	Spores carried via wind or water.	Remove infected leaves. Spray with fungicide.

Bacteria may produce toxins that damage tissues and make us fell ill

Viruses	Bacteria (prokaryotes)	Protists (eukaryotes)	Fungi (eukaryotes)
e.g. cold, influenza, measles, HIV, tobacco mosaic virus	*e.g. tuberculosis (TB), Salmonella, Gonorrhoea*	*e.g. dysentery, sleeping sickness, malaria*	*e.g. athlete's foot, thrush, rose black spot*
DNA or RNA surrounded by a protein coat	No membrane bound organelles (no chloroplasts, mitochondria or nucleus). Cell wall. Single celled organisms	Membrane bound organelles. Usually single celled.	Membrane bound organelles, cell wall made of chitin. Single celled or multi-cellular

Pathogens are microorganisms that cause infectious disease

Pathogens

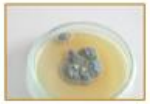
Communicable diseases

Viruses live and reproduce inside cells causing damage

AQA INFECTION AND RESPONSE

Antibiotics and painkillers

Traditionally drugs were extracted from plants and microorganisms

Digitalis	*Aspirin*	*Penicillin*
Extracted from foxglove plants and used as a heart drug	A painkiller and anti-inflammatory that was first found in willow bark	Discovered by Alexander Fleming from the *Penicillium* mould and used as an antibiotic
		

Most new drugs are synthesised by chemists in the pharmaceutical industry.

Antibiotics have greatly reduced deaths from infectious bacterial disease

antibiotics	*e.g. penicillin*	Kill infective bacteria inside the body. Specific bacterial infections require specific antibiotics.
Painkillers and other medicines	*e.g. aspirin, paracetamol, ibuprofen*	Drugs that are used to treat the symptoms of a disease. They do not kill pathogens

Antibiotics cannot be use to treat viral pathogens

Bacteria can mutate

Sometimes this makes them resistant to antibiotic drugs.

It is difficult to develop drugs to kill viruses without harming body tissues because viruses live and reproduce inside cells

Discovery and drug development

Drugs have to be tested and trialled before to check they are safe and effective

New drugs are extensively tested for:	
Efficacy	Make sure the drug works
Toxicity	Check that the drug is not poisonous
Dose	The most suitable amount to take

Double blind trial: patients and scientists do not know who receives the new drug or placebo until the end of the trial. This avoids bias.

Preclinical trials - using cells, tissues and live animals - must be carried out before the drug can be tested on humans.

Clinical trials use healthy volunteers and patients

Stage 1	*Stage 2*	*Stage 3*	*Stage 4*
Healthy volunteers try small dose of the drug to check it is safe record any side effects	A small number of patients try the drug at a low dose to see if it works	A larger number of patients; different doses are trialled to find the optimum dose	A double blind trial will occur. The patients are divided into groups. Some will be given the drug and some a placebo.

A placebo can look identical to the new drug but contain no active ingredients

Vaccination

Used to immunise a large proportion of the population to prevent the spread of a pathogen

Vaccination			
Small amount of dead or inactive form of the pathogen	*1st infection by pathogen*	White blood cells detect pathogens in the vaccine. Antibodies are released into the blood.
	Re-infection by the same pathogen	White blood cells detect pathogens. Antibodies are made much faster and in larger amounts.

A person is unlikely to suffer the symptoms of the harmful disease and it's spread in a population is prevented

Created more side effects than expected (fatal in some cases) and are not as widely used as everybody hoped when first developed.

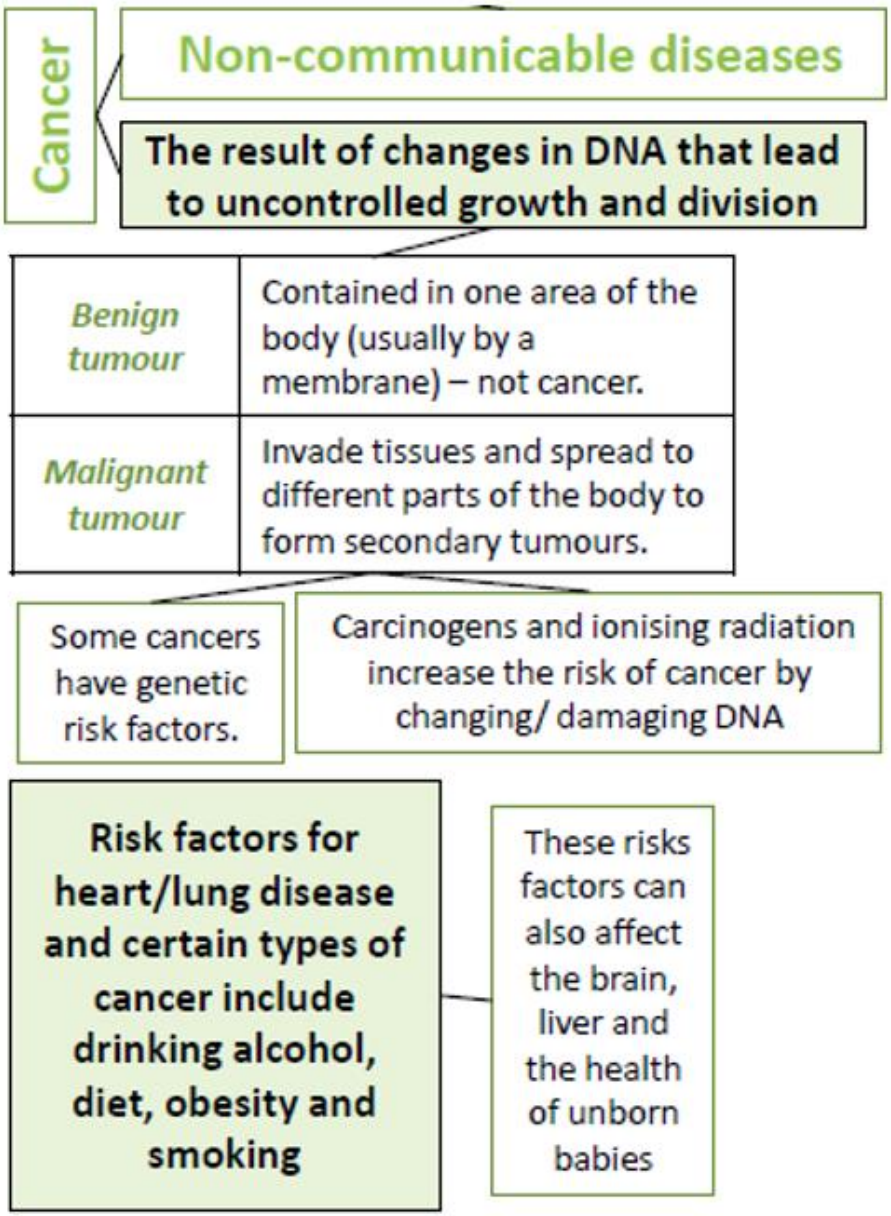
Monoclonal antibodies (Biology only HT)

Specific to one binding site on the antigen. Can target specific chemicals or cells in the body

Monoclonal antibodies	*Identical copies of one types of antibody produced in laboratory*	1. A mouse is injected with pathogen
		2. Lymphocytes produce antibodies
		3. Lymphocytes are removed from the mouse and fused with rapidly dividing mouse tumour cells
		4. The new cells are called hybridomas
		5. The hybridomas divide rapidly and release lots of antibodies which are then collected

Monoclonal antibodies can be used in a variety of ways

Diagnosis	*Detecting pathogens*	*Detecting molecules*	*Treatment*
e.g. pregnancy test – measure the level of hormones	Can detect very small quantities of chemicals in the blood	Fluorescent dye can be attached so it can be seen inside cells or tissues	Bound to radioactive substance, toxic drug or chemical Cancer cells are targeted to normal body cells are unharmed


Cancer
Non-communicable diseases
The result of changes in DNA that lead to uncontrolled growth and division
Benign tumour
Contained in one area of the body (usually by a membrane) – not cancer.
Malignant tumour
Invade tissues and spread to different parts of the body to form secondary tumours.
Some cancers have genetic risk factors.
Carcinogens and ionising radiation increase the risk of cancer by changing/ damaging DNA
Risk factors for heart/lung disease and certain types of cancer include drinking alcohol, diet, obesity and smoking
These risks factors can also affect the brain, liver and the health of unborn babies

C5 Chemical Changes

Displacement reactions and metal extraction

potassium	most reactive	K
sodium		Na
calcium		Ca
magnesium		Mg
aluminium		Al
carbon		C
zinc		Zn
iron		Fe
tin		Sn
lead		Pb
hydrogen		H
copper		Cu
silver		Ag
gold		Au
platinum	least reactive	Pt

Reactivity depends on tendency to form metal ion

A and C are Cations (Positive Ions)
B and D are Anions (Negative Ions)
Double Displacement Reaction

HT: OILRIG
Oxidation Is Loss of electrons
Reduction Is Gain of electrons

Metal + Oxygen → Metal Oxide

Metal + Water → Metal Hydroxide + hydrogen

Metal + acid → Metal salt + Hydrogen

Reactions of acids

Acid+metal → salt + hydrogen
Acid + alkali → salt + water
Acid + insoluble base → salt + water
Acid + carbonate → salt + water + carbon dioxide

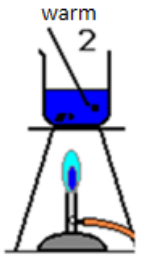
HT: OILRIG
e.g. $2HCl + Mg \rightarrow MgCl_2 + H_2$
Magnesium is oxidised
$Mg \rightarrow Mg^{2+} + 2e^-$

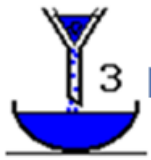
Hydrochloric Acid → Chlorides
HCl
Nitric Acid → Nitrates
HNO_3
Sulphuric Acid → Sulphates
H_2SO_4

RP: Preparation of a dry sample of a soluble salt

Choose correct acid

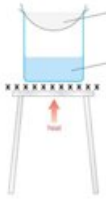
Add base to excess



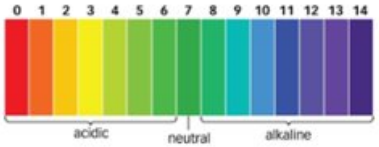


Filter off excess

Evaporate off water



Neutralisation



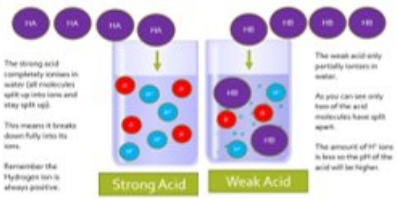
Acids produce H^+ ions
Alkalis produce OH^- ions

$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$

HT: Strong and Weak acids

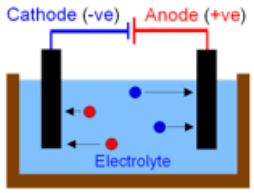
Concentration of hydrogen ions in mol/dm³	pH
0.10	1.0
0.010	2.0
0.0010	3.0
0.00010	4.0

Strong and weak acid:



Electrolysis

..of molten:

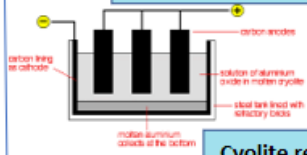


Higher:
At the cathode
$Pb^{2+} + 2e^- \rightarrow Pb$

Higher:
At the anode
$2Br^- \rightarrow Br_2 + 2e^-$
or
$2Br^- - 2e^- \rightarrow Br_2$

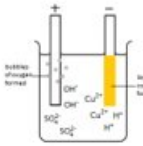
..to extract aluminium:

Oxygen goes to anode → CO_2 (needs replacing)



Cyolite reduces the melting point

..of solutions:



At the anode:
Halide (Gp7)
Oxygen

At the cathode:
Least reactive

Year 10 – Chemistry / Chemical Changes – HT1

Exmouth Community College
Academy Trust

Chemical Changes Knowledge Organiser

Section 1: Key Terms	
1 Metal oxide	Metals react with oxides to produce metal oxides. This is an oxidation reaction.
2 Displacement reaction	A **more reactive metal** can **displace** a **less reactive metal** from a **compound**.
3 Oxidation	Two definitions: Chemicals are oxidised if they **gain oxygen** in a reaction. Chemicals are oxidised if they **lose electrons** in a reaction. (HT)
4 Reduction	Two definitions: Chemicals are oxidised if they **lose oxygen** in a reaction. Chemicals are oxidised if they **gain electrons** in a reaction. (HT)
5 Acid	A chemical that **dissolves in water** to produce **H^+ ions**.
6 Base	A chemical that **reacts with acids** and **neutralise** them. E.g. **metal oxides, metal hydroxides, metal carbonate**
7 Alkali	A **base** that **dissolves in water**. It produces **OH^- ions** in solution.
8 Neutralisation	When a **neutral solution** is formed from reacting an **acid** and **alkali**. General equation: **$H^+ + OH^- \rightarrow H_2O$**
9 pH	A scale to **measure acidity/ alkalinity**. A **decrease of one pH** unit causes a **10x increase in H^+ ions**. (HT)
10 Strong acid (HT)	A strong acid is **completely ionised** in solution. E.g. **hydrochloric, nitric** and **sulfuric** acids.
11 Weak acid (HT)	A weak acid is **only partially ionised** in solution. E.g. **ethanoic, citric** and **carbonic** acids.

Section 2: Reactivity		
Element	**Reaction**	**Reactivity**
12 Potassium	When potassium is added to **water**, the metal **melts** and floats. It moves around very quickly. The metal is also **set on fire**, with sparks and a **lilac flame**.	↑
13 Sodium	When sodium is added to **water**, it **melts** to form a ball that moves around on the surface. It **fizzes rapidly**.	
14 Lithium	When lithium is added to **water**, it floats. It **fizzes steadily** and becomes smaller.	
15 Calcium	**Fizzes quickly** with dilute **acid**.	
16 Magnesium	**Fizzes quickly** with dilute **acid**.	
17 (Carbon)		
18 Zinc	**Bubbles slowly** with dilute **acid**.	
19 Iron	**Very slow reaction** with dilute **acid**.	
20 (Hydrogen)		
21 Copper	**No reaction** with dilute **acid.**	

Section 5: Reactions of Acids	
25 With metal	Acid + Metal -> Salt + Hydrogen
26 With alkali	Acid + Metal Hydroxide -> Salt + Water (Neutralisation reaction)
27 With metal oxide	Acid + Metal Oxide -> Salt + Water (Neutralisation reaction)
28 With carbonate	Acid + Metal Carbonate -> Salt + Water + Carbon Dioxide (Neutralisation reaction)

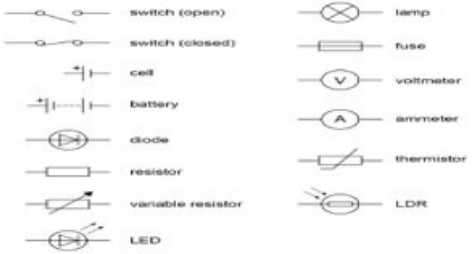
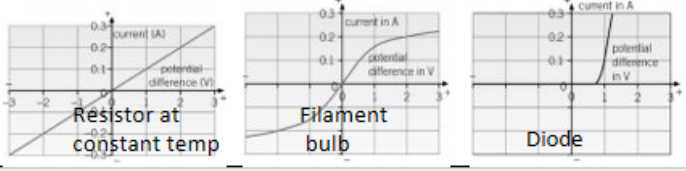
Section 6: Making a Soluble Salt	
29	**Add solid** metal, metal carbonate, metal oxide or metal hydroxide **to an acid**.
30	Add solid **until no more reacts**.
31	**Filter** off excess solid.
32	**Evaporate** to remove some of the water.
33	Leave to **crystallise**.
34	Remove all water in a **desiccator/ oven**.

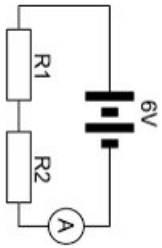
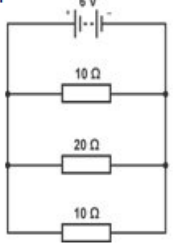
Section 3: Extracting Metals	
22 Very unreactive metals	Found **naturally** in the ground. **Don't need extracting**.
23 Metals less reactive than carbon	Extracted by **reduction with carbon**.
24 Metals more reactive than carbon	Extracted by **electrolysis**.

35 Acidic pH 0-6 36 Neutral pH 7 37 Neutral pH 8-14

Year 10 – Chemistry / Chemical Changes – HT1

P4: Electric Circuits Knowledge Organiser (Trilogy) PT20.1

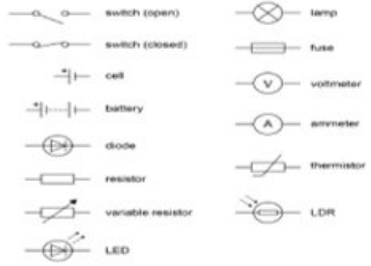
Current, I	•The flow of charge per second •Measured in Amperes, A •The charges that flow in a circuit are free electrons. •Electrons are pushed away from the negative terminal of the power supply and are pulled back towards the positive terminal.
Circuit Symbols *(You need to know what each of these components does as well as the symbol)*	
Potential Difference, V	
Resistance, R	•How easy or hard it is for electrons and therefore current to flow in a material. •Measured in Ohms, Ω •Filament lamp: higher temp, higher R •Diode: forward resistance low, reverse resistance high •Thermistor: R decreases as temp increases •LDR: R decreases as light intensity increases
Ohm's Law	•The current through a resistor at a constant temperature is directly proportional to the p.d. across it. •An Ohmic conductor gives a I-V graph that has a straight line through the origin.
I-V Graph / I-V Characteristic	A graph of current against p.d. for a component. 

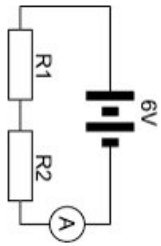
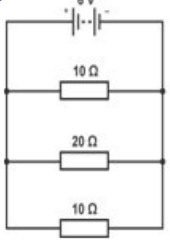
Series Circuit	 •A circuit where there is only one loop and one path for the current to take •I is the same in each component •Total p.d. is shared between components •R is the sum of all the resistances of the components added together → $R_{total} = R_1 + R_2$ •Adding more resistors in series increases the total R as there is less I flowing in each resistor and the total p.d. stays the same.
Parallel Circuit	 •A circuit where there are two or more loops and therefore multiple paths the current can take. •Total I is equal to the current in each component •p.d. across each component is the same •Less current passes through resistors with bigger R •The total R or two or more components in parallel is less than the resistor with the smallest R •As we add more resistors in parallel, total R decreases as total I increases and total p.d. across them is doesn't change

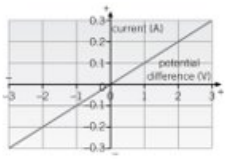
Key Equations To Learn	
Current, I	Current = Charge ÷Time I = Q ÷ t
Potential Difference, V	Potential difference = Energy ÷ Charge V = E ÷ t
Potential Difference, V	Potential difference = Current x Resistance V = I x R

Exmouth Community College
Academy Trust

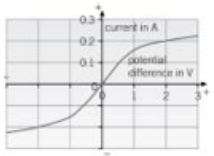
P4: Electric Circuits Knowledge Organiser (Physics) PT20.2

Current, I	•The flow of charge per second •Measured in Amperes, A •The charges that flow in a circuit are free electrons. •Electrons are pushed away from the negative terminal of the power supply and are pulled back towards the positive terminal.
Circuit Symbols *(You need to know what each of these components does as well as the symbol)*	
Potential Difference, V	•The work done (or energy transferred) per unit of charge that passes through a component •Measured in Volts, V
Resistance, R	•How easy or hard it is for electrons and therefore current to flow in a material. •Measured in Ohms, Ω •Filament lamp: higher temp, higher R •Diode: forward resistance low, reverse resistance high •Thermistor: R decreases as temp increases •LDR: R decreases as light intensity increases
Ohm's Law	•The current through a resistor at a constant temperature is directly proportional to the p.d. across it. •An Ohmic conductor gives a I-V graph that has a straight line through the origin.
I-V Graph / I-V Characteristic	A graph of current against p.d. for a component You need to know the I-V graphs for a resistor at constant temperature, a filament bulb and a diode (see right)

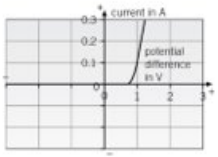
Series Circuit 	•A circuit where there is only one loop and one path for the current to take •I is the same in each component •Total p.d. is shared between components •R is the sum of all the resistances of the components added together → $R_{total} = R_1 + R_2$ •Adding more resistors in series increases the total R as there is less I flowing in each resistor and the total p.d. stays the same.
Parallel Circuit 	•A circuit where there are two or more loops and therefore multiple paths the current can take. •Total I is equal to the current in each component •p.d. across each component is the same •Less current passes through resistors with bigger R •The total R or two or more components in parallel is less than the resistor with the smallest R •As we add more resistors in parallel, total R decreases as total I increases and total p.d. across them is doesn't change



Resistor at constant temp



Filament bulb



Diode

Key Equations To Learn	
Current, I	Current = Charge ÷Time I = Q ÷ t
Potential Difference, V	Potential difference = Energy ÷ Charge V = E ÷ Q
Potential Difference, V	Potential difference = Current x Resistance V = I x R

Year 10 – Physics / Electric Circuits – HT1

P4: Electric Circuits Knowledge Organiser (Physics)

Electrical charge	•Atoms are made up of a positively charged nucleus, surrounded by negatively charged electrons arranged in energy levels. •Normally an atom has the same number of protons and electrons so has no overall charge •If electrons are removed from an atom, it becomes positively charged •If electrons are added to an atom, it becomes negatively charged •A charged atom is called an ion.
Charging insulators	•Some insulating materials become charged when rubbed as electrons are transferred due to friction. •To become positively charged, an insulating material loses electrons when rubbed •To become negatively charged, an insulating material gains electrons when rubbed
Electric field	•A charged object has an electric field around itself. This is an area where the object will exert a force on another charged object. •The force is a non-contact force •Like charges repel •Unlike (opposite) charges attract

Key Equations To Learn	
Current, I	Current = Charge ÷Time $I = Q \div t$
Potential Difference, V	Potential difference = Energy ÷ Charge $V = E \div Q$
Potential Difference, V	Potential difference = Current x Resistance $V = I \times R$