Core questions – Physic unit 1 – Energy

	Questions	My answer	My answer	Answers
1	What is a 'system'?			An object or group of objects
2	What can happen to energy?			It can be stored or transferred
3	What happens when a 'system' changes?			Energy is transferred either: • into or away **from** the system • between different objects **in** the system • between different types of energy stores
4	What is a 'closed system'?			A system where neither matter nor energy can enter or leave
5	What is the net change in the total energy of a closed system?			Zero
6	What is the unit and unit symbol for all types of energy?			Joules, J
7	What is an example of energy stored as elastic potential energy?			A stretched or compressed spring
8	What is an example of energy stored as thermal energy?			A property an object has because of the kinetic energy of its particles (so everything has a thermal energy store)
9	What is another name for a thermal energy store?			Internal energy store
10	What is an example of energy stored as kinetic energy?			Anything that is moving
11	What is an example of energy stored as gravitational potential energy?			Any object above the ground
12	What is an example of energy stored as chemical energy?			An object that has energy stored due to its chemical composition – e.g batteries, fuels, food
13	What is an example of energy stored as electrostatic energy?			Between two charged objects (i.e. two object that have a potential difference)
14	What is an example of energy stored as nuclear energy?			Radioactive nuclei
15	What are the four main ways energy can be **transferred** between energy stores?			Heating, radiation, electrically, mechanically
16	Give an example of how energy is transferred mechanically?			By a force doing some work
17	Give an example of how energy is transferred through waves?			Light, microwaves, radio waves
18	Give an example of how energy is transferred electrically?			A complete circuit allowing charge to flow
19	What are the energy store changes when a ball is thrown upwards?			Kinetic energy store decreases and gravitational potential store increases

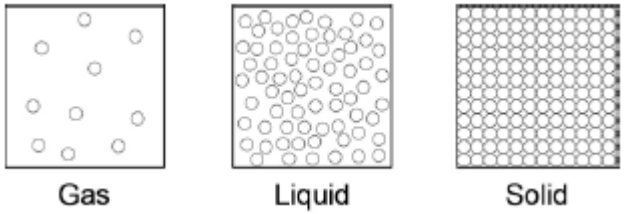
20	What is another way of saying 'energy transferred'?			Work done
21	What are the energy store changes when a moving object hits an obstacle?			The moving object has a store of kinetic energy, which is transferred to other stores when it hits the obstacle and suddenly stops. Some of these stores include elastic potential energy in squashing objects and thermal energy into the surroundings
22	What are the energy store changes when an object is accelerated by a constant force?			When a constant force is applied across a distance, work is done on the object. This work is transferred to a store of kinetic energy in the object, causing it to move
23	What are the energy store changes when a vehicle applies its brakes to slow down?			A moving vehicle has a store of kinetic energy, work is done when the brakes are applied and there is a large amount of friction. Energy is transferred to thermal energy stores.
24	What are the energy store changes when water is boiled in an electric kettle?			The kettle transfers a store of electrical energy to thermal energy, which is transferred to the water to heat it up as water has more internal energy.
25	What two measurements do you need to be able to calculate the kinetic energy store of a moving object?			Mass (in metres, m) Velocity (in metres per second, m/s)
26	What is the word equation for calculating kinetic energy?			Kinetic Energy = ½ x mass x velocity^2
27	What is the symbol equation for kinetic energy?			$E_k = ½ mv^2$
28	What is the word equation for calculating gravitational potential energy?			Gravitational potential energy = mass x gravitational field strength x height
29	What is the symbol equation for calculating gravitational potential energy?			$E_p = mgh$
30	What energy transfer happens when an object is falling?			Stored gravitational energy is transferred to its kinetic energy store
31	What two ways can elastic potential energy can be transferred to an object?			Stretching or squashing
32	What two measurements do you need to be able to calculate the elastic potential energy store of a squashed of stretched object?			Spring constant (in Newtons per metre, N/m) Extension or compression (in metres, m)
33	What does the increase in temperature of a system depend on?			The mass of the substance, the type of material and the energy input.
34	What is the word equation that relates the change in energy of a system, mass, specific heat capacity & temperature change?			Change in thermal energy = mass x specific heat capacity x temperature change

35	What is the symbol equation that relates the change in thermal energy of a system to the factors that it depends upon?			$\Delta E = m\, c\, \Delta\theta$
36	What are the units and unit symbols of specific heat capacity?			Joules per kilogram per degree Celsius, J/kg °C
37	What is the specific heat capacity of a substance?			The amount of energy required to raise the temperature of 1 kg of the substance by 1 °C
38	What is power?			Rate of energy transfer or rate of doing work
39	What is the unit and unit symbol of power?			Watts, W
40	How much energy is transferred by 1 watt?			1 Joule per second
41	What is the word equation for power?			$\text{Power} = \frac{\text{energy transferred}}{\text{time}}$, $\text{Power} = \frac{\text{work done}}{\text{time}}$
42	What is the symbol equation for power?			$P = \frac{E}{t}$, $P = \frac{W}{t}$
43	What does dissipated mean?			Energy that is not usefully transferred
44	What is the principle of conservation of energy?			Energy cannot be created or destroyed, it can only be transferred usefully, stored or dissipated
45	What does it mean when we say that energy is "wasted"?			When energy is dissipated, so that it is stored in less useful ways
46	What is the most common form of 'wasted' energy?			Into the thermal energy stores of the surroundings
47	What does thermal conductivity mean?			The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material.
48	What factors affect the rate of cooling of a building?			The thickness and thermal conductivity of its walls.
49	State four ways to insulator a house			Cavity wall insulation, double glazing, Loft Insulation, draft excluders.
50	How can you reduce the amount of energy dissipated by a device?			Lubricate to reduce friction or insulate to reduce thermal energy transfer
51	What is the mathematical link between useful and wasted energy?			Total Energy In = Useful energy + Wasted Energy
52	What is efficiency?			A measure of how much energy is transferred by a device into a useful energy store.
53	How do we measure efficiency			Efficiency = $\frac{\text{Useful output energy/power}}{\text{Total input energy/power}}$
54	What is the unit of efficiency?			Efficiency is measured as a decimal or a percentage

Core questions – Physics unit 1 - Energy

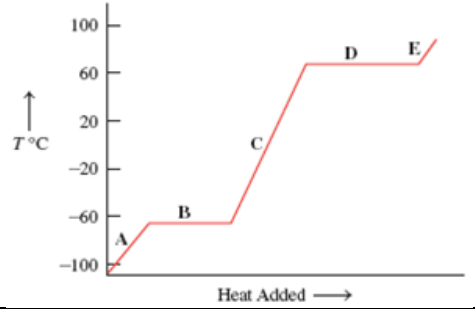
	Question	My answer	My answer	Answer
1	What is the source of most of our naturally occurring energy resources?			The sun
2	Name the three fossil fuels			Coal, oil and natural gas
3	What type of energy store do fuels have?			Chemical energy store
4	How is the energy stored in fossil fuels released into useful energy?			Combustion (transferred into thermal store)
5	How does a fossil fuelled power station work?	1.		2. Fuel combusts releasing thermal energy 3. Thermal energy used to heat water 4. Water turns into steam and turns a turbine 5. The turbine is connected to a generator which generates electricity
6	Name the three main uses of fossil fuels			Generating electricity, heating and transport
7	Fossil fuels are non-renewable, what does it mean?			They will run out
8	Why is burning fossil fuels bad for the environment?			They release CO_2 and sulfur dioxide into the atmosphere
9	Why is carbon dioxide bad for the environment?			It is a greenhouse gas and contributes to global warming
10	Why is sulfur dioxide bad for the environment?			It causes acid rain
11	What are the other disadvantages of using fossil fuels, other than the gases released?			Coal mining causes disruption to the landscape. Oil spillages cause serious environmental problems
12	What are the two main nuclear fuels?			Uranium and plutonium
13	What is a benefit of nuclear fuel?			Does not release greenhouse gases
14	What is the main disadvantage with nuclear power?			Produces nuclear waste which is hard to dispose of
15	State four renewable energy resources directly linked to the sun's energy			Solar, wind, wave and biofuels

16	What other renewable energy resources are there that don't rely on the sun?			Geothermal, tidal
17	Where does geothermal energy come from?			Volcanic regions or where hot rocks that are near the surface
18	Give two advantages of geothermal energy			Very reliable and causes very little environmental damage
19	Give two disadvantages of geothermal energy			Very limited availability, very expensive to build power plants
20	How does hydro-electric power generate electricity?			Water falling from height spins a turbine, connected to generator
21	Give two benefits of hydro-electric power			Immediate response to a sudden demand (no start up time) Very reliable
22	Give two disadvantages of hydro-electric power			Loss of habitat when dams are built, very expensive to build
23	What is the difference between a solar cell and solar panel/heater?			Solar cells use light energy to generate electricity and solar panels use heat from the sun heat water
24	Why are wind turbines and solar cells **unreliable**?			They depend on the weather
25	What are the advantages of both wind turbines and solar cells?			Produce no pollution (i.e. carbon dioxide), no fuel costs
26	What are the disadvantages of wind turbines?			Power output is unreliable, can be noisy, cause visual pollution
27	What is a bio-fuel?			A fuel made from plant material or animal waste
28	What is meant by the term "carbon neutral"?			Activities that do not add **extra** CO_2 into the atmosphere
29	Bio-fuels made from plants are said to be carbon neutral why?			CO_2 released when the fuel burns is removed from the atmosphere when the plants grow
30	What is a disadvantage of bio-fuels?			Loss of habitat used to grow plants for bio-fuels, land could be used for growing crops for food instead
31	Give three reasons for using more renewable energy in the future			Non-renewables are running out Combat global warming Higher demand for energy due to population growth
32	What are the main reasons we are not using more renewable fuels?			They are expensive to build and companies/governments don't want to pay. Infrastructure for fossil fuels is already there Many renewable energy resources are unreliable

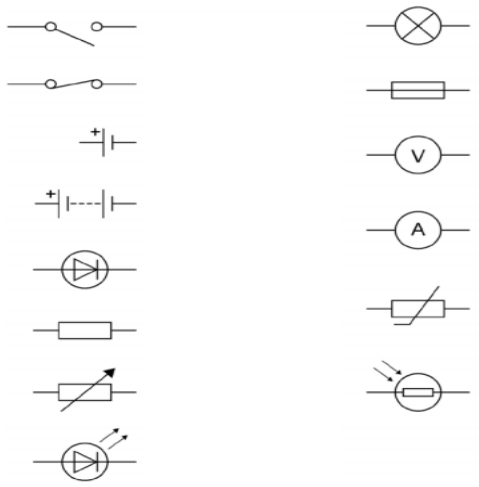
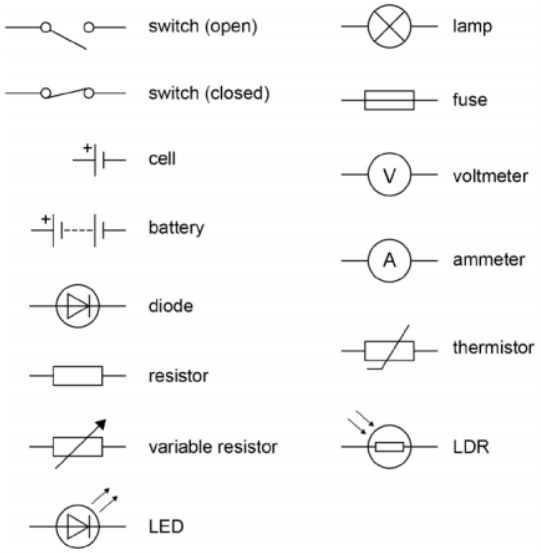
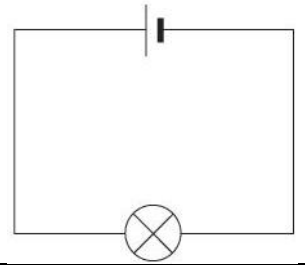
	Question	My answer	My answer	Answer
1	What is the particle model useful for?			To explain the states of matter and the differences in their density: solids are denser than gases as there are more particles in a given volume than gases have.
2	What are the limitations of using the particle model?			No movement shown, atoms not solid spheres, no forces shown, only in 2D
3	Draw a particle diagram for solid, liquid and gas.			
4	How are particles arranged in solids?			Close together, held in a fixed, regular arrangement
5	What are the forces of attraction like in solids?			Strong
6	How do particles move in solids?			Vibrate about a fixed position
7	How are particles arranged in liquids?			Close together, <u>irregular</u> arrangement
8	What are the forces of attraction like in liquids?			Weaker than solids, allowing particles to move
9	How do particles move in liquids?			Slow moving, random directions
10	How are particles arranged in gases?			Far apart, not touching
11	What are the forces of attraction like in gases?			No forces
12	How do particles move in gases?			High speed, random directions
13	What is the definition of density?			The amount of matter in a given volume. (mass per unit volume)
14	What is the word equation for density?			$\text{density} = \frac{\text{mass}}{\text{volume}}$
15	What is the symbol equation for density?			$\rho = \frac{m}{V}$
16	What are the common units of density?			kg/m^3

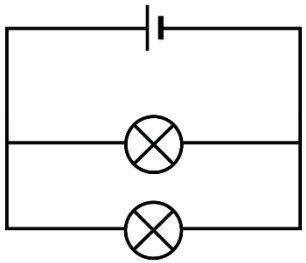
17	Describe how to find the volume of a regular solid.			• Use a ruler to measure the length, width and height of the object in metres • Find the volume by multiplying the *l x w x h* • Place the object on a balance to find the mass in kilograms • Find the density by dividing the mass by the volume
18	Describe how to find the volume of an irregular solid.			• Place the object on a balance to find its mass. • Place the object into a measuring cylinder filled with water. • Measure how much the volume in the measuring cylinder increases; this is the volume of the object • Find the density by dividing the mass by the volume.
19	Describe how to find the volume of a liquid.			• Place a measuring cylinder on a balance and make sure the balance reads zero • Pour a set volume of the liquid into the measuring cylinder (10ml) • Calculate the density of the liquid by dividing the mass by the volume
20	What other equipment could be used to measure length, if required to a more precise value?			A micrometre or a set of Vernier callipers.
21	What is a physical change?			One in which the material recovers its original properties if the change is reversed
22	When is mass conserved?			During changes of state which are examples of physical changes
23	What is a change of state?			If a substance is heated enough, the particles will have enough energy in the kinetic energy stores to break the bonds holding them together, changing the properties of the substance
24	What change of state is melting?			Solid → liquid
25	What change of state is freezing?			Liquid → solid
26	What change of state is boiling/evaporating?			Liquid → Gas
27	What change of state is condensing?			Gas → Liquid

28	What change of state is sublimating?			Solid → Gas / Gas → Solid
29	What is internal energy?			The total kinetic energy and potential energy stored inside a system by the particles that make up the system.
30	How does heating an object change the internal energy?			It increases the energy of the particles that make up the system to either increase the temperature or cause a change of state.
31	What does the increase in temperature of a system depend on?			The mass of the substance, the type of material and the energy input.
32	What is the word equation that relates the change in energy of a system, mass, specific heat capacity & temperature change?			Change in thermal energy = mass x specific heat capacity x temperature change
33	What is the symbol equation that relates the change in thermal energy of a system to the factors that it depends upon?			$\Delta E = m\,c\,\Delta\theta$
34	What are the units and unit symbols of specific heat capacity?			Joules per kilogram per degree Celsius, J/kg °C
35	What is the specific heat capacity of a substance?			The amount of energy required to raise the temperature of 1 kg of the substance by 1 °C
36	What is latent heat?			The amount of energy needed for a substance to change state
37	What happens to the energy supplied to a substance when it changes state?			It increases the potential energy stored but not the kinetic energy store of the particles
38	What is the specific latent heat of a substance?			The amount of energy required to change the state of 1 kg of the substance with no change in temperature
39	What is the word equation for the energy needed for a change of state of a substance?			Energy needed for a change of state = mass × specific latent heat
40	What is the symbol equation for the energy for a change of state?			$E = m\,L$
41	What is the unit and unit symbol of specific latent heat?			Joules per kilogram, J/kg

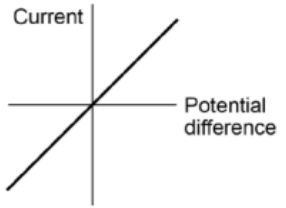
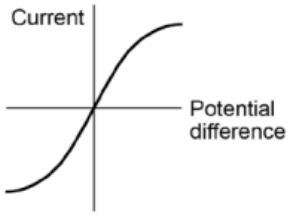
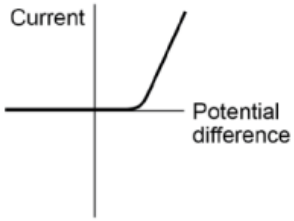
42	What is the specific latent heat of fusion?			The change of state from solid to liquid
43	What is the specific latent heat of vaporisation?			The change of state from liquid to vapour (gas)
45	Label this heating graph:  			A – solid B – melting (solid to liquid) C – liquid D – boiling (liquid to gas) E – gas
46	What is the temperature of a gas related to?			The average kinetic energy of the particles in the gas. Higher the temperature, the higher the average kinetic energy
47	How can we increase the speed and frequency of collision in a container?			Increase temperature and/or decrease volume
48	What happens to the pressure of a gas, held at constant volume, when the temperature is increased?			Increases
49	What happens to the pressure of a gas, held at constant temperature, when the volume is increased?			Decreases

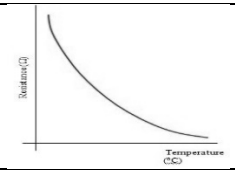
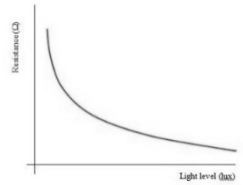
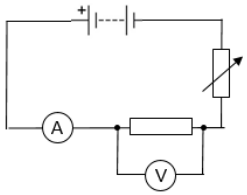
Core questions – Electricity I

No.	Question	My answer	My answer	Answer
1	Label these curcuit symbols: 			
2	What is electricity?			A form of energy
3	What is electrical current?			The rate of flow of electrical charge
4	In most circuits, what is the charge that flows to carry the current?			Electrons
5	What is needed for electrical charge to flow through a closed circuit?			A source of potential difference.
6	What is a circuit diagram?			Simplified circuit drawings using symbols
7	What is a series circuit?			A circuit where all of the components are connected in one loop.
8	Draw a series circuit containing a cell and a bulb.			
9	What is the parallel circuit?			A circuit where there is more than one loop of components.

10	Draw a parallel circuit containing a cell and two bulbs.			
11	What can you say about the current anywhere in a series circuit?			It stays the same
12	What happens to the current in a parallel circuit?			It is shared between the branches but the total stays the same
13	What happens if there is a break in a series circuit?			The current stops flowing
14	What happens if there is a break in one branch of a parallel circuit?			The current stops in that branch only
15	What is the word equation for flow of charge?			charge flow = current x time
16	What is the symbol equation for flow of charge?			Q = I t
17	What is the unit and unit symbol of charge?			Coulombs, C
18	What is the unit and unit symbol of current?			Amps, A
19	What piece of equipment is used to measure current?			Ammeter
20	How are ammeters arranged in a circuit?			In series
21	What is the direction of conventional current?			Positive to negative
22	What is another name for potential difference?			Voltage
23	What is potential difference?			The amount of energy lost or gained by one unit of charge
24	What is the unit and unit symbol of potential difference?			Volts, V
25	What piece of equipment is used to measure potential difference?			Voltmeter

26	How are voltmeters arranged in a circuit to measure the potential difference?			In parallel to the component you are measuring
27	What happens to the potential difference in series circuit?			It is shared between the components
28	What should all of the potential differences add up to in a series circuit?			The potential difference of the battery
29	What happens to the potential difference in a parallel circuit?			The total potential difference across each branch is the same as the potential difference from the battery
30	What equation links potential difference, current & resistance?			potential difference = current x resistance
31	What is the symbol equation for potential difference?			V = I R
32	What is resistance?			Anything in a circuit that slows down the flow of current
33	What is the unit and unit symbol of resistance?			Ohms, Ω (omega)
34	What do we call materials with a low resistance?			Conductors
35	What do we call materials with a high resistance?			Insulators
36	What is the job of a battery in a circuit?			Is the source of the potential difference (Provides the energy)
37	What happens if you add more batteries to a circuit?			More current will flow, the current will increase
38	What happens to the resistance if you add more resistors in series?			it increases
39	What happens to the resistance if you add more resistors to each branch in parallel?			Total resistance decreases
40	In the required practical on measuring resistance, what is the dependent variable?			Resistance
41	For some resistors, the resistance always remains constant. In others, it can change as…			The current changes.

42	At a constant temperature, the current through an ohmic conductor is…			Directly proportional to the potential difference across the resistor.
43	What does the I-V graph for an ohmic conductor look like?			
44	What does it mean that a component is "ohmic"?			Resistance remains constant as current changes.
45	What happens to the resistance of a filament lamp as the potential across the lamp increases?			It increases.
46	Why does the resistance of a filament lamp increase as the potential difference across it increases?			The wire heats up so particles move faster, getting in the way of moving charges more often
47	What does the I-V graph for a filament lamp look like?			
48	Describe the current flow through a diode.			It can only flow in one direction. There is a very high resistance in the reverse direction.
49	What does the I-V graph for a diode look like?			
50	Why does a diode only allow current to flow in one direction?			The particles act like a valve, only allowing charges to travel in one direction
51	What is a thermistor?			A temperature dependent resistor
52	What happens to the resistance of a thermistor when the temperature increases?			It decreases

53	Why does resistance of a thermistor decrease when the temperature increases?			Thermal energy helps the particles to line up and allow charges through more easily
54	What does a resistance-temperature graph look like for a thermistor?			
55	When would a thermistor be useful?			Thermostats – to make things change with temperature
56	What is an LDR?			A Light Dependent Resistor
57	What happens to the resistance of an LDR when the light intensity increases?			It decreases
58	Why does resistance of an LDR decrease when the light intensity increases?			Light energy helps the particles to line up and allow charges through more easily
59	What does a resistance-light intensity graph look like for a LDR?			
60	When would an LDR be useful?			Light sensors - to switch on lights when it gets dark
61	To measure the resistance of a component, what measurements should be made?			Measurements of the current through the component and the potential difference across it.
62	Draw a circuit to show how the resistance of a resistor could be measured?			
63	In the required practical on investigating I-V characteristics of components, what is the independent variable?			The current through the component
64	What happens to the potential difference across a wire when the length of the wire increases?			The longer the wire, the higher the resistance

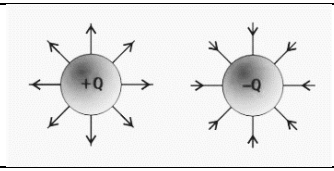
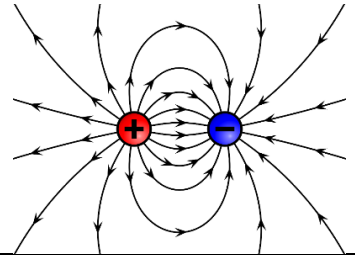
65	In a series circuit, what can be said about the current?			The current is the same through each component.
66	In a series circuit, what can be said about the potential difference?			The sum of the potential difference across each component is equal to the potential difference of the battery
67	In a series circuit, what can be said about the resistance?			The total resistance is the sum of the individual resistances.
68	What is the equation for the total resistance of a series circuit?			$R_{tot} = R_1 + R_2 \ldots$
69	In the branches of a parallel circuit, what can be said about the current?			The total current is equal to the sum of the current in each branch
70	In the branches of a parallel circuit, what can be said about the potential difference?			The potential difference across each branch is the same and the battery
71	In the branches of a parallel circuit, what can be said about the resistance?			The total resistance in the circuit is less than the resistance of the lowest of the resistor in any branch
72	Why does adding resistors in parallel decrease the total resistance?			There are more routes for electrons to take between the branches, so it is easier for current to flow.

Physics Unit 2 (part 2) – Electricity (mains) II

No.	Question	My answer	My answer	Answer
1	What does DC stand for?			Direct Current
2	In what direction does DC current flow?			Current flows in one direction (positive to negative for conventional current)
3	What type of circuits use DC?			Circuits powered by a cell or battery
4	What does AC stand for?			Alternating Current
5	Describe the flow of current in an AC circuit			The current flow rapidly changes direction, giving an alternating potential difference.
6	What type of current does mains electricity use?			Alternating current
7	What the frequency of the AC domestic electricity supply in the UK?			50 Hz, (50 cycles per second)
8	What is the potential difference of the domestic electricity supply in the UK?			230 V

9	How many wires make up the cables of most electrical appliances?			3
10	Why is each wire wrapped in a plastic coating?			As a safety feature. The plastic acts as an insulator from the electricity
11	What does the colour coding on each wire identify it as?			Brown - live wire Blue - neutral wire Green and yellow stripes - earth wire
12	What does the live wire do, and what is its potential?			It carries the alternating potential from the power supply. The potential difference between the live wire and earth is around 230 V.
13	What does the neutral wire do, and what is its potential?			It completes the circuit, and is close to earth potential (0 V).
14	What does the earth wire do, and what is its potential?			It is a safety wire to stop the casing of the appliance from becoming live, so is at 0V and only carries a current if there is a fault.
15	When is a live wire dangerous?			They are always dangerous when a current is flowing, because they carry a potential of 230V.
16	Why is it dangerous to touch a live wire?			A persons potential is 0V. Touching the live wire causes a potential difference of 230V and the charge is carried through the person.
17	What is power?			The amount of energy transferred per second
18	What is the unit of power and the unit symbol?			Watts, W
19	What does the amount of energy an appliance transfers depend on?			The power of the appliance and how long it is switched on for.
20	What does work have to do with electric circuits?			Work is done when charge flows in a circuit.
21	What two **word** equations relate energy transferred, power, time, charge and potential difference?			energy transferred = power x time energy transferred = charge x potential difference
22	What two **symbol** equations relate energy transferred, power, time, charge and potential difference?			$E = P\ t$ $E = Q\ V$
23	What is the unit and unit symbol of energy?			Joules, J
24	What is the power transfer in a circuit related to?			The potential difference across the circuit, the current through it and the energy changes over time.
25	What two word equations relate power, potential difference, current and resistance?			power = potential difference x current power = $(\text{current})^2$ x resistance

26	What two symbol equations relate power, potential difference, current and resistance?			$P = V I$ $P = I^2 R$
27	What does the power rating of an appliance mean?			The maximum operating power that is safe for the appliance.
28	What is the National Grid?			The National Grid is a system of cables and transformers linking power stations to consumers.
29	What is a transformer?			A device which alters the potential difference and current of electricity in the cables.
30	What does a step-up transformer do?			They are used to increase the potential difference from the power station to the transmission cables
31	Why do we increase the potential difference across the cables?			To decrease current and reduce the energy loss due to heating.
32	What does a step-down transformer do?			They are used to decrease the potential difference for safe domestic use.
33 Triple	Why is static-electricity called "static"?			It is related to "static" (or still) electrons which build up on materials.
34 Triple	What type of charge do electrons have?			Negative charge
35 Triple	How is static electricity produced?			When certain insulating materials are rubbed, the friction causes negatively charged electrons to move from one material to another
36 Triple	Which sub-atomic particle is transferred between materials to generate a static charge			Negatively charged electrons
37 Triple	If a material gains electrons what charge will it have?			The material that gains electrons becomes negatively charged.
38 Triple	If a material loses electrons what charge will it have?			The material that loses electrons is left with an equal positive charge.
39 Triple	What happens when electrically charged objects are brought close together?			When two electrically charged objects are brought close together they exert a force on each other.
40 Triple	What is the name of the force that exists between charged objects and what type of force is it?			Electrostatic, Non-contact (the objects do not need to touch)
41 Triple	What happens to two objects with the same type of charge?			They repel each other.
42 Triple	What happens to two objects with different types of charge?			They are attracted to each other.

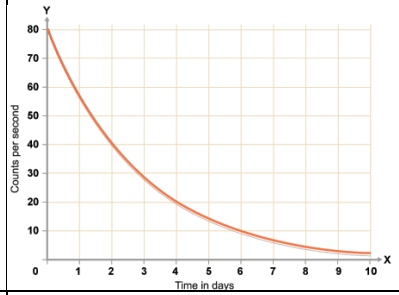
43 Triple	What is an electric field?			A field created around a sphere of charge
44 Triple	What happens if another charged object is placed in the field?			A second charged object placed in the field experiences a force.
45 Triple	Where is the charge strongest in an electric field?			The closer an object is to the charged sphere, the stronger the force
46 Triple	In what direction do field lines flow in a positive and negative charge?			Out of a positive object, into a negative object
47 Triple	How do field lines show the strength of a field?			The closer the lines the stronger the field
48 Triple	What would the field lines look like round isolated, charged spheres?			
49 Triple	What does the electric field pattern look like for a positive charge near a negative charge?			
50 Triple	When will static cause a spark?			If there is a high enough potential difference between a charged object and the earth/earthed object (0V)
51 Triple	What causes the spark?			An electric field occurs between the charged object and the earth object. Air particles in the electric field are ionised (electrons are removed) Ionised air is a conductor and so a current flows between the charged object and the earthed object

Core Questions – Physics unit 4 - Atomic Structure

No.	Question	My answer	My answer	Answer
1	What did scientists think about atoms before the discovery of the electron?			They were tiny spheres that could not be broken up
2	Which sub-atomic particle did JJ Thomson discover?			Electrons
3	What model did JJ Thomson use, following the discovery of an electron, to describe the structure of an atom?			Plum pudding model
4	How did Thomson describe an atom?			Spheres of positive charge with tiny negative electrons stuck in them
5	Which sub atomic particle was discovered by Rutherford and Marsden?			Protons
6	Describe the experiment Rutherford and Marsden did			Fired alpha particles at a thin piece of gold foil.
7	If the plum pudding model was correct what should have happened to the alpha particles when fired at the gold foil?			Pass straight through or be deflected only slightly
8	What did happen to the alpha particles when fired at the gold foil?			Most passed straight through, some were deflected more than expected and some were deflected backwards off the foil.
9	What new ideas about the atom were concluded from the gold foil experiment?			1. Most of the mass was in the centre of atom in a tiny nucleus 2. The nucleus had a positive charge 3. Most of the atom is empty space
10	What name was given to the model of the atom following the gold foil experiment?			The nuclear model
11	How was the atom described in the first nuclear model?			A positively charged nucleus surrounded by a *cloud* of electrons
12	How did the work of Niels Bohr improve the nuclear model?			He suggested that electrons orbit the nucleus at specific distances
13	How did Bohr realise that his suggestions were correct?			His theoretical calculations agreed with experimental observations
14	What did later experiments show that led to the understanding of protons?			Scientists discovered that the positive charge of a nucleus can be divided into a whole number of smaller particles that each have the same positive charge.

15	Which sub-atomic particle was identified by James Chadwick?			The neutron
16	What is the current model of an atom?			There is a positively charged nucleus (made up of protons and neutrons), surrounded by negatively charged electrons.
17	Where is most of the mass of the atom?			In the nucleus
18	What is the average radius of an atom			1×10^{-10} m or 0.1nm (nanometres)
19	How big is the radius of the nucleus?			It is less than 1/10,000th of the radius of the atom.
20	What are energy levels?			The electrons are arranged at different distances from the nucleus in "energy levels" which are sometimes called "shells".
21	What happens to an electron if it **absorbs** EM radiation?			They move up an energy level, further away from the nucleus
22	What happens when an electron **emits** EM radiation?			They move to a lower energy level, closer to the nucleus
23	What happens if one or more electrons leave an atom?			Atom becomes a positive ion
24	What does the proton or atomic number tell you about an atom?			What element it is
25	What does the mass number tell you about an atom?			The number of protons plus the number of neutrons in a the nucleus of an atom
26	What are isotopes?			Atoms of the same element with a different number of neutrons
27	Some isotopes are unstable, what does this mean?			They decay into other elements by emitting radiation
28	What is radioactive decay?			Unstable nuclei give out radiation as they change to become more stable
29	What is the "activity" of a radioactive source?			It is the rate at which a source of unstable nuclei decays
30	What key word can be used to describe the nature of radioactive decay?			Random
31	Name the four types of radiation emitted by unstable isotopes			Alpha, beta, gamma and neutrons
32	Alpha, beta and gamma radiation is ionising. What does it mean?			Knocks electrons off atoms creating positive ions.
33	What is the symbol for an alpha particle?			α
34	What does an alpha particle consist of?			2 protons and 2 neutrons
35	What is another name for an alpha particle?			Helium **nucleus**
36	How far can alpha particles travel in air?			A few centimetres

37	What materials can absorb alpha particles and stop them travelling?			Paper and skin
38	Is the ionising power of alpha particles strong or weak? Give a reason			Strong due to their big size and positive charge
39	Name a use of alpha radiation			Smoke Detector
40	What is the symbol for beta particle?			β
41	What is a beta particle?			A fast moving electron emitted by the nucleus of an atom
42	How far can beta travel through air?			A few metres
43	How ionising are beta particles?			Moderately (less than alpha, more than gamma)
44	What is an example of material that can absorb beta radiation?			Thin sheet of aluminium
45	How can an electron be emitted from the nucleus of an atom?			A neutron splits into a proton and an electron, the proton stays in the nucleus.
46	What is a use of beta radiation?			Testing the thickness of sheets of paper or metal
47	What is gamma radiation?			High frequency waves of electromagnetic radiation
48	How ionising are gamma waves?			Weakly
49	How far can gamma waves through air?			Very far
50	What materials can absorb gamma radiation?			Very thick lead or Concrete
51	Give two uses of gamma radiation?			Medical tracers and radiotherapy
52	What is a nuclear equation?			It shows radioactive decay using element symbols
53	What must be true about a nuclear equation?			Total mass and atomic numbers must be equal on both sides.
54	What happens to the mass and atomic number of an element after alpha decay?			Mass number decreases by 4 Atomic Number decreases by 2
55	How is an alpha particle represented in a nuclear equation?			$^{4}_{2}\mathrm{He}$
56	Write an equation for the alpha decay of radon-219 (proton number 86)			$^{219}_{86}\mathrm{radon} \longrightarrow {}^{215}_{84}\mathrm{polonium} + {}^{4}_{2}\mathrm{He}$
57	What happens to the mass and atomic number of an element after beta decay?			Mass number stays the same Atomic number increases by 1
58	How is a beta particle represented in a nuclear equation?			$^{0}_{-1}\mathrm{e}$
59	Write an equation for the beta decay of carbon-14 (proton number 6).			$^{14}_{6}\mathrm{carbon} \longrightarrow {}^{14}_{7}\mathrm{nitrogen} + {}^{0}_{-1}\mathrm{e}$
60	Gamma radiation does not have a nuclear equation, why?			No particle is lost from the nucleus, just energy

61	What piece of equipment measures radiation?			Geiger-Muller Tube and Counter (Geiger Counter)
62	What is the count-rate?			It is the number of decays recorded each second by a detector (such as a Geiger-Muller tube).
63	What is the unit and unit symbol for radioactivity?			Becquerels, Bq
64	Define the term half-life?			The time taken for the number of radioactive nuclei in an isotope to halve ***or*** The time taken for the radioactive count-rate to halve
65	What happens to the half-life of a source over time?			It stays the same
66	Why are sources with a short half-life dangerous?			The isotopes are very unstable and decay rapidly releasing a high amount of radiation very quickly
67	Why are sources with a long half-life dangerous?			They emit radiation over a very long period of time
68	What is the shape of all half-life graphs?			A downwards curve.
69	How do you use a half-life graph to find the half-life value?			Halve the initial activity on the y-axis Draw a line horizontally over to the curve Draw a line vertically down from the curve to the x-axis Read the time off the x-axis
70	What is the half-life of this substance?  			2 days
71	What is radioactive contamination?			The unwanted presence of materials containing radioactive atoms on other materials.
72	Why is radioactive contamination dangerous?			Due to the decay of the contaminating atoms. The type of radiation emitted affects the level of hazard.
73	What is irradiation?			Exposure to a radiation without physical contact to a radioactive source. The irradiated object **does not** become radioactive.
74	What precautions should people take when working with radioactive substances?			Distance, gloves, suits, screens, minimise exposure time

75	Which type of sources are most dangerous outside of the body and why?			Beta and Gamma as they emit radiation that can penetrate the skin
76	Why is an alpha source very dangerous inside of the body?			Alpha radiation is trapped inside the body and is very localised (does not travel very far)
77	How does radiation damage living tissue?			It ionises atoms and molecules inside cells.
78	What does a high dose of radiation do to a living cell?			Kills it
79	What damage can lower level doses do to cells			Mutate the DNA which may lead to cancer
80	Why is it important for the findings of studies into the effects of radiation on humans to be published and shared with other scientists?			So that the findings can be checked by peer-review and shared more widely if important.