**Core questions – Physic unit 1 – Energy**

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|  | **Questions** | **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, electrical working, mechanical working |
| 16 | Give an example of how energy is transferred mechanically? | By a force doing some work  |
|  | How is energy transferred by radiating? | Waves are given out in all directions |
| 17 | Give an example of how energy is transferred through radiation? | Light & sound, or anything that is part of the EM spectrum |
| 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 velocity2 |
| 27 | What is the symbol equation for kinetic energy? | Ek = ½ mv2 |
| 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? | Ep = mgh |
| 30 | What energy transfer happens when an object is falling? | Stored gravitational potential 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? | $$∆E = m c ∆θ$$ |
| 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? | $Power=\frac{energy transferred}{time}$ , $Power=\frac{work done}{time}$ |
| 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 calculate efficiency | Efficiency = Useful output energy/power Total input energy/power |
| 54 | What is the unit of efficiency? | Efficiency is measured as a decimal or a percentage |
| 55T | Name two ways that thermal energy is transferred **(Triple only)** | Conduction and Convection |
| 56T | How is thermal energy transferred between touching objects? **(Triple only)** | Conduction |
| 57T | How is thermal energy transferred through fluids? **(Triple only)** | Convection |
| 58T | What happens to particles when they are heated up? **(Triple only)** | They gain kinetic energy and vibrate more |
| 59T | How is energy transferred by conduction? **(Triple only)** | Vibrating particles collide passing on energy. |
| 60T | What happens to the particles in a fluid when they are heated? **(Triple only)** | Increase in kinetic energy means particles spread out |
| 61T | What happens to the density of a heated fluid? **(Triple only)** | It decreases |
| 62T | What is convection? **(Triple only)** | Hotter, less dense fluids rise |
| 63 | What is the source of most of our naturally occurring energy resources? | The sun |
| 64 | Name the three fossil fuels | Coal, oil and natural gas |
| 65 | What type of energy store do fuels have? | Chemical energy store |
| 66 | How is the energy stored in fossil fuels released into useful energy? | Combustion (transferred into thermal store) |
| 67 | How does a fossil fuelled power station work? | 1. Fuel combusts releasing thermal energy
2. Thermal energy used to heat water
3. Water turns into steam and turns a turbine
4. The turbine is connected to a generator which generates electricity
 |
| 68 | Name the three main uses of fossil fuels | Generating electricity, heating and transport |
| 69 | Fossil fuels are non-renewable, what does it mean? | They will run out |
| 70 | Why is burning fossil fuels bad for the environment? | They release CO2 andsulfur dioxide into the atmosphere |
| 71 | Why is carbon dioxide bad for the environment? | It is a greenhouse gas and contributes to global warming |
| 72 | Why is sulfur dioxide bad for the environment? | It causes acid rain |
| 73 | 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 |
| 74 | What are the two main nuclear fuels? | Uranium and plutonium |
| 75 | What is a benefit of nuclear fuel? | Does not release greenhouse gases |
| 76 | What is the main disadvantage with nuclear power? | Produces nuclear waste which is hard to dispose of |
| 77 | State four renewable energy resources directly linked to the sun’s energy | Solar, wind, wave and biofuels |
| 78 | What other renewable energy resources are there that don’t rely on the sun? | Geothermal, tidal |
| 79 | Where does geothermal energy come from? | Volcanic regions or where hot rocks that are near the surface |
| 80 | Give two advantages of geothermal energy | Very reliable and causes very little environmental damage |
| 81 | Give two disadvantages of geothermal energy | Very limited availability, very expensive to build power plants |
| 82 | How does hydro-electric power generate electricity? | Water falling from height spins a turbine, connected to generator |
| 83 | Give two benefits of hydro-electric power | Immediate response to a sudden demand (no start up time)Very reliable |
| 84 | Give two disadvantages of hydro-electric power | Loss of habitat when dams are built, very expensive to build |
| 85 | 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 |
| 86 | Why are wind turbines and solar cells **unreliable**? | They depend on the weather |
| 87 | What are the advantages of both wind turbines and solar cells? | Produce no pollution (i.e. carbon dioxide), no fuel costs |
| 88 | What are the disadvantages of wind turbines? | Power output is unreliable, can be noisy, cause visual pollution |
| 89 | What is a bio-fuel? | A fuel made from plant material or animal waste  |
| 90 | What is meant by the term “carbon neutral”? | Activities that do not add **extra** CO2 into the atmosphere |
| 91 | Bio-fuels made from plants are said to be carbon neutral why? | CO2 released when the fuel burns is removed from the atmosphere when the plants grow |
| 92 | 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 |
| 93 | Give three reasons for using more renewable energy in the future | Non-renewables are running outCombat global warmingHigher demand for energy due to population growth |
| 94 | 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 thereMany renewable energy resources are unreliable |

**Core questions – Physics unit 2 - Electricity**

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| **No.** | **Question** | **Answer** |
| 1 | Label these curcuit symbols: |  |
| 2 | How is energy transferred by electrical working? | It flows in an electrical circuit |
| 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. | Image result for cell bulb circuit |
| 9 | What is a parallel circuit? | A circuit where there is more than one loop of components. |
| 10 | Draw a parallel circuit containing a cell and two bulbs. | Related image |
| 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? | Rtot = R1 + R2 … |
| 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. |
| 73 | What does DC stand for? | Direct Current  |
| 74 | In what direction does DC current flow? | Current flows in one direction (positive to negative for conventional current) |
| 75 | What type of circuits use DC? | Circuits powered by a cell or battery |
| 76 | What does AC stand for? | Alternating Current  |
| 77 | Describe the flow of current in an AC circuit | The current flow rapidly changes direction, giving an alternating potential difference.  |
| 78 | What type of current does mains electricity use? | Alternating current |
| 79 | What the frequency of the AC domestic electricity supply in the UK? | 50 Hz, (50 cycles per second) |
| 80 | What is the potential difference of the domestic electricity supply in the UK? | 230 V |
| 81 | How many wires make up the cables of most electrical appliances? | 3 |
| 82 | Why is each wire wrapped in a plastic coating? | As a safety feature. The plastic acts as an insulator from the electricity |
| 83 | What does the colour coding on each wire identify it as? | Brown - live wireBlue - neutral wireGreen and yellow stripes - earth wire |
| 84 | 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. |
| 85 | What does the neutral wire do, and what is its potential? | It completes the circuit, and is close to earth potential (0 V). |
| 86 | 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. |
| 87 | When is a live wire dangerous? | They are always dangerous when a current is flowing, because they carry a potential of 230V. |
| 88 | 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. |
| 89 | What is power? | The amount of energy transferred per second |
| 90 | What is the unit of power and the unit symbol? | Watts, W |
| 91 | What does the amount of energy an appliance transfers depend on? | The power of the appliance and how long it is switched on for. |
| 92 | What does work have to do with electric circuits? | Work is done when charge flows in a circuit. |
| 93 | What two **word** equations relate energy transferred, power, time, charge and potential difference? | energy transferred = power x timeenergy transferred = charge x potential difference |
| 94 | What two **symbol** equations relate energy transferred, power, time, charge and potential difference? | E = P tE = Q V |
| 95 | What is the unit and unit symbol of energy? | Joules, J |
| 96 | 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. |
| 97 | What two word equations relate power, potential difference, current and resistance? | power = potential difference x currentpower = (current)2 x resistance |
| 98 | What two symbol equations relate power, potential difference, current and resistance? | P = V I P = I2 R |
| 99 | What does the power rating of an appliance mean? | The maximum operating power that is safe for the appliance. |
| 100 | What is the National Grid? | The National Grid is a system of cables and transformers linking power stations to consumers. |
| 101 | What is a transformer? | A device which alters the potential difference and current of electricity in the cables. |
| 102 | What does a step-up transformer do? | They are used to increase the potential difference from the power station to the transmission cables  |
| 103 | Why do we increase the potential difference across the cables? | To decrease current and reduce the energy loss due to heating. |
| 104 | What does a step-down transformer do? | They are used to decrease the potential difference for safe domestic use. |
| 105T | Why is static-electricity called "static"? **(Triple only)** | It is related to "static" (or still) electrons which build up on materials. |
| 106T | What type of charge do electrons have? **(Triple only)** | Negative charge |
| 107T | How is static electricity produced? **(Triple only)** | When certain insulating materials are rubbed, the friction causes negatively charged electrons to move from one material to another |
| 108T | Which sub-atomic particle is transferred between materials to generate a static charge? **(Triple only)** | Negatively charged electrons |
| 109T | If a material gains electrons what charge will it have? **(Triple only)** | The material that gains electrons becomes negatively charged. |
| 110T | If a material loses electrons what charge will it have? **(Triple only)** | The material that loses electrons is left with an equal positive charge. |
| 111T | What happens when electrically charged objects are brought close together? **(Triple only)** | When two electrically charged objects are brought close together they exert a force on each other. |
| 112T | What is the name of the force that exists between charged objects and what type of force is it? **(Triple only)** | Electrostatic, Non-contact (the objects do not need to touch) |
| 113T | What happens to two objects with the same type of charge? **(Triple only)** | They repel each other. |
| 114T | What happens to two objects with different types of charge? **(Triple only)** | They are attracted to each other. |
| 115T | What is an electric field? **(Triple only)** | A field created around a sphere of charge  |
| 116T | What happens if another charged object is placed in the field? **(Triple only)** | A second charged object placed in the field experiences a force.  |
| 117T | Where is the charge strongest in an electric field? **(Triple only)** | The closer an object is to the charged sphere, the stronger the force |
| 118T | In what direction do field lines flow in a positive and negative charge? **(Triple only)** | Out of a positive object, into a negative object |
| 119T | How do field lines show the strength of a field? **(Triple only)** | The closer the lines the stronger the field |
| 120T | What would the field lines look like round isolated, charged spheres? **(Triple only)** |  |
| 121T | What does the electric field pattern look like for a positive charge near a negative charge? **(Triple only)** | Image result for electric field point charge |
| 122T | When will static cause a spark? **(Triple only)** | If there is a high enough potential difference between a charged object and the earth/earthed object (0V) |
| 123T | What causes the spark? **(Triple only)** | 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 3 – Particle model of matter**

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|  | **Question** | **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, irregular 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? | $$density=\frac{mass}{volume}$$ |
| 15 | What is the symbol equation for density? | $$ρ=\frac{m}{V}$$ |
| 16 | What are the common units of density? | kg/m3 |
| 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? | $$∆E = m c ∆θ$$ |
| 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:Related image | A – solidB – melting (solid to liquid)C – liquidD – 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 |
| 50T | What happens when gas particles collide with something? **(Triple only)** | They exert a force  |
| 51T | What is gas pressure? **(Triple only)** | The **total force** exerted by all of the particles in the gas on a unit area of the container walls |
| 52T | What two factors will increase the gas pressure in a container? **(Triple only)** | Faster particles & more frequent collisions |
| 53T | What equation relates the pressure and volume of a gas held at constant temperature? **(Triple only)** | $$pressure×volume = constant$$$$p V = constant$$P1V1 = P2V2 |
| 54T | What is the unit and unit symbol of pressure? **(Triple only)** | Pascals, Pa |
| 55T | What is the unit and unit symbol of volume? **(Triple only)** | Metres cubed, m3 |
| 56T | What is work? **(Triple only)** | The transfer of energy by a force. |
| 57T | When work is done on a gas, what happens to the gas? **(Triple only)** | The internal energy increases and it can also cause an increase in temperature |
| 58T | State one example of when work is done on a gas **(Triple only)** | A bicycle pump, doing work on the gas leads to an increase in its temperature  |

**Core Questions – Physics unit 4 - Atomic Structure**

|  |  |  |
| --- | --- | --- |
| **No.** | **Question** | **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 nucleus2. The nucleus had a positive charge3. 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 X 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 4Atomic Number decreases by 2 |
| 55 | How is an alpha particle represented in a nuclear equation? |   |
| 56 | Write an equation for the alpha decay of radon-219 (proton number 86) |  |
| 57 | What happens to the mass and atomic number of an element after beta decay? | Mass number stays the sameAtomic number increases by 1 |
| 58 | How is a beta particle represented in a nuclear equation? |   |
| 59 | Write an equation for the beta decay of carbon-14 (proton number 6). |  |
| 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-axisDraw a line horizontally over to the curveDraw a line vertically down from the curve to the x-axisRead the time off the x-axis |
| 70 | Image result for half life graphWhat 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. |
| 80T | What is background radiation? **(Triple only)** | Low-level radiation that is always in the environment |
| 81T | State the three main sources of background radiation **(Triple only)** | 1. Naturally occurring isotopes in the air, food, building materials and rocks2. Cosmic Rays from space3. Man-made source e.g. nuclear power, medical usage and nuclear bombs |
| 82T | What is meant by the term “radiation dose”? **(Triple only)** | The risk of damage to body tissues due to exposure to radiation |
| 83T | What is the unit and unit symbol for radiation dose? **(Triple only)** | Sieverts, Sv |
| 84T | What sized unit is usually used to measure background radiation and why? **(Triple only)** | **Milli**sievert (mSv) because background radiation is very low |
| 85T | What can affect the level of background radiation or a person's radiation dose? **(Triple only)** | Location or occupation |
| 86T | How is nuclear radiation used in medicine? **(Triple only)** | Exploration of internal organs (tracers) & control or destruction of unwanted tissue (radiotherapy) |
| 87T | What is a medical tracers? **(Triple only)** | A radioactive isotope injected (or swallowed) into a person and their movement around the body is monitored by an external detector |
| 88T | Give an example of a radioactive tracer and its use **(Triple only)** | Iodine-123, used to find out if the thyroid gland is absorbing iodine normally |
| 89T | Why must radioactive tracers be either beta or gamma emitters? **(Triple only)** | So that the radiation passes out of the body and can be detected |
| 90T | What is radiotherapy? **(Triple only)** | Using high dose radiation to kill cancer cells |
| 91T | State the main problem associated with radiotherapy **(Triple only)** | Normal, healthy cells will also be killed making patients feel very ill |
| 92T | If radiation is dangerous, why do we use it for some medical treatments **(Triple only)** | The benefits i.e killing cancer cells, outweigh the risks |
| 93T | What is nuclear fission? **(Triple only)** | A nuclear reaction where a large unstable **nucleus** split in smaller nuclei, releasing large amounts so energy. |
| 94T | Nuclear fission is not usually spontaneous, what does this mean? **(Triple only)** | It does not occur on its own |
| 95T | What event can initiate a fission reaction? **(Triple only)** | A large unstable nucleus absorbs a neutron |
| 96T | What are the normal products of a fission reaction? **(Triple only)** | Two smaller nuclei and two or three neutrons plus gamma rays |
| 97T | What may happen to the neutrons released by a fission reaction? **(Triple only)** | Absorbed by other atoms causing more fission reactions. |
| 98T | What is it called when the neutrons released are absorbed by more nuclei, causing more fission reactions? **(Triple only)** | A chain reaction |
| 99T | Draw a diagram to represent nuclear fission and show how a chain reaction might happen: **(Triple only)** | Image result for nuclear fission |
| 100T | What are two uses of fission reactions? **(Triple only)** | Nuclear power stations (generating electricity) and nuclear weapons |
| 101T | How is an uncontrollable chain reaction avoided in nuclear power stations? **(Triple only)** | Control rods are used to absorb neutrons, reducing the amount of energy released |
| 102T | What is the explosion caused by in a nuclear weapon? **(Triple only)** | An uncontrolled chain reaction |
| 103T | What is nuclear fusion? **(Triple only)** | The joining of two light nuclei to form a heavier nucleus |
| 104T | How is energy released in nuclear fusion? **(Triple only)** | Some of the mass from the colliding nuclei is converted into energy |
| 105T | Why is nuclear fusion difficult to achieve? **(Triple only)** | Very high temperatures and pressures are required and so reactors would be very difficult and expensive to build |

**Core questions – Physics unit 5 - Forces**

|  |  |  |
| --- | --- | --- |
| **No.** | **Question** | **Answer** |
| 1 | What is a vector quantity? | A quantity with magnitude (size) and direction |
| 2 | What examples are there of vector quantities? | Any force, velocity, displacement, acceleration, momentum |
| 3 | What is a scalar quantity? | A quantity with magnitude (size) only |
| 4 | What examples are there of scalar quantities? | Speed, distance, mass, temperature, time |
| 5 | How are vectors represented in a diagram? | With an arrow  |
| 6 | How is the magnitude and direction of a force represented in a vector diagram? | The length represents the size of the quantity and the arrowhead the direction |
| 7 | What is a force? | A push or pull acting on an object |
| 8 | What is a contact force? | A force exerted when the objects are physically touching |
| 9 | What examples are there of contact forces? | Friction, air resistance, tension, normal contact force |
| 10 | What is a non-contact force? | A force exerted on objects that are physically separated |
| 11 | What examples are there of non-contact forces? | Magnetic force, gravitational force, electrostatic force |
| 12 | What happens when two objects interact? | A force is produced on both objects |
| 13 | What is an interaction pair? | Forces that are equal in size and opposite in direction |
| 14 | Which of Newton’s Laws of motion is defined by an interaction pair? | Third law |
| 15 | What is a gravitational force? | An attraction force that acts between masses |
| 16 | When do we notice a gravitational force? | When one of the masses is very, very big, like a planet or star |
| 17 | What is mass? | The amount of matter an object is made of |
| 18 | What is the standard unit of mass and its unit symbol? | Kilograms, kg |
| 19 | What is weight? | A force acting on an object due to gravity |
| 20 | What is the unit for weight and all other forces and the unit symbol? | Newton, N |
| 21 | In what direction does weight always act? | Towards the surface of the planet or star(downwards in most force diagrams) |
| 22 | What does the weight of an object depend on? | The strength of the gravitational field and the mass of an object |
| 23 | What is meant by the term “centre of mass”? | An assumption that identifies a single point on object where the whole mass is concentrated |
| 24 | State the word equation that links gravitational field strength, mass and weight | Weight = mass x gravitational field strength |
| 25 | Give the symbol equation used to calculate weight | W= m x g |
| 26 | What is the relationship between weight and mass, when gravity is constant? | They are directly proportional |
| 27 | How is weight measured, practically? | Using a calibrated spring balance (a newtonmeter) |
| 28 | What is a free body diagram? | A diagram that shows all of the forces acting on an object |
| 29 | How are forces represented on a free body diagram | With an arrow, the length represents the size of the force and the arrowhead the direction of the force. (arrows always point away from the object) |
| 30 | What is a resultant force? | The overall force acting on an object |
| 31 | How do you calculate the resultant of two forces that act in a straight line? | * Add together forces that are acting in the same direction
* Subtract any going in the opposite direction
 |
| 32 | What happens when a resultant force moves an object? | Energy is transferred between energy stores and work is done |
| 33 | What is the word equation that links distance moved, energy transferred and forces?  | Work Done = Force X distance moved |
| 34 | What is the symbol equation for work done? | W = F x s |
| 35 | What are the two units which can be used for measuring work done and the link between them? | Joules or Newton-metres 1J = 1Nm i.e 1J of energy is used when a force of 1N moves an object a distance of 1m |
| 36 | How do you use a scale diagram to find a resultant force? **(HT Only)** | 1. Chose a scale to represent a force e.g. 1cm = 1N
2. Draw your vertical or north pointing force first
3. Draw your horizontal force from the tip of your first arrow (pointing left for east or right for west)
4. Then add your resultant force arrow from the base to the first arrow to the tip of the second arrow
5. Measure the length of the arrow and use your scale to convert it to Newtons
6. Use a protractor to measure the bearing
 |
| 37 | How do you measure a bearing? **(HT Only)** | You measure clockwise from north and give it a three digit number. (the first number will be zero for any bearing smaller than 100o) |
| 38 | What does “resolving” a force mean? **(HT Only)** | Splitting a force into its horizontal and vertical components |
| 39 | How can you resolve a force? **(HT Only)** | 1. Use a scale which converts force to centimetres
2. Draw the resultant force on the correct bearing
3. Create a right angled triangle using the resultant force as the hypotenuse
4. Measure the length of the horizontal and vertical sides and convert to Newtons using your scale
 |
| 40 | What is true of the forces on an object that is in equilibrium? | Forces are balanced or there is an overall resultant force of zero |
| 41 | What three deformations can happen to an elastic object when forces are applied? | Stretching, compressing and bending |
| 42 | What is an elastic deformation? | The object will return to its original size and shape when forces are removed |
| 43 | What is an inelastic deformation? | One in which the object will not return to its original size and shape when forces are removed |
| 44 | Give two examples of elastic objects | A spring and a sponge |
| 45 | What type of energy is stored in a stretched spring? | Elastic potential energy |
| 46 | How do you calculate the extension of a spring? | Length of spring with force applied – original length of spring |
| 47 | How is the extension of a spring related to the force added?  | Extension is directly proportional to the force added (up to a limit) |
| 48 | What word equation links the extension of a spring, force applied and the spring constant? | Force Applied= Spring constant x extension |
| 49 | What letter represent the spring constant in an equation? | k |
| 50 | What does the spring constant depend on? | The stiffness of the spring |
| 51 | If you increase the stiffness of a spring what happens to the size of the spring constant? | It increases |
| 52 | On the following graph what does the letter P represent? | The limit of proportionality or the elastic limit of a spring |
| 53 | How can you calculate the spring constant from a force-extension graph? | Calculate the gradient of the linear part (straight part) of the graph |
| 54 | On a force-extension graph, what does a steeper line represent? | A stiffer spring with a larger spring constant |
| 55 | When measuring a spring with a ruler, why must the ruler be parallel? | To increase the accuracy of the reading |
| 56 | When reading a vertical scale, what is meant by a parallax error? | The reading changes depending on where you are looking from |
| 57 | How do you prevent a parallax error from occurring? | Always read the measurement at eye level |
| 58 | Give two reasons to do a pilot or preliminary experiment | To find an appropriate interval size for the independent variable i.e one that gives measurable results. To check that the method works |
| 59 | What type of quantity is distance? | Scalar |
| 60 | What type of quantity is displacement? | Vector |
| 61 | How is displacement different to distance? | Displacement is a vector quantity, measuring the distance **and** direction in a straight line from the starting point |
| 62 | What is the difference between speed and velocity? | Speed is a scalar quantity and velocity is a vector quantity |
| 63 | What two quantities do you need to measure to calculate speed? | Distance travelled and time taken |
| 64 | State the word equation used to calculate speed | Speed = distance ÷ time |
| 65 | What symbol is used to represent distance? | s |
| 66 | What is the standard unit and unit symbol of distance? | Metres, m |
| 67 | What symbol is used to represent speed (velocity) and  | v |
| 68 | What is the standard unit and unit symbol of velocity? | Metres per second, m/s |
| 69 | Give the symbol equation linking distance, speed and time | s = v x t |
| 70 | Why are most speeds said to be average speeds? | Objects rarely travel at a constant speed, they speed up and slow down. |
| 71 | What is the typical average speed for a person walking? | 1.5 m/s |
| 72 | What is the typical average speed for a person running? | 3.0 m/s |
| 73 | What is the typical average speed for a person cycling? | 6 m/s  |
| 74 | What is the typical average speed for a car? | 25 m/s |
| 75 | What is the typical average speed for a train? | 55 m/s |
| 76 | What is the typical average speed for a plane? | 250 m/s |
| 77 | What is the speed of sound in air? | 330 m/s |
| 78 | What is meant by acceleration? | Change in velocity in a certain amount of time |
| 79 | What happens to an objects velocity when it is travelling in a circle? **(HT only)** | It is constantly changing |
| 80 | Why is travelling at a constant speed in a circle considered to be an example of constant acceleration? **(HT only)** | Velocity is constantly changing due to the direction constantly changing |
| 81 | What equation is used to calculate average acceleration? | Acceleration = change in velocity/ time taken |
| 82 | What is the standard unit and unit symbol for acceleration? | Metres per second squared, m/s2 |
| 83 | What is meant by uniform acceleration? | constant acceleration |
| 84 | What is the word equation for uniform acceleration? | Final velocity – initial velocity = 2 x acceleration x distance travelled |
| 85 | State the symbol equation for uniform acceleration? | v2 – u2 = 2as |
| 86 | What is the acceleration due to gravity near the Earth’s surface? | 9.8 m/s2 |
| 87 | On a distance-tine graph what does a straight line with a gradient represent? | Constant speed |
| 88 | What does a horizontal line on a distance-time graph represent? | The object is stationary |
| 89 | What does a curve represent on a distance-time graph? | Acceleration or deceleration |
| 90 | How can you calculate the acceleration from a curve on a distance-time graph? **(HT only)** | Draw a tangent to the curve and calculate the gradient |
| 91 | On a velocity-time graph what does a straight line with a gradient represent? | Constant acceleration |
| 92 | What does a horizontal line on a velocity-time graph show? | Constant speed |
| 93 | What is different about the lines on a velocity-time graph which show acceleration and deceleration? | Acceleration is a line moving up the graph, deceleration is a line moving down the graph |
| 94 | How do you use a velocity-time graph to calculate the distance travelled by an object? **(HT only)** | Calculate the area under the graph |
| 95 | Which force always acts in the opposite direction to motion? | Friction |
| 96 | What other name is given to the force of friction due to objects moving through a fluid? | Drag |
| 97 | What must be true about the driving force and friction on an object moving at a constant speed? | They are the same sizeThey are balancedThe resultant force is zero |
| 98 | When an object speeds up, what happens to the friction/drag force? | Increases |
| 99 | How can you reduce the effect of drag on a moving object? | Make it more streamlined |
| 100 | What force causes a falling object to accelerate? | Gravity |
| 101 | What force acts against gravity? | Drag/friction |
| 102 | What is meant by the terminal velocity of a falling object? | Maximum constant velocity |
| 103 | When does a falling object reach terminal velocity? | When the weight of the object is equal to the force of drag so the resultant force is zero |
| 104 | Why do objects fall at different speeds on earth when they have the same acceleration force due to gravity? | Friction forces due to air resistance depends on the shape and surface area of the object |
| 105 | If a bike is travelling forwards with a force A, and force B is opposing the motion, describe what is happening at each stage on this graph? **(Triple only)**  | **Between X and Y:**Force A is greater than force B (but force B is increasing)Cyclist accelerates (but the rate of acceleration slows down)**Between Y and Z:**Force B becomes equal to force A (resultant force = 0)Cyclists acceleration stops and they reach terminal velocity (constant speed) |
| 106 | State Newton’s First Law | A resultant force is needed to make an object start moving, speed up, slow down or change direction. |
| 107 | What are the two possible conditions of an object with a resultant force of zero? | It must be stationary **or** moving at a constant velocity |
| 108 | State Newton’s Second Law | The acceleration of an object is directly proportional to the force applied |
| 109 | State the word equation used to represent Newton’s Second Law? | Force = mass x acceleration |
| 110 | State the symbol equation used to represent Newton’s Second Law? | F = m x a |
| 111 | What is inertia? **(HT only)** | The tendency of an object to continue in their state of rest or of uniform motion |
| 112 | What is inertial mass and how is it calculated? **(HT only)** | Measure of how difficult it is to change the velocity of an object, m= F ÷a |
| 113 | State Newton’s Third Law | Whenever two objects interact, the forces they exert on each other are equal and opposite |
| 114 | What symbol represent ‘approximately’ | ̴ |
| 115 | What is meant by the “Stopping Distance” of a car? | The **total distance travelled** by a car in an emergency |
| 116 | State the two components of the total stopping distance of a car | Thinking distance and braking distance |
| 117 | What is the thinking distance? | The **distance** a car travels between seeing a hazard and the brakes being applied (the drivers reaction time) |
| 118 | What does typical human reaction time range between? | 0.2s to 0.9s |
| 119 | What two key factors affect the thinking distance of a car? | The speed the car is travelling and the reaction time of the driver |
| 120 | What factors will increase the time it takes for a driver to react? | Alcohol, distractions, tiredness |
| 121 | What factors will increase the braking distance of a car? | Worn tyres, poor brakes, slippery roads (wet or icy) |
| 122 | What happens to the overall stopping distance as speed increases? | It increases |
| 123 | Why does the thinking distance increase at faster speeds when the driver’s reaction time stays the same? | At higher speeds a car travels further in the same length of time |
| 124 | What is the relationship between thinking distance and speed? | Proportional, linear |
| 125 | What happens when a force is applied to the brakes of a vehicle? | Work done by the friction force between the brakes and the wheel reduces the kinetic energy of the vehicle |
| 126 | What is the kinetic energy store of the car transferred into when the brakes are applied? | The thermal energy store in the brake discs (the brakes get hotter) |
| 127 | What needs to happen to the braking force for a vehicle to stop in the same distance at a greater speed? | Increase |
| 128 | What happens to the rate of deceleration if the braking force increases? | Increases |
| 129 | What might happen if the deceleration of a vehicle is too high? | Brakes may overheat and/or loss of control |
| 130 | What happens to the kinetic energy of a car if the speed doubles? | It increases by a factor of 4 |
| 131 | What happens to the work done to stop a car if speed doubles? | It increases by a factor of 4 |
| 132 | If braking force remains constant, what is the link between work done by the brakes and the distance the car travels when stopping? | They are directly proportional (Work done ∝ distance) |
| 133 | What is momentum? **(HT only)** | The tendency of a moving object to keep moving in the same direction |
| 134 | What two factors affect the momentum of an object? **(HT only)** | Its mass and velocity |
| 135 | What is the word equation for calculating momentum? **(HT only)** | Momentum= mass x velocity |
| 136 | What is the symbol equation for momentum? **(HT only)** | p = m X v |
| 137 | What is the principle of “conservation of momentum”? **(HT only)** | The total momentum before an event is equal to the total momentum after the event |
| 138 | What is true about the momentum before and after an explosion? **(HT only)** | It is zero |
| 139 | What is meant by the word recoil? **(HT only)** | The movement backwards of a gun when it is fired |
| 140 | Why is the velocity of a gun’s recoil action negative compared to the bullets velocity? **(HT only)** | It is moving in the opposite direction (velocity is a vector quantity) |
| 141 | What causes a change of momentum? **(Triple only)** | A resultant force acting on a moving object |
| 142 | What equation can be used to calculate changes in velocity during a collision? **(Triple only)** | Momentum before = momentum afterM1V1 = M2V2 |
| 143 | What equation links force, time and velocity? **(Triple only)** | Force applied = change in velocity change in time |
| 144 | What two things would cause a big change in momentum? **(Triple only)** | A large change of velocity A very short period of time |
| 145 | How do safety features in cars reduce the chance of injuries during a crash? **(Triple only)** | They increase the time taken to slowdown during a collision and this reduces the force |
| 146 | What safety features are designed to increases the rate of change of momentum? **(Triple only)** | Air bags, seat belts, gym crash mats, cycle helmets, cushioned surfaces in playgrounds |
| 147 | How do light gates work? | An object interrupts a beam of light and starts a timer, when the beam is interrupted again the timer stops. The distance between the objects is used to calculate speed. |
| 148 | How can light gates be used to calculate acceleration? | Use two light gates, a known distance apart and measure the speed of a moving object at the two different points |
| 149 | State two factors affecting the acceleration of a moving object that can be investigated using light gates.  | The mass of the object, the force applied to an object. |
| 150 | Describe a simple experiment used to investigate Newton’s Second Law | A trolley is attached to a piece of string that goes over pulley,Masses are adding to the end of the string to make the trolley moveThe trolley has a card attached which passes through two light gates  |
| 151 | Describe a simple experiment used to measure reaction time. | Drop a ruler through the hand of a person and measure how far the ruler falls. |

**Core questions – Physics unit 5 – Forces (part 3 – triple only)**

|  |  |  |
| --- | --- | --- |
| **No.** | **Question** | **Answer** |
| 1 | What is a moment? | The turning effect of a force |
| 2 | What two factors affect the size of a moment? | The force applied and the distance from the pivot or turning point |
| 3 | What word equation links distance, force and moment? | Moment = force x distance |
| 4 | What is the symbol equation for the moment of a force? | M = Fd |
| 5 | What is the unit and unit symbol for the moment of a force? | Newton-metres, Nm |
|  | What does the ‘distance’ represent in the moment equation? | The perpendicular distance (at right angles) from the pivot to the line of action of the force |
| 6 | When will a see-saw be in balance? | When the clockwise moment is equal to the anticlockwise moment |
| 7 | How do levers work? | The longer the lever, the smaller the force needed for the same sized moment |
| 8 | How do you maximise the effect of a moment on a lever? | Apply the force perpendicular (at right angles) to the lever |
| 9 | What is a gear? | A circular disc with teeth that interlock with another gear, they transmit the rotational effect of a force |
| 10 | How do gears work? | Turning one gear causing another to turn but in the opposite direction |
| 11 | What happens when you increase the size of a gear? | The moment increases, the gear turns more slowly |
| 12 | What is a fluid? | Substances that can flow because their particles are free to move |
| 13 | What two physical states are classed as fluids? | Liquids and gases |
| 14 | How do particles of a fluid exert a pressure? | The particles collide with an object exerting a force on the surface |
| 15 | What word equation is used to calculate pressure? | Pressure = Force/Area |
|  | What symbol equation is used to calculate pressure? | P = F/A |
| 16 | What are the units and unit symbol for pressure? | Pascals, Pa |
| 17 | What two things affect the pressure of a liquid? | The density of the liquid and the depth the pressure is measured at |
| 18 | What equation links density, depth, gravitational field strength and pressure? | Pressure = depth (height of a column of liquid) x density x gravitational field strength |
| 19 | What causes upthrust in water? | A resultant force due to the pressure above an object being lower than the pressure below an object |
| 20 | What is upthrust equal to? | The weight of water displaced by the object |
| 21 | When will an object float? | When the upthrust on an object is equal to the weight of an object |
| 22 | How is the density of an object linked to floating? | If an object is less dense than water it will float.It weighs less than the volume of water it displaces |
| 23 | What causes atmospheric pressure? | Air particles colliding with a surface |
| 24 | What happens to atmospheric pressure at high altitude and why? | It decreases because the air is less dense. Less air particles means less collisions |

**Core questions – Physics unit 6 - Waves**

|  |  |  |
| --- | --- | --- |
| 1 | What is a wave? | Transfers energy from one place to another without transferring matter |
| 2 | What are the two types of waves? | Transverse and longitudinal |
| 3 | What is an example of a transverse wave? | Ripples on the surface of water |
| 4 | What is an example of a longitudinal wave? | Sound waves travelling through air |
| 5 | What direction are the oscillations of a transverse wave compared to the direction of the energy travel? | The oscillations (vibrations) are **perpendicular** (at 90o) to the direction of energy transfer |
| 6 | What direction are the oscillations of a longitudinal wave compared to the direction of the energy travel? | The oscillations (vibrations) are **parallel** to the direction of energy transfer |
| 7 | Draw a labelled diagram of a longitudinal wave? | RarefactionCompression |
| 8 | Draw a labelled diagram of a wave to demonstrate amplitude, wavelength, peaks, troughs and one complete cycle of a wave. | Image result for amplitude wavelength |
| 9 | What is the definition of amplitude? | The maximum displacement of a point on a wave away from its undisturbed position. |
| 10 | What is the definition of wavelength? | The wavelength of a wave is the distance from a point on one wave to the equivalent point on the adjacent wave. |
| 11 | What is the definition of frequency? | The frequency of a wave is the number of waves passing a point each second |
| 12 | What is the equation from the physics equation sheet that relates the period of one wave and frequency? | $$period=\frac{1}{frequency}$$ |
| 13 | What is the symbol equation from the physics equation sheet that relates period and frequency? | $$T=\frac{1}{f}$$ |
| 14 | What are the units and unit symbol of frequency? | Hertz, Hz |
| 15 | What is the wave speed? | The speed at which the energy is transferred through the medium. |
| 16 | What is the word equation for wave speed? | $$wave speed  = frequency × wavelength$$ |
| 17 | What is the symbol equation for wave speed? | $$v = f  λ$$ |
| 18 | What are the unit and unit symbol of wave speed? | metres per second, m/s |
| 19 | What happens to waves at the boundary between materials? **(Triple only)** | They can be reflected, absorbed or transmitted. |
| 20 | What is a ‘normal’ line? **(Triple only)** | An imaginary line that’s perpendicular to the surface at the point where the wave hits the surface |
| 21 | What is the relationship between the angles of incidence and reflection? **(Triple only)** | Angle of incidence = angle of reflection |
| 22 | Draw a ray diagram to show how light is reflected by a plane mirror. **(Triple only)** | Image result for ray diagram reflection |
| 23 | What is specular reflection? **(Triple only)** | When a wave is reflected in a single direction by a smooth surface (e.g. a mirror) and you get a clear reflection |
| 24 | What is diffuse reflection? **(Triple only)** | When a wave is reflected by a rough surface (e.g. a piece of paper) and the rays are scattered in lots of different directions |
| 25 | How do sound waves travel through solids? **(Triple only)** | Vibrations in the solid cause the sound wave to travel |
| 26 | How do humans hear sounds? **(Triple only)** | The sounds waves cause the ear drum and other parts of the ear to vibrate, causing a sensation of sound |
| 27 | Why can humans hear only a limited range of sounds? **(Triple only)** | Human hearing is limited by the size and shape of our ear drum as well as the structure of all the parts in the ear that vibrate |
| 28 | What is a reflected sound called? **(Triple only)** | An echo |
| 29 | What is the range of normal human hearing? **(Triple only)** | 20 Hz to 20 kHz |
| 30 | What are ultrasound waves? **(Triple only)** | Ultrasound waves have a frequency higher than the upper limit of hearing for humans (frequencies above 20, 000 Hz) |
| 31 | What happens when ultrasound waves meet a boundary between two different media? **(Triple only)** | They are partially reflected |
| 32 | What does it mean when an ultrasound is described as ‘partially reflected’? **(Triple only)** | Some of the wave is reflected off the boundary between the two media, and some is transmitted (and refracted) |
| 33 | How can partial reflection be used in ultrasound to determine how far away a boundary between one substance and another is? **(Triple only)** | By the time taken for the reflections to reach a detector |
| 34 | What can ultrasound waves be used for? **(Triple only)** | Medical and industrial imaging |
| 35 | What are seismic waves? **(Triple only)** | Waves produced by earthquakes |
| 36 | What are P-waves? **(Triple only)** | P-waves are longitudinal, seismic waves. P-waves travel at different speeds through solids and liquids. |
| 37 | What are S-waves? **(Triple only)** | S-waves are transverse, seismic waves |
| 38 | Which type of media are S-waves unable to travel through? **(Triple only)** | Liquids |
| 39 | What do P-waves and S-waves provide evidence for? **(Triple only)** | The structure and size of the Earth’s core, which are not easily observable |
| 40 | How are waves used to detect objects in deep water and measure water depth? **(Triple only)** | Echo sounding, using high frequency sound waves |
| 41 | What are electromagnetic waves? | Transverse waves that transfer energy from the source of the waves to an absorber |
| 42 | What are the groups of waves in the electromagnetic spectrum? Label increasing wavelength and frequency? |  |
| 43 | What is the velocity of all electromagnetic waves through a vacuum? | 300 000 000 m/s (3.0 x 108 m/s) |
| 44 | What is the only electromagnetic waves our eyes are able to detect? | Visible light |
| 45 | What is a practical application for radio waves? | Television and radio |
|  | What is a practical application for microwaves? | Satellite communications, cooking food |
| 46 | Why are microwaves used for satellite communications? | They are able to pass through the Earth’s atmosphere |
| 47 | What is a practical application for infrared? | Electrical heaters, cooking food, infrared cameras |
| 48 | What is a practical application for visible light? | Fibre optic communications |
| 49 | What is a practical application for ultraviolet? | Energy efficient lamps, sun tanning |
| 50 | What is a practical application for x-rays and gamma rays? | Medical imgaing and treatments |
| 51 | What happens when a wave crosses a boundary between different materials at an angle and what is this called? **(HT only)** | They speed up or slow down and it changes directions – called refraction |
| 52 | Why do waves refract when they enter different substances? **(HT only)** | They speed up of slow down |
| 53 | What does the size of refraction depend on? **(HT only)** | How much the wave speeds up or slows down |
| 54 | What happens to a wave if it crosses a boundary at an angle and slows down? **(HT only)** | It bends towards the normal |
| 55 | What happens to a wave if it crosses a boundary at an angle and speeds up? **(HT only)** | It bends away from the normal |
| 56 | Draw a ray diagram to show how light is refracted at a surface between two materials. **(HT only)** | Image result for ray diagram refraction |
| 57 | Draw a **wave front** diagram to explain how refraction is related to the change of speed that happens when a wave travels from one medium to another. **(HT only)** | Related image |
| 58 | What happens to the wavelength and frequency of a wave when it is refracted? **(HT only)** | The wavelength changes, but the frequency stays the same |
| 59 | How can radio waves be produced? **(HT only)** | Oscillations in electrical circuits  |
| 60 | What is the object called in which charges oscillate to create the radio waves? **(HT only)** | A transmitter |
| 61 | What is the frequency of the waves produced by a transmitter the same as? **(HT only)** | The frequency of the alternating current in the electrical circuit |
| 62 | What happens when transmitted radio waves reach a receiver? **(HT only)** | They are absorbed |
| 63 | What happens to the energy that is being carried by the radio waves when it reaches a receiver? **(HT only)** | It is transferred to the electrons in the material of the receiver and causes them to oscillate at the same frequency as the radio wave that generated it |
| 64 | How are electromagnetic waves related to atoms and nuclei? | Changes in atoms and the nuclei of atoms can result in electromagnetic waves being generated or absorbed  |
| 65 | Where do gamma rays originate from? | Changes in the nucleus of an atom |
| 66 | What is radiation dose? | Radiation dose is a measure of the risk of harm resulting from an exposure of the body to the radiation. |
| 67 | What are the units of radiation dose? | Sieverts, Sv |
| 68 | How many millisieverts (mSv) make up 1 sievert (Sv)? | 1000 millisieverts (mSv) = 1 sievert (Sv) |
| 69 | What effect do ultraviolet waves have on skin? | They can cause it to age prematurely and they increase the risk of skin cancer. |
| 70 | Which types of EM radiation are ionising? | X-rays and gamma rays |
| 71 | What effects can ionising radiation have on the body? | They can cause mutation of genes and cancer |
| 72 | What are the two different types of lens? **(Triple only)** | Convex and concave |
| 73 | What is the definition of converging and which lens does this apply to? **(Triple only)** | Brought together, convex |
| 74 | What is the definition of diverging and which lens does this apply to? **(Triple only)** | Spread out, concave |
| 75 | How do convex lenses form an image? **(Triple only)** | Parallel rays of light are brought together (converge) at the principal focus |
| 76 | Where is the principle focus of a convex lens? **(Triple only)** | Where rays hitting the lens parallel to the axis all meet |
| 77 | Where is the principle focus of a concave lens? **(Triple only)** | The point where rays hitting the lens parallel to the axis appear to all come from. You have to trace them back until they appear to meet up. |
| 78 | What is the focal length? **(Triple only)** | The distance from the lens to the principal focus |
| 79 | What is a real image? **(Triple only)** | One that can be shown on a screen |
| 80 | What is a virtual image? **(Triple only)** | One that does not exist, and only appears to  |
| 81 | What can you not do with a virtual image? **(Triple only)** | Project it onto a screen |
| 82 | What type of image does a convex (converging) lens produce? **(Triple only)** | Real or virtual |
| 83 | What type of image does a concave (diverging) lens produce? **(Triple only)** | Virtual only |
| 84 | What is the equation from the Physics equation sheet for magnification? **(Triple only)** | Magnification = image height / object height |
| 85 | What are the units for image height and object height? **(Triple only)** | mm or cm |
| 86 | What are the units of magnification? **(Triple only)** | Magnification is a ratio and so has no units |
| 87 | How is a convex lens represented in ray diagrams? **(Triple only)** |  |
| 88 | How is a concave lens represented in ray diagrams? **(Triple only)** |  |
| 89 | What would a ray diagram look like for an image through a convex lens? **(Triple only)** | Image result for convex lens ray diagram |
| 90 | How does the distance the object is from a convex lens affect the image? **(Triple only)** | An object at 2F will produce a **real**, inverted image the same size as the objectAn object between F and 2F will produce a **real**, inverted image that is bigger than the objectAn object nearer than F will make a **virtual** image the right way up, bigger than the object |
| 91 | What would a ray diagram look like for an image through a concave lens? **(Triple only)** | Image result for convex lens ray diagram |
| 92 | What is the difference between the colours in the visible light spectrum? **(Triple only)** | They each have their own narrow band of wavelength and frequency |
| 93 | What is the word for reflection from a smooth surface in a single direction? **(Triple only)** | Specular reflection |
| 94 | What is the word for reflection from a rough surface? **(Triple only)** | Diffuse reflection |
| 95 | How do colour filters work? **(Triple only)** | By absorbing certain wavelengths (and colour) and transmitting other wavelengths (and colour) |
| 96 | What is an opaque object? **(Triple only)** | An object in which no light is transmitted |
| 97 | What determines the colour of an opaque object? **(Triple only)** | By which wavelengths of light are more strongly reflected |
| 98 | What happens to the colours hitting an opaque object that are not reflected? **(Triple only)** | They are absorbed |
| 99 | When does an object appear white? **(Triple only)** | When all wavelengths of light are reflected equally |
| 100 | When does an object appear black? **(Triple only)** | When all wavelengths of light are absorbed |
| 101 | What is the definition of transparent? **(Triple only)** | An object that is see through |
| 102 | What is the definition of translucent? **(Triple only)** | An object that is partially see through |
| 103 | What words are used to describe objects which transmit light? **(Triple only)** | Transparent or translucent |
| 104 | What radiation do all objects, no matter what temperature, emit & absorb? **(Triple only)** | Infrared |
| 105 | What can be said about the amount of radiation a hot body emits? **(Triple only)** | The hotter the body, the more infrared radiation it radiates in a given time |
| 106 | What is a perfect black body? **(Triple only)** | An object that absorbs all of the radiation incident on it. No radiation is reflected or transmitted. |
| 107 | What type of object is the best possible emitter of radiation? **(Triple only)** | A perfect black body |
| 108 | What can be said about the rate that an object absorbs and emits radiation? **(Triple only)** | A body at constant temperature is absorbing radiation at the same rate as it is emitting radiation.  |
| 109 | When does the temperature of a body increase? **(Triple only)** | The temperature of a body increases when the body absorbs radiation faster than it emits radiation |
| 110 | What factors affect the temperature of the Earth? **(Triple only)** | The rates of absorption and emission of radiation; Reflection of radiation into space |

**Core questions – Physics unit 7 – Magnetism and electromagnetism**

|  |  |  |
| --- | --- | --- |
|  | **Question** | **Answer** |
| 1 | What are the poles of a magnet? | The place where the magnetic forces are strongest |
| 2 | What happens when two magnets are brought close to each other? | They exert a force on each other |
| 3 | What happens when two like poles of magnets are brought close to each other? | The repel each other |
| 4 | What happens when two unlike poles of magnets are brought close to each other? | They attract each other |
| 5 | What type of force is magnetism an example of? | A non-contact force |
| 6 | What is a permanent magnet? | One which produces its own magnetic field |
| 7 | What is an induced magnet? | A material that becomes a magnet when it is placed in a magnetic field |
| 8 | What happens to an induced magnet when it is taken out of a magnetic field? | It loses most/all of its magnetism quickly |
| 9 | What is the only force that is caused by an induced magnet? | A force of attraction |
| 10 | What is a magnetic field? | The region around a magnet where a force acts on another magnet or on a magnetic material |
| 11 | What materials are magnetic? | Iron, cobalt, nickel, steel (an iron alloy) |
| 12 | What type of force exists between a magnet and a magnetic material? | Attractive magnetic force |
| 13 | What does the strength of the magnetic field depend upon? | The distance it is from the magnet. The field is strongest at the poles |
| 14 | How do we define the direction of the magnetic field? | The direction of the magnetic field at any point is given by the direction of the force that would act **on another north pole** placed at that point |
| 15 | What direction do magnetic field lines point? | From the north seeking pole of a magnet to the south seeking pole of a magnet |
| 16 | How does a magnetic compass work? | It contains a small bar magnet that points in the direction of the Earth’s magnetic field |
| 17 | Why does Earth have a magnetic field? | It has an iron core |
| 18 | How can you use a compass to plot the magnetic field pattern of a magnet? | 1. Place the compass in the field around the magnet
2. Draw a dot where the compass points (north and south)
3. Move the compass so that the south direction of the needle is at the dot you just drew
4. Repeat until the lines form a loop and **connect the dots**
 |
| 19 | Draw the magnetic field pattern of a bar magnet. | Image result for magnetic field pattern bar magnet |
| 20 | What happens when a current flows through a conducting wire? | A magnetic field is produced around the wire |
| 21 | What does the strength of a magnetic field depend on when a current flows through a wire? | The size of the currentThe distance from the wire |
| 22 | What is a solenoid? | A coil of wire  |
| 23 | What happens to the magnetic field when a wire is shaped into a solenoid? | It becomes much stronger |
| 24 | Describe the magnetic field **inside** the solenoid? | It is strong and uniform (it has the same strength and direction at every point) |
| 25 | Describe the shape of the magnetic field around a solenoid? | The same as the shape of a magnetic field around a bar magnet |
| 26 | How can the strength of a solenoid be increased? | By adding an iron core |
| 27 | What is an electromagnet? | A solenoid with an iron core |
| 28 | How can the magnetic field of a solenoid be stopped? | Turn of the current |
| 29 | What is an advantage of using an electromagnetic instead of a permanent magnet? | The magnetic field can be turned on and off |
| 30 | Draw the magnetic field pattern for a straight wire carrying a current? | Related image |
| 31 | Draw the magnetic field pattern for a solenoid? | Image result for magnetic field pattern solenoid |
| 32 | What is the motor effect? **(higher tier only)** | The term used when a current carrying wire experiences a force, causing it to move, when placed in a magnetic field |
| 33 | Describe what happens when a current carrying wire is put between magnetic poles? **(higher tier only)** | The magnetic field around the wire interacts with the magnetic field it has been placed in, causing the wire and the magnet to exert a force on each other |
| 34 | To experience the full force from the motor effect, what direction does the wire have to be compared to the magnetic field? **(higher tier only)** | 90o to the magnetic field |
| 35 | When would a wire experience no force from the motor effect? **(higher tier only)** | If the wire runs **parallel** to the magnetic field |
| 36 | What does Fleming’s left hand rule represent? **(higher tier only)** | The relative orientation of the directions of the force, the current in the conductor and the magnetic field |
| 37 | How can we use Fleming’s left hand rule to determine the direction of the force, the direction of current and the direction of the magnetic field? **(higher tier only)** | Image result for flemings left hand ruleThu**m**b = direction of force (**motion**)**F**irst finger = direction of magnetic **field**Se**c**ond finger = direction of **current** |
| 38 | What will affect the size of the force acting on the conductor in a magnetic field? **(higher tier only)** | The magnetic flux density, the size of the current, the length of the conductor that’s in the magnetic field |
| 39 | What word equation represents the force exerted on a conductor carrying a current at 90o to a magnetic field? **(higher tier only)** | Force = magnetic flux density x current x length |
| 40 | What symbol equation represents the force exerted on a conductor carrying a current at 90o to a magnetic field? **(higher tier only)** | F = B I l |
| 41 | What is the unit and unit symbol of magnetic flux density (B) **(higher tier only)** | Tesla, T |
| 42 | What is the unit and unit symbol of current (I) **(higher tier only)** | Amps, A |
| 43 | What happens to a loop of wire carrying a current when placed in a magnetic field? **(higher tier only)** | It rotates |
| 44 | Why does a loop of wire rotate in a magnetic field? **(higher tier only)** | The current travels in opposite directions through the magnetic field meaning the forces acting on the wire act in opposite directions |
| 45 | What is used in an electric motor to switch the direction of the current in the wires causing it to continue to rotate? **(higher tier only)** | A split ring commutator |
| 46 | How do loudspeakers and headphones use the motor effect? **(higher tier only)** | They convert variations in current in electrical circuits to the pressure variations in sound waves |
| 47 | Describe how loudspeakers and headphones works? **(higher tier only)** | 1. A coil of wire is attached to a cone
2. When an alternating current flows through the wire it creates a magnetic field
3. The magnetic field interacts with the field from the permanent magnet
4. This produces a resultant force on the cone causing it to move
5. When the frequency of the AC current changes, the frequency of the sound changes
 |
| 48 | What is the generator effect? **(triple science only)** | The induction of a potential difference in a wire which is moving relative to a magnetic field |
| 49 | When would a current be induced during the generator effect? **(triple science only)** | If the conductor moving through the magnetic field was in a complete circuit |
| 50 | How does the magnetic field produced from an induced current interact with the magnetic field already there? **(triple science only)** | The magnetic field created by a induced current acts **against** the change that made it |
| 51 | How can the size of the induced potential difference be changed? **(triple science only)** | * Increasing the speed of movement that the conductor is moving in and out of a magnetic field
* Increasing the strength of the magnetic field
* Turn the wire into a coil
 |
| 52 | How is the generator effect used in an **alternator**? **(triple science only)** | To generate an alternating current (AC) |
| 53 | How is the generator effect used in a **dynamo**? **(triple science only)** | To generate a direct current (DC) |
| 54 | Describe how an alternator works? **(triple science only)** | 1. Generators rotate a coil in a magnetic field
2. As the coil rotates, a current is induced in the coil
3. AC generators have slip rings and brushes so the current changes every half turn generating an alternating current (AC)
 |
| 55 | Draw how the output potential difference of an alternator varies with time? **(triple science only)** |  |
| 56 | Describe how a dynamo works? **(triple science only)** | 1. Generators rotate a coil in a magnetic field
2. As the coil rotates, a current is induced in the coil
3. The wire is attached to a split ring commutator
4. This keeps the current flowing in the same direction generating a direct current (DC)
 |
| 57 | Draw how the output potential difference of a dynamo varies with time? **(triple science only)** |  |
| 58 | How do microphones use the generator effect? **(triple science only)** | They convert the pressure variations in sound waves into variations in current in electrical circuits |
| 59 | What is a transformer? **(triple science only)** | They can change the size of the potential difference |
| 60 | What type of current does a transformer only work for? **(triple science only)** | Alternating current |
| 61 | What does a basic transformer consist of? **(triple science only)** | A primary coil of wire and a secondary coil of wire wound on an iron core |
| 62 | Why is iron used as the core of a transformer? **(triple science only)** | It is easily magnetised |
| 63 | What is produced in the iron core when an alternating current is applied in the primary coil of wire of a transformer? **(triple science only)** | A magnetic field that is changing |
| 64 | Describe how a transformer works? **(triple science only)** | * An alternating current travels through the primary coil
* This causes a **changing** magnetic field around the bar magnet
* This **induces** an alternating current in the secondary coil
 |
| 65 | What equation is used to show how the potential difference across the coils relates to the number of turns on each coil? **(triple science only)** | $$\frac{V\_{p}}{V\_{s}}=\frac{N\_{p}}{N\_{s}}$$ |
| 66 | In a step up transformer, in which coil of wire is the potential difference greatest? **(triple science only)** | The secondary coil |
| 67 | In a step down transformer, in which coil of wire is the potential difference greatest? **(triple science only)** | The primary coil |
| 68 | If transformers were 100% efficient, what would the electrical power output be? **(triple science only)** | Equal to the electrical power input |
| 69 | What equation relates the power input and output of transformers? **(triple science only)** | $V\_{s}×I\_{s} = V\_{P}×I\_{p}$  |
| 70 | What are is the unit and unit symbol of power? **(triple science only)** | Watts, W |

**Core questions – Physics Unit 8 – Space physics**

|  |  |  |
| --- | --- | --- |
| **No.** | **Question** | **Answer** |
| 1 | What orbital bodies are found in our solar system? | Planet; dwarf planets; moons; artificial satellites |
| 2 | What defines a planet? | A body that orbits a star, massive enough for its own gravity to make it round |
| 3 | What defines a moon? | A natural object which orbits a planet |
| 4 | What galaxy is our solar system part of? | Milky Way galaxy |
| 5 | How is a star formed? | From clouds of dust and gas drawn together by gravity, which caused fusion reactions to occur |
| 6 | What is a nebula? | A cloud of dust and gas  |
| 7 | What is a protostar? | When dust and gas are pulled together by gravity |
| 8 | When does a protostar become a main sequence star? | When gravity is strong enough for nuclear fusion to happen, releasing energy |
| 9 | What is the life cycle of a star that is a similar size to our sun? | Nebula; protostar; main sequence star; red giant; white dwarf; black dwarf |
| 10 | What is the life cycle of a star that is much bigger than our sun? | Nebula; protostar; main sequence star; red super giant; supernova; neutron star or black dwarf |
| 11 | What is nuclear fusion? | When two smaller nuclei fuse together to form one larger nucleus, releasing energy from the reaction |
| 12 | What elements are fused together during the main sequence stage of a star life cycle? | Hydrogen nuclei fuse to form helium nuclei |
| 13 | Why are stars ‘stable’ during the main sequence stage? | The outward pressure caused by fusion is balanced by the force of gravity pulling everything inwards |
| 14 | What causes main sequence stars to expand and turn in red giants / super giants? | Hydrogen runs out and heavier elements are formed  |
| 15 | Which elements can be created in a star? | Elements up to iron |
| 16 | What is a red giant? | A cooler, bigger star that is formed after hydrogen has run out, and heavier elements are being formed |
| 17 | What is a white dwarf? | What is left behind when a star ejects its outer layer of dust and gas to leave behind a hot, dense solid core |
| 18 | What is a black dwarf? | What is left behind as a white dwarf cools down and no longer emits a significant amount of energy |
| 19 | What is a supernova? | The explosion of a massive star |
| 20 | What elements are formed in a supernova? | Elements heavier than iron |
| 21 | What is a neutron star? | What is left behind after a supernova has thrown the outer layers of dust and gas into space leaving a very dense core |
| 22 | What is a black hole? | What is left behind after the supernova of a massive enough star that is so dense, not even light can escape the gravitational pull |
| 23 | What shape is the shape of an ‘orbit’? | Circular |
| 24 | What is an artificial satellite? | Something man-made which is in orbit of the Earth |
| 25 | What is the force that keeps something in orbit? | Gravity |
| 26 | In a circular orbit, how can there be changing velocity if the speed is constant? | It is constantly changing direction to remain in the circular orbit |
| 27 | What must also be true if an object is constantly changing velocity in circular orbit? | It is also constantly accelerating |
| 28 | What happens to the speed of an orbiting object if the radius of its orbit decreases? | It speeds up |
| 29 | Why does the speed of an object change depending on how close it is to the thing it is orbiting? | The force of gravity changes so it needs to speed up/slow down to maintain a stable orbit |
| 30 | What is the Doppler effect? | The observed change in frequency of the waves emitted by a moving source |
| 31 | What is red-shift? | The observed increase of wavelength of light waves coming from distant galaxies |
| 32 | What does red-shift tell us about the universe? | That the light source is moving away from us, therefore the universe must be expanding |
| 33 | What does it show us that more distant galaxies have greater red-shifts than nearer ones? | More distant galaxies are moving away faster than nearer ones |
| 34 | What is the big bang theory? | The universe began from a very small region that was extremely hot and dense |
| 35 | How does observed red-shift support the Big Bang theory? | The universe is expanding, so therefore must have once been much smaller |
| 36 | What have scientists observed since 1998 to suggest the rate of universe expansion is increasing? | By observing supernovae it shows that distant galaxies are moving away from us faster and faster |
| 37 | Why is it important for scientists to keep observing changes in the universe? | Observations allow them to obtain data, which can then either confirm or reject current theories |
| 38 | What do scientists currently think the universe is made up of? | Dark matter and dark energy  |