

GCSE SCIENCE HOMEWORK BOOKLET – Year 9

Autumn 2

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How to use this booklet

Each week this booklet gives you a set of GCSE keywords and definitions, written to match the AQA specification. For each topic:

- Learn the keywords – make flashcards and use them.
- Test yourself actively in the 'Which Keyword?' section – read each scenario and use the word bank to pick out the correct keyword.
- Complete the AQA-style exam questions in full, using the correct scientific vocabulary, to the best of your ability.

Bring your completed booklet to school every week, on the date shown at the top of that week's page. This homework is completed by hand, not online – it supports your learning and helps you practise answering questions in the way GCSE examiners expect, and we will use it in lessons. Please see your class teacher before the deadline if you have any problems completing it. It is important that it is handed in on time, every week.

Autumn 2 overview

Week	Topic	Week set commencing
Week 1	C1 – Atomic Structure	2 November 2026
Week 2	C1 – Atomic Structure	9 November 2026
Week 3	C1 – Atomic Structure	16 November 2026
Week 4	C2 – The Periodic Table	23 November 2026
Week 5	C2 – The Periodic Table	30 November 2026
Week 6	P1 – Energy Stores	7 December 2026
Week 7	P1 – Energy Stores	14 December 2026

Key Word Flashcards

Keyword	Definition (AQA specification wording)
Atom	The smallest part of an element that can exist. Atoms have a radius of about 0.1 nm (1×10^{-10} m) and are neutral overall.
Element	A substance made of only one type of atom. There are about 100 different elements, shown in the periodic table.
Compound	A substance made of two or more different elements chemically combined in fixed proportions. Compounds can only be separated into elements by chemical reactions.
Mixture	Two or more elements or compounds that are not chemically combined. The chemical properties of each substance are unchanged, so they can be separated by physical methods.
Pure substance	In chemistry, a single element or compound that is not mixed with any other substance. Pure substances melt and boil at specific, fixed temperatures.
Chemical formula	Shows the elements in a compound and the ratio of their atoms, e.g. H_2O has two hydrogen atoms for every one oxygen atom.
Chemical reaction	A process in which atoms are rearranged to make one or more new substances (products) from the starting substances (reactants).
Physical process	A process, such as filtration, crystallisation, distillation or chromatography, that does not involve a chemical reaction. No new substances are made.
Solvent	The liquid that a solute dissolves in to form a solution, e.g. water in salt solution.
Filtration	A method used to separate an insoluble solid from a liquid. The solid is trapped as the residue on the filter paper and the liquid passes through as the filtrate.
Crystallisation	A method used to obtain a soluble solid from a solution. Some of the solvent is evaporated off and the solution is left to cool so that crystals form.
Simple distillation	A method used to separate a solvent from a solution. The solution is heated, the solvent evaporates, then cools and condenses in a condenser and is collected.
Fractional distillation	A method used to separate a mixture of liquids with different boiling points. The liquids evaporate and condense at different temperatures up a fractionating column.
Chromatography	A method used to separate the substances in a mixture. Different substances move at different rates through a solvent held on paper, so they separate.

Which Keyword?

Cover the table above. Read each scenario below and use the word bank to write the keyword it describes.

Word bank: Atom · Element · Compound · Mixture · Pure substance · Chemical formula · Chemical reaction · Physical process · Solvent · Filtration · Crystallisation · Simple distillation · Fractional distillation · Chromatography

1. Harry heats salt solution. The water evaporates, cools in a condenser and is collected as pure water.

Keyword: _____

2. Emily melts a sample and finds that it melts at one exact, fixed temperature, showing it is a single element or compound with nothing else mixed in.

Keyword: _____

3. Bessie dissolves salt in water. The water is the liquid that the salt dissolves in.

Keyword: _____

4. Finley gently heats copper sulfate solution to evaporate some of the water, then leaves it to cool to obtain crystals.

Keyword: _____

5. Leo separates ethanol from water by heating the mixture and collecting each liquid at its own boiling point from a fractionating column.

Keyword: _____

6. William pours sand and water through filter paper. The sand stays on the paper and the water passes through.

Keyword: _____

7. Arthur is told that the smallest part of an element that can exist has a radius of about 0.1 nm.

Keyword: _____

8. Muhammed places a spot of black ink on paper and watches different coloured substances travel up the paper at different rates.

Keyword: _____

9. Verity writes about a substance made of two different elements chemically joined in a fixed ratio, which can only be split up by a chemical reaction.

Keyword: _____

10. Ania burns magnesium in air and the atoms are rearranged to form a new substance, magnesium oxide.

Keyword: _____

11. Joel stirs iron filings and sulfur together without heating. Each substance keeps its own properties and they can be separated with a magnet.

Keyword: _____

12. Isla looks at a substance made of only one type of atom, such as oxygen or iron.

Keyword: _____

13. Freddie writes H_2O to show that a compound contains two hydrogen atoms for every oxygen atom.

Keyword: _____

14. Jake separates a mixture using a method that involves no chemical reaction and makes no new substances.

Keyword: _____

Exam Practice Questions (AQA style)

Answer every question fully, using the keywords above wherever you can. Write in full sentences for 'describe' and 'explain' questions.

Question 1

Annabel has a sample of sea water and wants to obtain pure water from it.

(a) Name the technique Annabel should use. [1 mark]

(b) Describe how this technique separates the water from the salt. [3 marks]

(c) Name the process used to obtain solid salt crystals from salt solution. [1 mark]

Question 2

Kai has a mixture of sand and salt and adds water to it.

(a) Explain why adding water allows the sand and salt to be separated. [1 mark]

(b) Name the solid left behind on the filter paper. [1 mark]

(c) Describe how Kai could obtain dry salt from the filtrate. [2 marks]

Question 3

Matilda uses paper chromatography to test a black ink. The chromatogram shows three separate coloured spots.

(a) State the minimum number of substances in the ink. [1 mark]

(b) Explain why the substances travel different distances up the paper. [2 marks]

Question 4

Nabile mixes iron filings with sulfur, then heats the mixture strongly to form iron sulfide.

(a) Name the type of change that happens when the mixture is heated. [1 mark]

(b) Explain why iron sulfide is a compound and not a mixture. [2 marks]

Question 5

Alice separates a mixture of ethanol (boiling point 78 °C) and water (boiling point 100 °C).

(a) Name the method Alice should use. [1 mark]

Key Word Flashcards

Keyword	Definition (AQA specification wording)
Scientific model	A description, analogy or representation that helps us to explain and predict observations. Models are changed or replaced when new experimental evidence does not fit them.
Dalton model	Before the electron was discovered, atoms were thought of as tiny solid spheres that could not be divided into anything smaller (John Dalton, early 1800s).
Electron	A tiny, negatively charged particle found in shells around the nucleus. Its discovery showed that atoms are not indivisible.
Plum pudding model	The model that followed the discovery of the electron (J. J. Thomson): the atom is a ball of positive charge with negative electrons embedded in it.
Alpha particle	A positively charged particle, made of two protons and two neutrons, given out by some radioactive substances.
Alpha particle scattering experiment	Alpha particles were fired at thin gold foil by Rutherford, Geiger and Marsden. Most passed straight through, a few were deflected and a very few bounced back, which the plum pudding model could not explain.
Nucleus	The tiny, positively charged centre of an atom, where almost all of the mass is concentrated. Its radius is about 1/10 000 of the atom's radius.
Nuclear model	Rutherford's model, which replaced the plum pudding model: the positive charge and most of the mass are concentrated in a tiny nucleus, with electrons around it. Most of the atom is empty space.
Bohr model	Niels Bohr's adaptation of the nuclear model: electrons orbit the nucleus at specific distances (energy levels). Its predictions agreed with experimental observations.
Proton	A positively charged particle found in the nucleus. Rutherford's work showed that the positive charge of the nucleus could be divided into whole-number units, each called a proton.
Neutron	A particle with no charge found in the nucleus. It was discovered by James Chadwick about 20 years after the nuclear model was proposed.
Experimental evidence	Results from experiments that are used to support a model or to show that it needs to be changed or replaced.

Which Keyword?

Cover the table above. Read each scenario below and use the word bank to write the keyword it describes.

Word bank: Scientific model · Dalton model · Electron · Plum pudding model · Alpha particle · Alpha particle scattering experiment · Nucleus · Nuclear model · Bohr model · Proton · Neutron · Experimental evidence

1. Freddie reads that James Chadwick discovered a particle in the nucleus that has no charge.

Keyword: _____

2. Lewis learns that atomic models are representations that help to explain observations, and that they are changed when new evidence does not fit them.

Keyword: _____

3. Joel reads that electrons orbit the nucleus at specific distances, and that this idea agreed with experimental observations.

Keyword: _____

4. Ania notices that the plum pudding model was replaced because new results did not fit it.

Keyword: _____

5. Arthur studies the experiment in which particles were fired at thin gold foil and a few bounced back, which the plum pudding model could not explain.

Keyword: _____

6. George draws a ball of positive charge with small negative particles dotted through it, like fruit in a pudding.

Keyword: _____

7. Verity draws a model with the positive charge and most of the mass concentrated at the centre of the atom and most of the atom as empty space.

Keyword: _____

8. Frankie is told about a positively charged particle, made of two protons and two neutrons, that is given out by some radioactive substances.

Keyword: _____

9. Emily identifies the particle in the nucleus that carries a positive charge.

Keyword: _____

10. Joshua identifies the negatively charged particle whose discovery showed that atoms can be divided.

Keyword: _____

11. Isla identifies the tiny central part of an atom where almost all of its mass is found.

Keyword: _____

12. Josh reads about an early idea that atoms were tiny solid spheres that could not be divided.

Keyword: _____

Exam Practice Questions (AQA style)

Answer every question fully, using the keywords above wherever you can. Write in full sentences for 'describe' and 'explain' questions.

Question 1

Jake is learning how the model of the atom has changed over time.

(a) Describe the plum pudding model of the atom. *[2 marks]*

(b) Name the particle whose discovery led to the plum pudding model. *[1 mark]*

Question 2

Before the electron was discovered, Dalton described atoms as tiny solid spheres that could not be divided.

(a) Explain why Dalton's model had to be changed. *[2 marks]*

Question 3

William reads about the alpha particle scattering experiment, in which alpha particles were fired at thin gold foil.

(a) State the charge on an alpha particle. *[1 mark]*

(b) State what happened to most of the alpha particles. *[1 mark]*

(c) Explain what the results showed about the structure of the atom. *[3 marks]*

Question 4

Finley compares the plum pudding model with the nuclear model.

(a) State one way the nuclear model is different from the plum pudding model. *[1 mark]*

(b) Explain why the plum pudding model was replaced by the nuclear model. *[2 marks]*

Question 5

Niels Bohr and James Chadwick later made improvements to the model of the atom.

(a) State the change that Bohr made to the nuclear model. *[1 mark]*

(b) Name the particle with no charge that was discovered by Chadwick. *[1 mark]*

(c) Describe why scientific models change over time. *[2 marks]*

Key Word Flashcards

Keyword	Definition (AQA specification wording)
Subatomic particle	A particle smaller than an atom. The three subatomic particles are protons, neutrons and electrons.
Relative charge	The charge of a particle compared with a proton: proton +1, neutron 0, electron -1.
Relative mass	The mass of a particle compared with a proton: proton 1, neutron 1, electron very small (negligible).
Atomic number	The number of protons in the nucleus of an atom. It is different for each element and equals the number of electrons in a neutral atom.
Mass number	The total number of protons and neutrons in the nucleus of an atom. Number of neutrons = mass number – atomic number.
Isotope	Atoms of the same element (the same number of protons) with different numbers of neutrons, so they have different mass numbers, e.g. carbon-12 and carbon-14.
Relative atomic mass (Ar)	An average value for the mass of the atoms of an element, which takes account of the abundance of its isotopes. $A_r = \sum(\text{isotope mass} \times \% \text{ abundance}) \div 100$.
Electronic structure	The arrangement of the electrons in the shells of an atom, written as numbers, e.g. sodium is 2,8,1.
Energy level (shell)	A region at a particular distance from the nucleus where electrons are found. Electrons fill the lowest energy level (closest to the nucleus) first.
Outer shell	The highest energy level that contains electrons. The number of electrons in it decides how an element reacts and its group in the periodic table.
Atomic radius	Atoms have a radius of about 0.1 nm (1×10^{-10} m).
Nuclear radius	The radius of a nucleus is about 1×10^{-14} m, which is about 1/10 000 of the radius of the atom.
Ion	A charged particle formed when an atom loses or gains electrons.

Which Keyword?

Cover the table above. Read each scenario below and use the word bank to write the keyword it describes.

Word bank: Subatomic particle · Relative charge · Relative mass · Atomic number · Mass number · Isotope · Relative atomic mass (Ar) · Electronic structure · Energy level (shell) · Outer shell · Atomic radius · Nuclear radius · Ion

1. Josh learns that electrons occupy regions at set distances from the nucleus, filling those closest to the nucleus first.

Keyword: _____

2. Annabel states that a proton and a neutron both have a mass of 1, but an electron's mass is negligible.

Keyword: _____

3. Leo lists the three particles that are smaller than an atom: protons, neutrons and electrons.

Keyword: _____

4. Joshua counts the electrons in the highest energy level to work out which group an element is in.

Keyword: _____

5. Frankie is told that the centre of an atom is about 1/10 000 of the size of the whole atom.

Keyword: _____

6. Alice calculates an average mass for chlorine atoms, taking account of how much of each isotope is present.

Keyword: _____

7. Kai counts the protons in an atom to identify which element it is.

Keyword: _____

8. Muhammed states that a proton is +1, a neutron is 0 and an electron is -1.

Keyword: _____

9. Arthur learns that a sodium atom that loses an electron becomes a charged particle.

Keyword: _____

10. Lewis writes 2,8,1 to show how the electrons are arranged in a sodium atom.

Keyword: _____

11. Matilda adds the number of protons and neutrons in the nucleus of an atom.

Keyword: _____

12. George is told that an atom is about 0.1 nm across.

Keyword: _____

13. Nabile compares carbon-12 and carbon-14, which are atoms of the same element with different numbers of neutrons.

Keyword: _____

Exam Practice Questions (AQA style)

Answer every question fully, using the keywords above wherever you can. Write in full sentences for 'describe' and 'explain' questions.

Question 1

Isla is learning about the particles that make up an atom.

(a) Name the subatomic particle with a relative charge of -1 . [1 mark]

(b) State the relative mass of a neutron. [1 mark]

(c) Explain why an atom has no overall charge. [2 marks]

Question 2

A sodium atom has an atomic number of 11 and a mass number of 23.

(a) State the number of protons. [1 mark]

(b) Calculate the number of neutrons. [1 mark]

(c) State the number of electrons. [1 mark]

(d) Write the electronic structure of a sodium atom. [1 mark]

Question 3

Carbon-12 and carbon-14 are isotopes of carbon. Carbon has an atomic number of 6.

(a) Explain what is meant by the term 'isotopes'. [2 marks]

(b) Calculate the number of neutrons in an atom of carbon-14. [1 mark]

Question 4

Chlorine has two isotopes: chlorine-35 (75% abundance) and chlorine-37 (25% abundance).

(a) Calculate the relative atomic mass of chlorine. Give your answer to one decimal place. [2 marks]

(b) Explain why the relative atomic mass of chlorine is not a whole number. [1 mark]

Question 5

The radius of an atom is about 0.1 nm ($1 \times 10^{-10} \text{ m}$). The radius of its nucleus is about $1 \times 10^{-14} \text{ m}$.

(a) Calculate how many times larger the radius of the atom is than the radius of the nucleus. [1 mark]

(b) State where most of the mass of an atom is found. [1 mark]

(c) A sodium atom loses one electron to form a sodium ion. State the charge on the ion and explain why it has this charge. [2 marks]

Key Word Flashcards

Keyword	Definition (AQA specification wording)
Periodic table	A table of the elements arranged in order of atomic number, in columns (groups) and rows (periods), so that elements with similar properties are in the same column.
Group	A vertical column of the periodic table. Elements in a group have similar chemical properties and the same number of electrons in their outer shell, equal to the group number.
Period	A horizontal row of the periodic table. The period number is the number of occupied electron shells.
Mendeleev	Russian scientist who in 1869 arranged the elements in order of atomic weight. He left gaps for undiscovered elements and predicted their properties, and swapped the order of some elements to fit patterns.
Metal	Elements that react to form positive ions. They are on the left and towards the bottom of the periodic table and are typically shiny, strong, malleable and good conductors with high melting points.
Non-metal	Elements that do not form positive ions. They are on the right of the periodic table and typically have low melting points and boiling points, low density and are poor conductors.
Malleable	Able to be hammered or bent into shape without breaking, as metals can.
Brittle	Breaks or shatters easily when hit or bent instead of changing shape, as solid non-metals do.
Electrical conductor	A material that allows an electric current to flow through it. Metals are good electrical conductors; non-metals are poor conductors.
Noble gas	The unreactive non-metal gases of Group 0. They have eight electrons in their outer shell (helium has two), exist as single atoms and their boiling points increase down the group.
Inert	Not reacting, or very unreactive. Noble gases are inert because their atoms have a full outer shell of electrons.
Transition metal	A metal in the central block of the periodic table. Compared with Group 1, they have higher melting points (except mercury) and densities, are stronger, harder and less reactive.
Catalyst	A substance that speeds up a reaction without being used up. Transition metals and their compounds are often used as catalysts.

Which Keyword?

Cover the table above. Read each scenario below and use the word bank to write the keyword it describes.

Word bank: Periodic table · Group · Period · Mendeleev · Metal · Non-metal · Malleable · Brittle · Electrical conductor · Noble gas · Inert · Transition metal · Catalyst

1. Harry identifies a dull element on the right of the periodic table that has a low melting point and is a poor conductor.

Keyword: _____

2. Nabile studies a block of metals in the centre of the periodic table that are hard, dense and have high melting points.

Keyword: _____

3. Ania looks at a chart of the elements arranged in order of atomic number, with similar elements in the same column.

Keyword: _____

4. Alice adds iron to a reaction and the reaction speeds up, but the iron is not used up.

Keyword: _____

5. Leo hammers a piece of copper into a flat sheet without it breaking.

Keyword: _____

6. Bessie counts across a horizontal row of the periodic table and notices that the elements all have the same number of occupied shells.

Keyword: _____

7. Muhammed hits a lump of solid sulfur and it shatters into small pieces.

Keyword: _____

8. Matilda explains why argon does not react with other elements, because it has a full outer shell.

Keyword: _____

9. William reads about the scientist who left gaps for undiscovered elements and correctly predicted their properties.

Keyword: _____

10. Annabel connects a piece of iron into a circuit and the lamp lights, showing that it lets an electric current flow.

Keyword: _____

11. Finley tests an element that is shiny, strong and a good conductor, and which forms positive ions.

Keyword: _____

12. Kai studies the elements of Group 0, which exist as single atoms and have boiling points that increase down the group.

Keyword: _____

13. Jake notices that sodium and potassium are in the same vertical column and both have one electron in their outer shell.

Keyword: _____

Exam Practice Questions (AQA style)

Answer every question fully, using the keywords above wherever you can. Write in full sentences for 'describe' and 'explain' questions.

Question 1

Lewis is learning how the periodic table was developed.

(a) State how the elements are arranged in the modern periodic table. [1 mark]

(b) Mendeleev left gaps in his periodic table. Explain why. [2 marks]

Question 2

Josh is comparing metals and non-metals.

(a) State two physical properties of metals. [2 marks]

(b) Sulfur is a solid non-metal. Describe two properties of sulfur. [2 marks]

Question 3

Neon is an element in Group 0 of the periodic table.

(a) Give the name used for the elements in Group 0. [1 mark]

(b) Explain why the noble gases are unreactive. [2 marks]

(c) State the trend in boiling points down Group 0. [1 mark]

Question 4

George compares the transition metals with the Group 1 metals.

(a) Give two ways in which the transition metals are different from the Group 1 metals. [2 marks]

(b) Name the type of substance that speeds up a reaction without being used up. [1 mark]

Question 5

Magnesium is an element in Group 2 and Period 3 of the periodic table.

(a) State the number of electrons in the outer shell of a magnesium atom. [1 mark]

(b) State the number of occupied electron shells in a magnesium atom. [1 mark]

(c) Write the electronic structure of a magnesium atom. [1 mark]

Key Word Flashcards

Keyword	Definition (AQA specification wording)
Alkali metal	The elements in Group 1 (lithium, sodium, potassium...). They are soft, have low melting points and low densities, and have one electron in their outer shell.
Alkaline solution	A solution with a pH greater than 7, which contains hydroxide ions. Group 1 metals react with water to form alkaline solutions.
Metal hydroxide	A compound formed when a Group 1 metal reacts with water, e.g. sodium + water → sodium hydroxide + hydrogen.
Reactivity (Group 1)	How easily an element reacts. Reactivity increases down Group 1 because the outer electron is further from the nucleus, is less strongly attracted and is lost more easily.
Halogen	The elements in Group 7 (fluorine, chlorine, bromine, iodine). They are non-metals with seven electrons in their outer shell and are coloured.
Diatomic molecule	A molecule made of two atoms joined together, e.g. the halogens exist as Cl ₂ , Br ₂ and I ₂ .
Reactivity (Group 7)	Reactivity decreases down Group 7, because the outer shell is further from the nucleus so it is harder to attract the extra electron needed.
Displacement reaction	A reaction in which a more reactive element takes the place of a less reactive element in a compound, e.g. chlorine displaces bromine from potassium bromide.
Halide ion	A negative ion formed when a halogen atom gains one electron, e.g. chloride (Cl ⁻), with a charge of -1.
Ionic compound	A compound formed when a metal reacts with a non-metal, e.g. sodium reacts with chlorine to form sodium chloride.
Trend	A pattern in properties as you go down a group, e.g. in Group 1 melting point decreases, and in Group 7 melting point and boiling point increase.
Vigorous	Describes a reaction that happens quickly and strongly. Group 1 metals react more vigorously the further down the group they are.

Which Keyword?

Cover the table above. Read each scenario below and use the word bank to write the keyword it describes.

Word bank: Alkali metal · Alkaline solution · Metal hydroxide · Reactivity (Group 1) · Halogen · Diatomic molecule · Reactivity (Group 7) · Displacement reaction · Halide ion · Ionic compound · Trend · Vigorous

1. Bessie writes Cl^- for the particle formed when a chlorine atom gains one electron.

Keyword: _____

2. Ania explains why fluorine is more reactive than iodine, as its outer shell is closer to the nucleus and attracts an extra electron more strongly.

Keyword: _____

3. Joel explains that potassium is more reactive than sodium because its outer electron is further from the nucleus and lost more easily.

Keyword: _____

4. Arthur cuts a soft metal with a knife and notes that it is in Group 1 and has one outer electron.

Keyword: _____

5. Jake adds chlorine water to potassium bromide solution and the solution turns orange as bromine is formed.

Keyword: _____

6. Verity notes that sodium hydroxide is made when sodium reacts with water.

Keyword: _____

7. Finley observes that the melting points of Group 1 metals decrease from lithium to potassium.

Keyword: _____

8. Freddie writes Cl_2 to show that chlorine exists as pairs of atoms joined together.

Keyword: _____

9. Harry sees potassium react more quickly and strongly with water than lithium does.

Keyword: _____

10. Isla tests the solution made when sodium reacts with water and finds its pH is 13.

Keyword: _____

11. William reacts sodium with chlorine to make sodium chloride, a compound of a metal and a non-metal.

Keyword: _____

12. Emily studies the coloured non-metals in Group 7, which each have seven electrons in their outer shell.

Keyword: _____

Exam Practice Questions (AQA style)

Answer every question fully, using the keywords above wherever you can. Write in full sentences for 'describe' and 'explain' questions.

Question 1

Leo drops a small piece of lithium into a trough of water.

(a) Name the gas produced in the reaction. [1 mark]

(b) Name the alkaline solution formed. [1 mark]

(c) State the pH of the solution formed compared with 7. [1 mark]

Question 2

Muhammed compares how lithium, sodium and potassium react with water.

(a) State how reactivity changes going down Group 1. [1 mark]

(b) Explain this trend in terms of the outer electron. [2 marks]

(c) Predict how potassium would react with water compared with sodium. [1 mark]

Question 3

Annabel is studying the halogens in Group 7.

(a) State the number of electrons in the outer shell of a halogen atom. [1 mark]

(b) Name the type of molecule that chlorine (Cl₂) forms. [1 mark]

(c) State the trend in boiling points down Group 7. [1 mark]

(d) State and explain how the reactivity of the halogens changes down Group 7. [2 marks]

Question 4

Kai adds chlorine water to potassium bromide solution. The solution turns orange.

(a) Explain what happens in this reaction. [2 marks]

(b) Write the word equation for the reaction. [2 marks]

(c) Predict whether iodine would react with potassium chloride solution. Explain your answer. [2 marks]

Question 5

Sodium reacts with chlorine gas.

(a) Name the compound formed. [1 mark]

(b) State the charge on a chloride ion. [1 mark]

(c) Explain how a chlorine atom forms a chloride ion. [1 mark]

Key Word Flashcards

Keyword	Definition (AQA specification wording)
Energy store	A way in which energy is held. Energy is described as being in different stores, e.g. kinetic, thermal, chemical, gravitational potential, elastic potential, nuclear, magnetic and electrostatic.
System	An object or a group of objects being studied. When a system changes, there are changes in the way energy is stored.
Closed system	A system in which neither matter nor energy can enter or leave. The net change in the total energy of a closed system is zero.
Energy transfer	Energy moving from one store to another, mechanically (a force doing work), electrically, by heating or by radiation (light and sound waves).
Joule	The unit of energy, symbol J. 1 kilojoule (kJ) = 1000 J.
Kinetic energy store	The energy of a moving object. $E_k = \frac{1}{2} \times m \times v^2$ (kinetic energy in J, mass in kg, speed in m/s).
Gravitational potential energy store	The energy stored by an object raised above the ground. $E_p = m \times g \times h$ (mass in kg, gravitational field strength in N/kg, height in m). Use $g = 9.8 \text{ N/kg}$.
Elastic potential energy store	The energy stored when an object is stretched or compressed, e.g. a spring. $E_e = \frac{1}{2} \times k \times e^2$ (spring constant in N/m, extension in m).
Thermal energy store	The energy stored in a hot object. The higher the temperature of an object, the more energy it has in its thermal store.
Chemical energy store	The energy stored in fuels, foods and batteries, which is released in chemical reactions.
Nuclear energy store	The energy stored in the nucleus of an atom, which is released in nuclear reactions such as in a nuclear power station.
Magnetic energy store	The energy stored between magnets, or between a magnet and a magnetic material, e.g. two magnets held close together.
Electrostatic energy store	The energy stored between electrically charged objects, e.g. a balloon rubbed to build up a static charge.
Work done	The energy transferred when a force moves an object through a distance. Work done = force $\times$ distance ($W = F s$). 1 J is the work done when 1 N moves an object 1 m.

Which Keyword?

Cover the table above. Read each scenario below and use the word bank to write the keyword it describes.

Word bank: Energy store · System · Closed system · Energy transfer · Joule · Kinetic energy store · Gravitational potential energy store · Elastic potential energy store · Thermal energy store · Chemical energy store · Nuclear energy store · Magnetic energy store · Electrostatic energy store · Work done

1. Emily pushes two magnets together against their repulsion and increases the energy stored between them.

Keyword: _____

2. Verity burns a fuel and notes that the energy released came from a store in food, fuel or a battery.

Keyword: _____

3. Alice chooses a falling ball and the air around it to be the objects they will study.

Keyword: _____

4. Arthur stretches a spring and calculates the energy it stores using $\frac{1}{2} \times k \times e^2$.

Keyword: _____

5. Nabile says that energy is held in different ways, such as in kinetic and thermal.

Keyword: _____

6. Freddie rubs a balloon on their hair and energy is stored between the charged balloon and the hair.

Keyword: _____

7. Joel reads that a nuclear power station releases energy from the nucleus of an atom.

Keyword: _____

8. Josh describes energy moving from the chemical store of a battery to the kinetic store of a motor.

Keyword: _____

9. Frankie calculates the energy stored by a book lifted onto a shelf using $m \times g \times h$.

Keyword: _____

10. Lewis studies a situation in which no matter or energy can enter or leave, so the total energy cannot change.

Keyword: _____

11. George calculates the energy of a moving cyclist using $\frac{1}{2} \times m \times v^2$.

Keyword: _____

12. Ania pushes a trolley with a force of 20 N for 5 m and calculates force $\times$ distance.

Keyword: _____

13. Isla notices that a cup of boiling water holds more energy than a cup of cold water.

Keyword: _____

14. Joshua writes the symbol J after the value 3600 to show the unit that energy is measured in.

Keyword: _____

Exam Practice Questions (AQA style)

Answer every question fully, using the keywords above wherever you can. Write in full sentences for 'describe' and 'explain' questions.

Question 1

A battery-powered toy car drives across a table, speeds up, then stops.

- (a) Name the energy store in the battery of the toy car. [1 mark]
- (b) Name the energy store that increases as the car speeds up. [1 mark]
- (c) Name the energy store that increases in the surroundings because of friction. [1 mark]
-

Question 2

Bessie lifts a ball of mass 0.50 kg onto a shelf 2.0 m above the floor. Use $g = 9.8 \text{ N/kg}$.

- (a) Write down the equation that links gravitational potential energy, mass, gravitational field strength and height. [1 mark]
- (b) Calculate the increase in the ball's gravitational potential energy store. [2 marks]
- (c) The ball falls off the shelf. Describe the energy transfer as it falls. [2 marks]
-

Question 3

A cyclist of mass 60 kg travels along a flat road at a speed of 5.0 m/s.

- (a) Calculate the kinetic energy of the cyclist. [2 marks]
- (b) The cyclist's speed doubles to 10 m/s. State how many times greater the kinetic energy is. [1 mark]
-

Question 4

A spring has a spring constant of 40 N/m. Finley stretches the spring by 0.10 m.

- (a) Name the energy store that increases as the spring is stretched. [1 mark]
- (b) Calculate the energy stored in the spring using the equation $E_e = \frac{1}{2} k e^2$. [2 marks]
-

Question 5

Harry pushes a trolley with a constant force of 20 N for a distance of 5.0 m.

- (a) State what is meant by 'work done'. [1 mark]
- (b) Calculate the work done on the trolley. [2 marks]
- (c) State what is meant by a 'closed system'. [1 mark]
-

Key Word Flashcards

Keyword	Definition (AQA specification wording)
Conservation of energy	Energy can be transferred usefully, stored or dissipated, but it cannot be created or destroyed. The total energy before a change equals the total energy after.
Useful energy	The part of the energy input to a device that is transferred to the store where it is wanted, e.g. the light from a lamp.
Wasted energy	The part of the energy input that is not transferred to the useful store. It is usually transferred to the thermal store of the surroundings.
Dissipated	Energy that is spread out into the surroundings, usually by heating, so that it is stored in a less useful way.
Efficiency	How much of the energy input is transferred usefully. Efficiency = useful output energy transfer ÷ total input energy transfer (× 100 for a percentage).
Power	The rate at which energy is transferred or the rate at which work is done. Power = energy transferred ÷ time ($P = E \div t$).
Watt	The unit of power, symbol W. 1 watt is 1 joule of energy transferred per second.
Specific heat capacity	The amount of energy needed to raise the temperature of 1 kg of a substance by 1 °C. $\Delta E = m \times c \times \Delta\theta$.
Thermal conductivity	How well a material transfers energy by conduction. The higher the thermal conductivity, the faster the rate of energy transfer through the material.
Thermal insulation	Using materials with low thermal conductivity, or thicker materials, to reduce unwanted energy transfer by heating, e.g. in the walls of a house.
Lubrication	Using oil or grease between moving parts to reduce friction, which reduces unwanted energy transfers to the thermal store.
Friction	A force that opposes motion between surfaces in contact. Work done against friction transfers energy to the thermal store.
Rate of cooling	How quickly an object transfers energy to its surroundings. It is reduced by using thicker walls or materials with a lower thermal conductivity.

Which Keyword?

Cover the table above. Read each scenario below and use the word bank to write the keyword it describes.

Word bank: Conservation of energy · Useful energy · Wasted energy · Dissipated · Efficiency · Power · Watt · Specific heat capacity · Thermal conductivity · Thermal insulation · Lubrication · Friction · Rate of cooling

1. Lewis finds out how much energy is needed to heat 1 kg of water by 1 °C.

Keyword: _____

2. George puts oil on a squeaky bicycle chain to reduce wasted energy.

Keyword: _____

3. Alice writes W after 60 for a lamp that transfers 60 joules of energy every second.

Keyword: _____

4. Frankie rubs their hands together and feels them warm up as a force opposes the motion between their palms.

Keyword: _____

5. Leo explains that the total energy before a change is always equal to the total energy after it.

Keyword: _____

6. Joshua fits thick layers of a material with low thermal conductivity in a loft to reduce unwanted energy loss by heating.

Keyword: _____

7. Muhammed notes that the light from a lamp is the energy transferred to the store that is wanted.

Keyword: _____

8. Nabile calculates how much energy a machine transfers each second by dividing energy by time.

Keyword: _____

9. Kai explains that the warm air around a running motor has gained energy that has spread out and cannot easily be used again.

Keyword: _____

10. Arthur finds that a hot drink cools more slowly in a thick-walled mug than in a thin-walled mug.

Keyword: _____

11. Josh compares copper and plastic to see which transfers energy through it faster.

Keyword: _____

12. Annabel finds that most of the energy supplied to a lamp is not transferred to light.

Keyword: _____

13. Matilda divides the useful energy output of a motor by the total energy input and multiplies by 100.

Keyword: _____

Exam Practice Questions (AQA style)

Answer every question fully, using the keywords above wherever you can. Write in full sentences for 'describe' and 'explain' questions.

Question 1

Isla says that a lamp 'uses up' energy. A lamp transfers 100 J of electrical energy: 20 J as light and 80 J as heat.

(a) State the principle of conservation of energy. [2 marks]

(b) State how much energy is wasted by the lamp. [1 mark]

(c) State what happens to the wasted energy. [1 mark]

Question 2

An electric motor has a total input energy of 200 J and a useful output energy of 150 J.

(a) Write down the equation for efficiency. [1 mark]

(b) Calculate the efficiency of the motor as a decimal. [2 marks]

(c) Give the efficiency as a percentage. [1 mark]

(d) Suggest one way to increase the efficiency of the motor. [1 mark]

Question 3

A motor transfers 3000 J of energy in 10 s.

(a) Write down the equation that links power, energy transferred and time. [1 mark]

(b) Calculate the power of the motor. [2 marks]

(c) A 60 W lamp is switched on for 2 minutes. Calculate the energy it transfers. [2 marks]

Question 4

Emily heats 2.0 kg of water from 20 °C to 30 °C. The specific heat capacity of water is 4200 J/kg °C.

(a) State what is meant by 'specific heat capacity'. [1 mark]

(b) Write down the equation that links energy change, mass, specific heat capacity and temperature change. [1 mark]

(c) Calculate the energy transferred to the water. [2 marks]

Question 5

A homeowner wants to reduce the rate at which energy is transferred from their house to the surroundings.

(a) Explain how the thickness and thermal conductivity of the walls affect the rate of cooling. [2 marks]

(b) Name one way of reducing unwanted energy transfers in a machine, other than thermal insulation. [1 mark]

(c) Explain how a lubricant reduces wasted energy. [2 marks]
