Resource list: mapping Level 3 Applied General Science to A-level Science approved textbooks – Unit 1

The mapping document has been created to support the teaching and delivery of Unit 1 Key Concepts in Science. AQA approved A-level text books have been used to map the depth of teaching required for content in this unit. Where there are no matches suitable teaching resource links have been identified.

Unit 1: Key concepts in biology

1 (a) Cell structure

The ultrastructure of eukaryotic and prokaryotic cells on electron micrographs

- Oxford A-level Year 1 and AS: pages 67-72.
  - Do not need ultrastructure of nucleus (p67); ultrastructure of mitochondria (P67/68); ultrastructure of chloroplast (p68).
- Hodder Biology for A-level Year 1 and AS: Table 3.1 page 41; page 38.
  - Do not need the detail of how TEM works.
- Collins Year 1 book: pages 68-78.

The differences between eukaryotic and prokaryotic cell structure

- Oxford A-level Year 1 and AS: pages 71 and 75-76.
- Hodder Biology for A-level Year 1 and AS: pages 50-51.
- Collins Year 1 book: pages 77-78.

The functions of nuclei, SER, RER, mitochondria, vesicles, lysosomes, Golgi apparatus, chloroplasts, vacuoles, cell walls, ribosomes, flagella, nucleoid, plasmid, mesosome, pili, slime capsules

- Oxford A-level Year 1 and AS: pages 67-72 and 75-76.
- Hodder Biology for A-level Year 1 and AS: Table 3.1 page 41.
- Collins Year 1 book: pages 68-78.

Nucleic acid structure (DNA/RNA)

- Oxford A-level Year 1 and AS: pages 36-39.
  - Do not need to know about the history - Watson, Crick and Franklin.
- Hodder Biology for A-level Year 1 and AS: pages 57-59.
  - Do not need to know about the history - Watson, Crick and Franklin.
- Collins Year 1 book: pages 54-55.

Calculating magnification or object size using:

$$magnification = \frac{obseerved\ size}{actual\ size}$$

- Oxford A-level Year 1 and AS: page 58.
- Hodder Biology for A-level Year 1 and AS: pages 51-52.
- Collins Year 1 book: pages 79-80.

1(b) Transport mechanisms

The structure of cell membranes, as a phospholipid bilayer with proteins interspersed

- Oxford A-level Year 1 and AS: pages 84-86.
- Hodder Biology for A-level Year 1 and AS: pages 43-44.
- Collins Year 1 book: pages 99-100.

The function of intrinsic proteins, including their role in facilitated diffusion and active transport

- Oxford A-level Year 1 and AS: pages 84-86.
  - Do not need information on cholesterol: pages 87 and 93-94.
- Hodder Biology for A-level Year 1 and AS: pages 44-46 and 50-51.
- Collins Year 1 book: pages 100, 103-104 and 113-114.

The function of extrinsic proteins

- Oxford A-level Year 1 and AS: pages 84-85.
- Hodder Biology for A-level Year 1: page 44.
- Collins Year 1 book: pages 99-100.

1(c) The heart

Key structures of the heart, including bicuspid valve, tricuspid valve, mitral valves, SAN, AVN, Purkinje fibres, bundle of His

- Oxford A-level Year 1 and AS: pages 170-171.
- Hodder Biology for A-level Year 1 and AS: pages 165-169.
- Collins Year 1 book: page 1.
- Hodder PE Year 1: page 2.

Myogenic stimulation of the heart

- Oxford A-level Year 2: pages 76-77.
- Hodder Biology 2: page 58.
- Collins Year 2 book: page 95.
- Hodder PE Year 1: pages 3-4.

The role of the SAN, AVN, Purkinje fibres and bundle of His in cardiac stimulation

- Oxford A-level Year 2: pages 76-77.
- Hodder Biology 2: pages 58-61.

- Collins Year 2 book: page 95.
- Hodder PE Year 1: pages 3-4.

The role of carbon dioxide chemoreceptors and baroreceptors in controlling heart rate

- Oxford A-level Year 2: page 78.
- Hodder Biology 2: page 60.
- Collins Year 2 book: pages 95-96.
- Hodder PE Year 1: pages 4-5.
- Hodder PE Year 2: page 4.

Artificial pacemakers as treatment for arrhythmia (abnormal heart rate), and how they work to re-establish normal heart rate

- Oxford A-level Year 1 and AS: Students need to understand the principles of a pacemaker related to the myogenic stimulation of the heart so that they can apply this to information given about specific examples of types of pacemakers. Students are not expected to recall different types of pacemaker.
- Other sources - advisory only as many will contain additional information that is not needed:
  - bhf.org.uk/publications/treatments-for-heart-conditions/pacemakers - has more detail than needed but discusses why pacemakers are needed and some possible complications. Method of surgery etc are beyond the specification.

The advantages and disadvantages of different types of artificial pacemakers

- Oxford A-level Year 1 and AS: Students need to understand the principles of a pacemaker related to the myogenic stimulation of the heart so that they can apply this to information given about specific examples of types of pacemakers. Students are not expected to recall different types of pacemaker.
- Other sources - advisory only as many will contain additional information that is not needed:
  - NHS website has some good information about pacemakers and discusses possible safety considerations.

1(d) Homeostasis

How homeostasis involves physiological control systems that maintain the internal environment within restricted limits:

- body temperature range (35.8 –37.5 °C)
- blood glucose range (82 –110 mg/dL)
- blood pH range (7.35 –7.45).

- Hodder Biology 2: pages 103-104.
- Oxford A-level Year 2: pages 114-115.
- Collins Year 2 book: page 141.

Negative feedback as a homeostatic mechanism, eg controlling water retention using ADH, produced by the pituitary gland

- Oxford A-level Year 2: pages 115-116 and 119-120.

The role of different hormones in body function, including:

- insulin
- glucogon
- ADH
- aldosterone.

- Oxford A Level Year 2: pages 124-125 and 140-141.
- Hodder Biology 2: pages 104, 106 and 118-119.
- Collins Year 2 book: pages 141-145.

The roles of the pancreas and liver in regulating blood glucose concentration

- Oxford A-level Year 2: pages 122-123 and 126.
- Hodder Biology 2: pages 104-107.
- Collins Year 2 book: pages 141-145.

The body's normal system for regulating blood glucose concentration:

- action of insulin in activating enzymes to convert glucose to glycogen
- action of glucagon in activating enzymes to convert glycogen to glucose
- action of adrenaline in activating enzymes to convert glycogen to glucose.

- Oxford A-level Year 2: pages 122-126.
- Hodder Biology 2: pages 104-107.
- Collins Year 2 book: pages 141-145.

The causes of Types I and II diabetes

- Oxford A-level Year 2: page127.
- Hodder Biology 2: pages 108-9.
- Collins Year 2 book: page 139.

The control of Types I and II diabetes

- Oxford A-level Year 2: page 127-128.
- Hodder Biology 2: pages 108-9.

How health professionals and patients with diabetes use physiological measurements to inform diagnosis & treatment of diabetes, including:

- fasting glucose levels
- urine dipsticks
- blood glucose 'pinprick' tests.

- Hodder Biology 2: page 110.

- Nuffield Foundation website nuffieldfoundation.org/sites/default/files/17_Lung_function.pdf
- Collins Year 2 book: page 139.
- Information on Diabetes UK website. Detail of testing schedules is not needed. diabetes.org.uk/Guide-to-diabetes/Managing-your-diabetes/Testing/

The roles of the hypothalamus, pituitary and ADH in osmoregulation

- Oxford A-level Year 2: pages 140-141.
- Hodder Biology 2: page 112.

The different parts of the nephron and their roles, including:

- Bowman's capsule as an ultrafiltration unit
- convoluted tubules in selective reabsorption of glucose, sodium ions and water.

- Oxford A-level Year 2: pages 130-139.
- Hodder Biology 2: pages 113-119.
- Collins Year 2 book: pages 149-153.

The roles of the adrenal cortex, convoluted tubules and aldosterone in the reabsorption of sodium ions

- Oxford A-level Year 2: pages 136-139.
  - This does not cover the full requirements of this specification statement.

The consequences of sodium chloride (salt) deficiency in the short term, and the long-term effects on health

- Other sources - advisory only as many will contain additional information that is not needed.
- Resources used to teach SC14 on the outgoing A-level Applied Science would be appropriate here.

The circumstances in which certain people may be at risk of losing too much salt

- Other sources - advisory only as many will contain additional information that is not needed.
- Resources used to teach SC14 on the outgoing A-level Applied Science would be appropriate here.

Why excess salt in the diet might create health problems

- Other sources - advisory only as many will contain additional information that is not needed.
- Resources used to teach SC14 on the outgoing A-level Applied Science would be appropriate here.

The consequences of excess/deficiency of ions and hormones on health

- Other sources - advisory only as many will contain additional information that

is not needed.
- Resources used to teach SC14 on the outgoing A-level Applied Science would be appropriate here.

1(e) Breathing and cellular respiration

The distinction between breathing and cellular respiration:

- breathing as a physical, external process
- cellular respiration as a chemical, internal process.

- Oxford A-level Year 1 and AS: page 144.
- Oxford A-level Year 2: pages 19-27.
- Hodder Biology 2: page 15.
- Collins Year 1 book: page 152.

Methods of monitoring the respiratory system (breathing rate and volumes)

- Oxford A-level Year 1 and AS: page 144.
- Nuffield Foundation website nuffieldfoundation.org/sites/default/files/17_Lung_function.pdf

How, during cellular respiration, ATP is produced by phosphorylation, in which a phosphate group is added to a molecule of ADP

- Oxford A-level Year 1 and AS: pages 46-47.
- Hodder Biology for A-level Year 1 and AS: pages 64-65.
- Collins Year 2 book: page 6.

How ATP is used to release energy for cell activity

- Oxford A-level Year 1 and AS: pages 46-47.
- Collins Year 2 book: page 6.

The stages in respiration of glucose that result in the production of ATP, and the site of each process:

- glycolysis (in the cell cytoplasm)
- Krebs cycle (in the mitochondria)
- electron transfer chain (in the mitochondria).

- Oxford A-level Year 2: pages 19-30.
- Hodder Biology 2: pages 15-18.
- Collins Year 2 book: pages 30-34.

The process of glycolysis, to include:

- phosphorylation of glucose to glucose phosphate, using ATP
- production of triose phosphate (TP)
- oxidation of TP to pyruvate with a net gain of ATP and reduced nicotinamide adenine dinucleotide NAD (NADH).

- Oxford A-level Year 2: pages 20-21.
- Hodder Biology 2: pages 15-16.
- Collins Year 2 book: pages 30-32.

The process of the Krebs cycle, to include:

- pyruvate is converted to acetyl coenzyme A (acetyl-CoA) which enters the Krebs cycle
- acetyl-CoA reacts with a four-carbon molecule, to form a six-carbon molecule
- a series of oxidation-reduction reactions generates reduced coenzymes and ATP, and carbon dioxide is lost.

- Oxford A-level Year 2: pages 22-23.
- Hodder Biology 2: pages15-16.
- Collins Year 2 book: pages 32-33.

The process of the electron transfer chain, to include:

reduced NAD (NADH) or FAD (FADH2) release hydrogen atoms which provide electrons to transfer down electron transfer chain as electrons are passed down the chain, energy is released which is used to phosphorylate ADP to ATP the final acceptor of the electrons is oxygen, which forms water.

- Oxford A-level Year 2: pages 17-25.
- Hodder Biology 2: pages 17-18.
- Collins Year 2 book: pages 33-34.

The amount of ATP that can be produced from aerobic and anaerobic pathways

- Oxford A-level Year 2: pages 21 and 26.
- Collins Year 2 book: pages 33-35.

What is meant by basal metabolic rate (BMR) and how it can be determined by direct or indirect methods

- Hodder PE Year 2: pages 16 and 178-179.
- Other sources - advisory only as many will contain additional information that is not needed.
- Students need to know the two methods of measuring BMR. Resources used to teach SC14 on the outgoing A-level Applied Science would be appropriate.

The differences in BMR for males and females, and for different age groups of both genders, using secondary data

- Oxford A-level Year 2: pages 4-6.
- Hodder Biology: pages 2 -3.
- Collins Year 2 book: page 7.
- Other sources - advisory only as many will contain additional information that is not needed.
- Students need to know the two methods of measuring BMR. Resources used to teach SC14 on the outgoing A-level Applied Science would be appropriate.

1(f) Photosynthesis and food chain productivity

Photosynthesis as a process of organic carbon capture, to include:

- essential raw materials and their sources
- the two stages in photosynthesis: light-dependent and light-independent
- initial conversion to carbohydrates and subsequent conversions to lipids and proteins.

- Oxford A-level Year 2: pages 4-6.
- Hodder Biology 2: page 3.
- Collins Year 2 book: pages 7-9 and 13-14.

Green plants (producers) as the initiators of food chains

- Oxford A-level Year 2: page 34.
- Hodder Biology 2: pages 22-23.
- Collins Year 2 book: pages 46-47.

Efficiency of food chains, to include:

- constraints
- solar, temperature, water, nutrient and space availability for plants
- energy transfer out of the food chain through respiration, excretion and movement
- gross primary production (GPP)
- net primary production (NPP)
- biomass/energy pyramids to demonstrate productivity
- advantages/disadvantages of following a meat-free/reduced meat diet.

- Oxford A-level Year 2: pages 36-40.
- Hodder Biology 2: pages 12-13.
- Collins Year 2 book: pages 47-49, 51-52 and 54.

Unit 1: Key concepts in chemistry

2(a) Atomic structure

Atomic structure in terms of protons, neutrons and electrons, and their relative charges and relative masses

- Collins A-level Year 1: page 8.
- AQA A-level Chemistry 1 (Hodder): pages 2-3.
- AQA A-level Chemistry Year 1 (OUP): pages 4-5.
- AQA A-level Chemistry (OUP): pages 4-5.

The terms atomic (proton) number (Z), mass number (A), isotope, isotopic abundance

- Collins A-level Year 1: pages 11-13.
- AQA A-level Chemistry 1 (Hodder): pages 3-4.
- AQA A-level Chemistry Year 1 (OUP): pages 6-7.

- AQA A-level Chemistry (OUP): pages 6-7.

Electron configurations for atoms and ions up to Z = 36 in terms of shells

- Collins A-level Year 1: pages 18-22.
- AQA A-level Chemistry 1 (Hodder): pages 12-17.
- AQA A-level Chemistry Year 1 (OUP): pages 14-16.
- AQA A-level Chemistry (OUP): pages 14-16.

The origin of coloured flame emission spectra and of colour in transition metal compounds in terms of electron transitions

- Collins A-level Year 2: page 252.
- AQA A-level Chemistry 2 (Hodder): pages 162-163.
- AQA A-level Chemistry Year 2 (OUP): page 110.
- AQA A-level Chemistry OUP: page 364.

Calculating relative atomic mass, relative molecular mass and relative formula mass in terms of 12 C

- Collins A-level Year 1: pages 15 and 31.
- AQA A-level Chemistry 1 (Hodder) : pages 4-5.
- AQA A-level Chemistry Year 1 (OUP): pages 22-23.
- AQA A-level Chemistry (OUP): pages 22-23.

2(b) The Periodic Table

That the Periodic Table lists elements in increasing order of proton number

- Collins A-level Year 1: pages 89-90.
- AQA A-level Chemistry 1 (Hodder): page 212.
- AQA A-level Chemistry Year 1 (OUP): page 142.
- AQA A-level Chemistry (OUP): page 142.

How each row is equivalent to the filling of an electron shell up to two (in row 1) or eight electrons

- Collins A-level Year 1: page 18.
- AQA A-level Chemistry 1 (Hodder): page 212.
- AQA A-level Chemistry Year 1 (OUP): pages 8-9.
- AQA A-level Chemistry (OUP): pages 8-9.

How each column or group contains elements with the same number of outer shell electrons and thus similar chemical properties

- Collins A-level Year 1: page 90.
- AQA A-level Chemistry 1 (Hodder): pages 218-225.
- AQA A-level Chemistry Year 1 (OUP): pages 143-144.
- AQA A-level Chemistry (OUP): pages 143-144.

How each row begins with a highly reactive alkali metal (Group I) and ends with a noble gas

- Collins A-level Year 1: page 94.
- AQA A-level Chemistry 1 (Hodder): page 213.
- AQA A-level Chemistry Year 1 (OUP): page 145.
- AQA A-level Chemistry (OUP): page 145.

How, across a period (row), properties of elements change from metallic to non-metallic

- Collins A-level Year 1: page 96.
- AQA A-level Chemistry 1 (Hodder): page 215.
- AQA A-level Chemistry Year 1 (OUP): page 146.
- AQA A-level Chemistry (OUP): page 146.

The properties (including radii, ionisation energy and electronegativity) of:

- the s-block elements
- the d-block metals (including the transition metals and their coloured compounds in solution)
- Group VII (17), the halogens
- Group 0 (18), the noble gases.

- Collins A-level Year 1: pages 23, 24, 74-76, 94-96, 226-228 and 243-244.
- Collins A-level Year 2: page 246.
- AQA A-level Chemistry 1 (Hodder): pages 12, 21-23, 212-225 and 227-228.
- AQA A-level Chemistry 2 (Hodder): pages 150,161,166-171 (not Al).
- AQA A-level Chemistry Year 1 (OUP): pages 147-149.
- AQA A-level Chemistry Year 2 (OUP): pages 104-105 and 110.
- AQA A-level Chemistry (OUP): pages147-149, 358-359 and 364.

2(c) Amount of substance

The mole as the amount of a substance that always contains the same number of entities (eg atoms, molecules, ions, electrons)

- Collins A-level Year 2: page 32.
- AQA A-level Chemistry 1 (Hodder): pages 33 and 35.
- AQA A-level Chemistry Year 1 (OUP): pages 23-24.
- AQA A-level Chemistry (OUP): pages 23-24.

The relationship between mass of substance and amount in moles

- Collins A-level Year 2: pages 33-35.
- AQA A-level Chemistry 1 (Hodder): page 34.
- AQA A-level Chemistry Year 1 (OUP): page 24.
- AQA A-level Chemistry (OUP): page 24.

The relationship between volume of gas at RTP and STP and amount in moles

- Collins A-level Year 2: pages 36-40.
- AQA A-level Chemistry 1 (Hodder): pages 60-61.
- AQA A-level Chemistry Year 1 (OUP): pages 27-28.
- AQA A-level Chemistry (OUP): pages 27-28.

Concentrations of solutions in terms of mol dm–3 and g dm–3

- Collins A-level Year 2: pages 49-50.
- AQA A-level Chemistry 1 (Hodder): pages 42-49.
- AQA A-level Chemistry Year 1 (OUP): pages 25-26.
- AQA A-level Chemistry (OUP): pages 25-26.

Molecular formulas

- Collins A-level Year 2: page 41.
- AQA A-level Chemistry 1 (Hodder): pages 27-29.
- AQA A-level Chemistry Year 1 (OUP): page 32.
- AQA A-level Chemistry (OUP): page 32.

Empirical formulas

- Collins A-level Year 2: page 42.
- AQA A-level Chemistry 1 (Hodder): pages 28-29.
- AQA A-level Chemistry Year 1 (OUP): page 30.
- AQA A-level Chemistry (OUP): page 30.

Calculating empirical formulas

- Collins A-level Year 2: pages 41-42.
- AQA A-level Chemistry 1 (Hodder): pages 64-66.
- AQA A-level Chemistry Year 1 (OUP): pages 30-32.
- AQA A-level Chemistry (OUP): pages 30-32.

Writing balanced equations for typical reactions including:

- acid–base neutralisation (draws on prior knowledge). Examples to come from GCSE specification or acids/bases such as HCl, HNO3, H2SO4, H3PO4, CH3COOH, NH3
- acid/metal - hydroxides of Group I and II
- acid/carbonate
- thermal decomposition
- precipitation
- combustion reactions.

- Collins A-level Year 1: pages 231-237 and 249.
- AQA A-level Chemistry 1 (Hodder): pages 221-223, 237 and 268-271.
- AQA A-level Chemistry Year 1 (OUP): pages 35-37.
- AQA A-level Chemistry (OUP): pages 35-37.

Calculating reacting masses based on correct stoichiometries

- Collins A-level Year 1: pages 44-45.
- AQA A-level Chemistry 1 (Hodder): pages 36-39.
- AQA A-level Chemistry Year 1 (OUP): pages 37-38.
- AQA A-level Chemistry (OUP): pages 37-38.

Equivalence point of an acid–base titration

- Collins A-level Year 2: pages 72-73.
- AQA A-level Chemistry 2 (Hodder): pages 121.
- AQA A-level Chemistry Year 2 (OUP): pages 72.
- AQA A-level Chemistry (OUP): pages 326.

How the choice of indicator for an acid–base titration depends on the types (strengths) of acid and base used and the resulting pH titration curve

- Collins A-level Year 2: pages 73-74.
- AQA A-level Chemistry 2 (Hodder): page 124.
- AQA A-level Chemistry Year 2 (OUP): pages 74-76.
- AQA A-level Chemistry (OUP): pages 328-330.

Calculating unknown concentrations and volumes from results involving volumetric analysis (limited to acid–base titrations)

- Collins A-level Year 1: pages 52-54.
- AQA A-level Chemistry 1 (Hodder): pages 53-57.
- AQA A-level Chemistry Year 1 (OUP): page 38.
- AQA A-level Chemistry (OUP): page 38.

Plotting and interpreting pH curves.

- Collins A-level Year 2: pages 71-72.
- AQA A-level Chemistry 2 (Hodder): pages 121-123.
- AQA A-level Chemistry Year 2 (OUP): pages 72-73.
- AQA A-level Chemistry (OUP): pages 326-327.

2(d) Bonding and structure

Formulas for common cations

- Collins A-level Year 1: pages 63-64.
- AQA A-level Chemistry 1 (Hodder): pages 27-29.

Formulas for common anions (sulfate, carbonate, nitrate, hydroxide)

- Collins A-level Year 1: pages 63-64.
- AQA A-level Chemistry 1 (Hodder): pages 27-29.

Deducing formulas for ionic compounds

- Collins A-level Year 1: page 64.
- AQA A-level Chemistry 1 (Hodder): pages 27-29.

Ionic bonding and ionic crystal lattices in terms of strong electrostatic forces of attraction

- Collins A-level Year 1: pages 67-68.

- AQA A-level Chemistry 1 (Hodder): pages 77-79.
- AQA A-level Chemistry Year 1 (OUP): pages 44-46.
- AQA A-level Chemistry (OUP): pages 44-46.

A covalent bond as a shared pair of electrons

- Collins A-level Year 1: pages 64-65.
- AQA A-level Chemistry 1 (Hodder): pages 83-87.
- AQA A-level Chemistry Year 1 (OUP): page 47.
- AQA A-level Chemistry (OUP): page 47.

Multiple bonds, neutral molecules, non-conductors and weak intermolecular forces of attraction

- Collins A-level Year 1: pages 65-66.
- AQA A-level Chemistry 1 (Hodder): pages 87-88 and 108.
- AQA A-level Chemistry Year 1 (OUP): page 48.
- AQA A-level Chemistry (OUP): page 48.

Metallic bonding

- Collins A-level Year 1: pages 66 and 68.
- AQA A-level Chemistry 1 (Hodder): pages 90-91.
- AQA A-level Chemistry Year 1 (OUP): page 50.
- AQA A-level Chemistry (OUP): page 50.

Structures of:

- ionic crystal lattices typified by sodium chloride, magnesium oxide
- metallic lattices typified by magnesium
- covalent structures typified by iodine, methane, carbon dioxide
- giant covalent structures (macromolecular), eg diamond, graphite, graphene, fullerene

- Collins A-level Year 1: pages 66-70.
- AQA A-level Chemistry 1 (Hodder): pages 79, 90-91 and 94-95.
- AQA A-level Chemistry Year 1 (OUP): pages 45, 50 and 66-67.
- AQA A-level Chemistry (OUP): pages 45, 50 and 66-67.

Predicting types of bonding for compounds given their typical properties and vice versa

- Collins A-level Year 1: pages 61-71.
- AQA A-level Chemistry 1 (Hodder): page 96.
- AQA A-level Chemistry Year 1 (OUP): page 70.
- AQA A-level Chemistry (OUP): page 70.

Typical properties based on the type of bonding, particles present and forces between particles

- Collins A-level Year 1: pages 61-71.
- AQA A-level Chemistry 1 (Hodder): page 96.

- AQA A-level Chemistry Year 1 (OUP): page 70.
- AQA A-level Chemistry (OUP): page 70.

Common physical properties of materials related to their structure and bonding, to include:

- electrical conductivity
- melting point and boiling point
- volatility
- solubility in water
- non-polar solvents.

- Collins A-level Year 1: pages 61-71.
- AQA A-level Chemistry 1 (Hodder): pages 80-82, 90-91, 94-95, 97, 105-107 and prior knowledge.

Drawing diagrams to represent:

- a named ionic lattice
- a generalised metallic lattice
- an alloy
- giant covalent structures, including silicon, graphite, graphene.

- Collins A-level Year 1: pages 67-69.
- AQA A-level Chemistry 1 (Hodder): pages 79, 90 and 94-95.
- AQA A-level Chemistry Year 1 (OUP): pages 45, 50 and 66-67.
- AQA A-level Chemistry (OUP): pages 45, 50 and 66-67.

2(e) Enthalpy changes

Energy profiles for exothermic and endothermic reactions

- Collins A-level Year 1: pages 148-149 but need a peak for activation energy.
- AQA A-level Chemistry 1 (Hodder): pages 118-121.
- AQA A-level Chemistry Year 1 (OUP): pages 96-97.
- AQA A-level Chemistry (OUP): pages 96-97.

Activation energy using an energy profile

- AQA A-level Chemistry 1 (Hodder): pages 120-121.
- AQA A-level Chemistry Year 1 (OUP): pages 96-97.
- AQA A-level Chemistry (OUP): pages 96-97.

Types of enthalpy changes from equations (limited to combustion, neutralisation, formation and mean bond enthalpies)

- Collins A-level Year 1: pages 149-153 and 162-164.
- AQA A-level Chemistry 1 (Hodder): pages 121-122.
- AQA A-level Chemistry Year 1 (OUP): pages 77 and 91.
- AQA A-level Chemistry (OUP): pages 77 and 91.

Units for molar enthalpy change (kJ mol –1)

- Collins A-level Year 1: page149.
- AQA A-level Chemistry 1 (Hodder): page 119.
- AQA A-level Chemistry Year 1 (OUP): page 75.
- AQA A-level Chemistry (OUP): page 75.

Enthalpy changes as the heat energy change (at constant pressure)

- Collins A-level Year 1: page 148.
- AQA A-level Chemistry 1 (Hodder): pages 118-119.
- AQA A-level Chemistry Year 1 (OUP): page 75.
- AQA A-level Chemistry (OUP): page 75.

Enthalpy of formation, enthalpy of combustion and enthalpy of reaction, as represented by Δ f H, ΔcH and ΔrxH

- Collins A-level Year 1: pages 149-153 and 162-164.
- AQA A-level Chemistry 1 (Hodder): pages 121-122.
- AQA A-level Chemistry Year 1 (OUP): page 77.
- AQA A-level Chemistry (OUP): page 77.

The term ‘mean bond enthalpy’

- Collins A-level Year 1: pages 162-163.
- AQA A-level Chemistry 1 (Hodder): page 137.
- AQA A-level Chemistry Year 1 (OUP): page 91.
- AQA A-level Chemistry (OUP): page 91.

Calculating enthalpy changes based on Hess’s Law cycles

- Collins A-level Year 1: pages 158-162.
- AQA A-level Chemistry 1 (Hodder): pages 132-136.
- AQA A-level Chemistry Year 1 (OUP): pages 82-86.
- AQA A-level Chemistry (OUP): pages 82-86.

Calculating enthalpy changes based on mean bond enthalpies and why these values are only approximate

- Collins A-level Year 1: pages 162-164.
- AQA A-level Chemistry 1 (Hodder): pages 137-141.
- AQA A-level Chemistry Year 1 (OUP): pages 91-93.
- AQA A-level Chemistry (OUP): pages 91-93.

Determining practically the molar enthalpy of combustion of a liquid fuel (eg ethanol)

- Collins A-level Year 1: pages 151-152.
- AQA A-level Chemistry 1 (Hodder): pages 127-128.
- AQA A-level Chemistry Year 1 (OUP): page 78.
- AQA A-level Chemistry (OUP): page 78.

Determining practically the molar enthalpy of neutralisation for a simple acid–base reaction.

- Collins A-level Year 1: page 153.
- AQA A-level Chemistry 1 (Hodder): pages 124-127.
- AQA A-level Chemistry Year 1 (OUP): page 79.
- AQA A-level Chemistry (OUP): page 79.

Unit 1: Key concepts in physics

3(a) Useful energy and efficiency

The meaning of 'efficiency'

- AQA A-level Physics 1 England et al (Hodder): pages 173-174.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 177-178.
- AQA A-level Year 1 and AS Kelly (Collins): pages 270-271.

Why efficiency is important and why a device can never be 100% efficient

- Builds on prior knowledge.
- AQA A-level Year 1 and AS Kelly (Collins): page 270.

Methods of improving the efficiency of a system or device

- AQA Physics A-level Year 1 Breithaupt (Oxford): page 178.
- AQA A-level Year 1 and AS Kelly (Collins): page 272.

The formula:

$$\text{efficiency} = \frac{\text{useful energy (or power) output}}{\text{total energy (or power) input}}$$

- AQA A-level Physics 1 England et al (Hodder): page 174.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 178.
- AQA A-level Year 1 and AS Kelly (Collins): page 270.

The importance of efficiency in making the best use of available energy
ase.org/resources/top-5-reasons-be-energy-efficient

Ways in which efficiency can be increased in mechanical and thermal systems

- AQA Physics A-level Year 1 Breithaupt (Oxford): page 178.
- AQA A-level Year 1 and AS Kelly (Collins): page 270.

Examples of situations where thermal transfer needs to be maximised and situations where it needs to be minimised

pbslearningmedia.org/resource/lsps07-sci-phys-thermalenergy/thermal-energy-transfer/#.WTR_amgrLIV

energysavingtrust.org.uk/home-energy-efficiency

The meaning of U values

thenbs.com/knowledge/what-is-a-u-value-heat-loss-thermal-mass-and-online-calculators-explained

thegreenage.co.uk/article/thermal-conductivity-r-values-and-u-values-simplified/

The formula:

$$U = \frac{Q}{A t \Delta T}$$

thenbs.com/knowledge/what-is-a-u-value-heat-loss-thermal-mass-and-online-calculators-explained

thegreenage.co.uk/article/thermal-conductivity-r-values-and-u-values-simplified/

The generation of useful energy through the use of a range of different sources, such as:

- fossil fuels
- nuclear fuels
- renewable fuels such as:
- solar power (both heat and light)
- wind power
- wave power
- tidal power
- traditional hydroelectric power
- geothermal sources
- biomass.

alternative-energy-tutorials.com/energy-articles/renewable-energy-sources-a-brief-summary.html

childrensuniversity.manchester.ac.uk/interactives/science/energy/

environmentalscience.org/renewable-energy

ase.org/resources/top-5-reasons-be-energy-efficient

- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 179-180 and 481.
- AQA A-level Year 1 and AS Kelly (Collins): page 323.
- AQA A-level Year 2 Pharaoh et al (Collins): page 211.

The advantages and disadvantages of these sources and their suitability for use in a range of contexts

childrensuniversity.manchester.ac.uk/interactives/science/energy/

environmentalscience.org/renewable-energy

Experiments related to measurement of efficiency.

- AQA A-level Physics 1 England et al (Hodder): pages 175-176.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 177.
- AQA A-level Year 1 and AS Kelly (Collins): page 272.

3(b) Electricity and circuits

Calculating current, voltage, power and resistance in a range of electrical circuits

- AQA A-level Physics 1 England et al (Hodder): pages 244-249.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 202-219.

Calculating the heating effect of a current

- AQA A-level Physics 1 England et al (Hodder): page 247.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 218.
- AQA A-level Year 1 and AS Kelly (Collins): pages 315-316.
- AQA A-level Year 2 Pharaoh et al (Collins): pages 168-169.

The formulas:

- $I = Q/t$
- $P = IV$
- $I = V/R$
- rate of heat loss = $I^2 R$

- AQA A-level Physics 1 England et al (Hodder): pages 222, 230 and 246-247.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 202, 205, 206 and 218.
- AQA A-level Year 1 and AS Kelly (Collins): pages 299, 300-301, 306, 308-9 and 315-316.

The behaviour of electric current, voltage and resistance in series and parallel circuits

- AQA A-level Physics 1 England et al (Hodder): pages 144-249.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 214-219.
- AQA A-level Year 1 and AS Kelly (Collins): pages 302-306.

Calculating the total resistance of a circuit which contains resistors in series, resistors in parallel and a combination of both

- AQA A-level Physics 1 England et al (Hodder): pages 255-258.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 217-218.
- AQA A-level Year 1 and AS Kelly (Collins): pages 313-315.

The formulas:

- $R_{total} = R1 + R2 + R3 \ldots$

- 1/R total = 1/R1 + 1/R2 + 1/R3 …

- AQA A-level Physics 1 England et al (Hodder): pages 255-256.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 217.
- AQA A-level Year 1 and AS Kelly (Collins): page 313.

Uses of potential divider circuit

- AQA A-level Physics 1 England et al (Hodder): pages 259-262.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 227.
- AQA A-level Year 1 and AS Kelly (Collins): pages 338-341.

Free electrons and the electrical behaviour of conductors and semiconductors

- AQA A-level Physics 1 England et al (Hodder): pages 229-233.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 202-203.
- AQA A-level Year 1 and AS Kelly (Collins): pages 301-302, 308 and 333-334.

The effect of temperature on the resistance of conductors and semiconductors

- AQA A-level Physics 1 England et al (Hodder): pages 231 and 233.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 203 and 211.
- AQA A-level Year 1 and AS Kelly (Collins): pages 330 and 333-334.

The behaviour of thermistors and light-dependent resistors (LDRs)

- AQA A-level Physics 1 England et al (Hodder): pages 233 and 262.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 211 and 227.
- AQA A-level Year 1 and AS Kelly (Collins): pages 333-334.

Graphs of V against I to find resistance

- AQA A-level Physics 1 England et al (Hodder): page 230.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 207 and 210.
- AQA A-level Year 1 and AS Kelly (Collins): pages 309-311.

Graphs of voltage against current for a range of components including standard resistors, thermistors and lamps

- AQA A-level Physics 1 England et al (Hodder): pages 230-233.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 210-211.
- AQA A-level Year 1 and AS Kelly (Collins): pages 309-311.

3(c) Dynamics

Application of Newton's First Law of Motion to both stationary and moving objects

- AQA A-level Physics 1 England et al (Hodder): pages 151-152.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 138.
- AQA Physics A-level Breithaupt (Oxford): page 251.

Inertia

- AQA Physics A Level Year 1 Breithaupt (Oxford): page 140.

Newton's Second Law of Motion

- AQA A-level Physics 1 England et al (Hodder): pages 151 and 153.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 139.
- AQA Physics A Level Breithaupt (Oxford): page 252.

The formula:
$F = ma$

- AQA A-level Physics 1 England et al (Hodder): page 153.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 139.
- AQA Physics A-level Breithaupt (Oxford): page 252.

weight = mg as an example of Newton's Second Law of Motion

- AQA A-level Physics 1 England et al (Hodder): page 151.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 140.
- AQA Physics A-level Breithaupt (Oxford): page 223.

Newton's Third Law of Motion including its relationship to the Law of Conservation of Momentum

- AQA A-level Physics 1 England et al (Hodder): pages 155-157.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 161
- AQA Physics A-level Breithaupt (Oxford): pages 254-255.

The meaning of 'momentum'

- AQA A-level Physics 1 England et al (Hodder): pages 183-184.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 154-155.
- AQA Physics A-level Breithaupt (Oxford): page 251.

The formulas

- $p = mv$
- $F = \Delta p/t$

- AQA A-level Physics 1 England et al (Hodder): pages 183-185.
- AQA Physics A Level Year 1 Breithaupt (Oxford): pages 154-156.
- AQA Physics A Level Breithaupt (Oxford): pages 251 and 253-254.

Applying the Law of Conservation of Momentum to a range of situations including collisions and/or the motion of objects

- AQA A-level Physics 1 England et al (Hodder): pages 186-189.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 149-151 and 161-163.
- AQA Physics A-level Breithaupt (Oxford): pages 253-254 and 256-258.

The formulas:

- (average) $v = s/t$
- $v = u + at$
- $v^2 = u^2 + 2as$
- $s = ut + ½ at^2$

- AQA A-level Physics 1 England et al (Hodder): pages 134-139.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 118-124.
- AQA Physics A-level Breithaupt (Oxford): pages 188-189 and 202-203.

Representing motion through the use of graphs of displacement against time and velocity against time

- AQA A-level Physics 1 England et al (Hodder): pages 134-136.
- AQA Physics A-level Year 1 Breithaupt (Oxford): pages 128-129.
- AQA Physics A-level Breithaupt (Oxford): pages 196-201.

Calculating the gravitational potential energy of an object

- AQA A-level Physics 1 England et al (Hodder): page 171.
- AQA Physics A Level Year 1 Breithaupt (Oxford): pages 173.
- AQA Physics A Level Breithaupt (Oxford): pages 266-267.

The formula:
$GPE = mgh$

- AQA A-level Physics 1 England et al (Hodder): page 171.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 173.
- AQA Physics A-level Breithaupt (Oxford): pages 266-267.

Calculating the kinetic energy of a moving object

- AQA A-level Physics 1 England et al (Hodder): pages 171-172.
- AQA Physics A Level Year 1 Breithaupt (Oxford): pages 173.
- AQA Physics A Level Breithaupt (Oxford): pages 264-265.

The formula:
$KE = \frac{1}{2} mv^2$

- AQA A-level Physics 1 England et al (Hodder): pages 171-172.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 173.
- AQA Physics A Level Breithaupt (Oxford): pages 264-265.

Calculating the power of a mechanical system

- AQA A-level Physics 1 England et al (Hodder): pages 174-175.
- AQA Physics A-level Year 1 Breithaupt (Oxford): page 175.
- AQA Physics A-level Breithaupt (Oxford): page 267.

The formula:
$P = E/t$

- AQA A-level Physics 1 England et al (Hodder): pages 174-175.

- AQA Physics A-level Year 1 Breithaupt (Oxford): page175.
- AQA Physics A-level Breithaupt (Oxford): page 267.