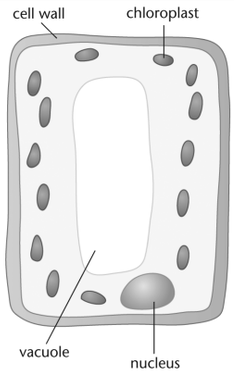
B4 answers

Remember: Check which grade you are working at.

Page 85 Who planted that there?

1 a *(See diagram)*



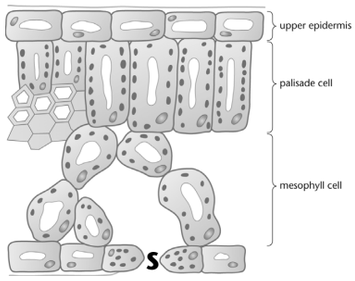
b Chloroplast

2 a **i** From soil; through root hairs; up stem *(Any 2 = 1 mark)*
ii Through pores (stomata)

b Thin so gases or light do not have far to travel; chlorophyll to absorb light; network veins for support/transport; stomata for gas exchange *(Any 3 = 1 mark)*

c Diffusion

3 a **i** *(See diagram)*
ii *(See diagram)*
iii *(See diagram)*



b *(See diagram)*

Page 86 Water, water everywhere

1 Not enough water; so no support

2 a Higher concentration water inside potato; water moved out

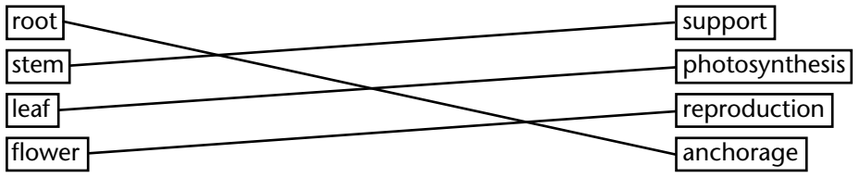
b Take on water; and burst (lysis)

3 a C D B (A) *(C before D =1; D before B =1 mark)*

b **i** Photosynthesis; cooling; support *(Any 2 = 1 mark)*
ii Waxy cuticle; small number of stomata on upper surface or more stomata on lower surface

Page 87 Transport in plants

1



(4 correct = 3; 3 correct = 2; 1 or 2 correct = 1 mark)

2 a A = phloem; B = xylem

b Transport water or minerals; from root to leaves; support plant *(Any 2 = 1 mark each)*

3 a Light intensity

b Any value below 7.4 g

c Lowers rate

B4 answers

Page 88 Plants need minerals too

1 a i Help plant growth
ii Potassium; magnesium

b i 3%
ii 0.6 kg

2 a

mineral	why the mineral is needed
phosphate	respiration or growth
potassium	respiration or photosynthesis
magnesium	photosynthesis

b i Poor root growth; discoloured leaves
ii Poor flower or fruit growth; discoloured leaves
iii Yellow leaves

Page 89 Energy flow

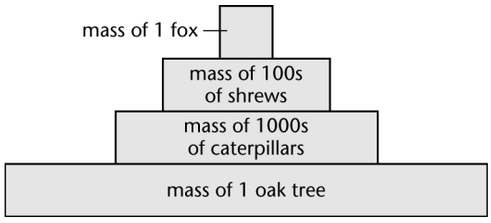
1 a i Oak leaves
ii Makes own food

b i Caterpillar/shrew/fox
ii Eat food

c Sun

2 a Numbers of organisms; at each stage of food chain

b



c Heat from respiration; egestion of waste; movement *(Any 1)*

3 a Photosynthesis

b Alcohol

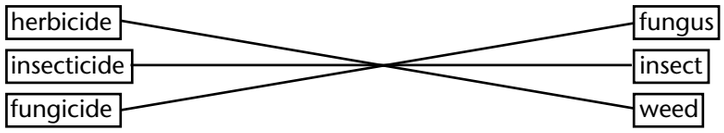
4 Yeast is used to ferment the sugar; to produce alcohol; alcohol is mixed with petrol

(Any 2 = 1 mark each)

B4 answers

Page 90 Farming

1 a



(3 correct = 2; 1 or 2 correct = 1 mark)

b Free range hens

c DDT gets into plankton; passed along food chain; does not breakdown; builds up to toxic levels in seals

(Any 3 = 1 mark each)

d By hydroponics; roots grow in water containing correct nutrients

2 a Farmer who does not use manufactured chemicals

b Use of animals' manure or compost; nitrogen fixing crops; weeding; growing seeds at different times

(Any 2 = 1 mark each)

c **i** Biological control
ii No predators so population keeps increasing

Page 91 Decay

1 a **i** 6.2 – 5.8 = 0.4
ii Carbon dioxide
iii Water/correct temperature
iv Microorganisms had been killed

b **i** Detritivores
ii Breaks up remains; increasing surface area

2 a **i** Freeze; make jam; dry

(Any 2 = 1 mark each)

ii Freezing: kills or slows growth of bacteria;
jam: kills bacteria or fungi by removing water;
dry: bacteria and fungi need water to grow

(Any 2 = 1 mark each)

Page 92 Recycling

1 Decay nitrogen recycled

2 a i: burning ii: respiration iii: photosynthesis

b Photosynthesis

c Carry out respiration; when they break down the dead plant and animal material

3 a To make proteins for growth

b Break down dead plants and animals; turning nitrogen compounds into nitrates

c Unreactive

C4 answers

Remember: Check which grade you are working at.

Page 94 Acids and bases

1 a i Neutralisation
ii The manufacture of fertilisers; cleaning metals; car battery acids

(Any 2)

b i A base when it dissolves in water
ii Acid; water

c Copper carbonate + sulphuric acid ⟶ copper sulphate + water + carbon dioxide

d The salt formed is sodium nitrate

2 a i Strong acid
ii Strong alkali

b Increases from a low number to 7 on neutralisation; then from 7 to a higher number if excess alkali is added

c The pH at the start is high; colour is purple

The pH falls as the acid neutralises the alkali; colour changes to blue; when neutral, the pH = 7; colour is green

Page 95 Reacting masses

1 a i 56
ii 23 + 16 + 1 = 40
iii 40 + 12 + (16 x 3) = 100

b 40 + 2 (16 + 1) = 40 + (2 x 17) = 74

c i The reaction has given off a gas
ii Oxygen from the air has probably reacted with the chemical

d In filtration: small amounts stay on the filter paper; in evaporation: some chemicals spit out into the room; in transferring liquids: tiny amounts of liquid stick to the sides of the beaker because more than one reaction might be taking place so the reactants are being used up in a different reaction

(Any 2)

2 a i 28
ii 42
iii

$$\frac{\text{Actual yield}}{\text{Percentage yield}} \times 100$$

iv

$$\frac{28 \times 100}{42} = 66\%$$

C4 answers

Page 96 Fertilisers and crop yield

1 a Minerals through its roots

b Nitrogen (N); phosphorus (P); potassium (K)

c Fertilisers

d To increase their crop yields

e They are dissolved in water so they can be absorbed by plants through their roots

f $(NH_4)_2SO_4$
Mr = 2(14 + 4) + 32 + (16 x 4)
= 132

2 a C D B A

b A: acid is added from a burette to an alkali; B: the crystals are filtered off;
C: alkali is measured and put into a flask; D: water is evaporated off to leave crystals

c Water

d **i** Phosphoric acid
ii Ammonium hydroxide
iii Phosphoric acid + ammonium hydroxide ⟶ ammonium phosphate + water

Page 97 The Haber process

1 a Ammonia

b The air

c Reversible reaction

2 a Nitrogen is obtained from the air; hydrogen comes from natural gas; the gases are passed over an iron catalyst under high pressure; an optimum temperature of 450 °C is chosen; there is a recycling system for unreacted nitrogen and hydrogen

3 a The cost of building the plant; people's wages; the cost of the raw materials; nitrogen and hydrogen and the energy costs; how quickly the new substance can be made (cost of a catalyst) *(Any 3)*

b

factor	explanation
cost of building the plant	The bigger the plant the longer it takes to repay so putting up cost of fertiliser
people's wages	Constant cost added to cost of fertiliser
cost of the raw materials	Constant cost added to cost of fertiliser
energy costs	The higher the pressure used the more energy needed as a cost added to cost of fertilser
how quickly the new substance can be made	The quicker it can be made the less the cost of energy and people's wages needed

(Any 3)

c 400 atmospheres

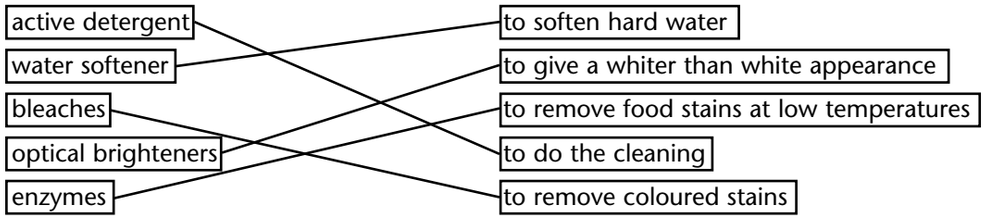
d Increases

e Decreases

C4 answers

Page 98 Detergents

1 a



b Organic acid + alkali ⟶ detergent (salt) + water

c It dissolves grease stains; it dissolves in water at the same time

d **i** It is better to wash clothes at 40 °C instead of at high temperatures because washing machines have to heat up a lot of water; this needs energy; so the lower the temperature of the water the less energy is used and less greenhouse gases are released into the atmosphere

ii As many dyes are easily damaged by high temperatures; it also means that many more fabrics can be machine washed as their structure would be damaged at higher temperatures

2 a Solvents; solute; solution; soluble; insoluble

3 a Dry-cleaned

b It does not mean that no liquids are used, just that the liquid solvent is not water

Page 99 Batch or continuous?

1 a **i** Speciality chemicals, such as medicines and pharmaceutical drugs, are often made on demand in a batch process

ii Bulk chemicals such as ammonia

b Need to be made for a smaller demand; sterile conditions required so need to re-clean, need to change type of drug produced *(Any 1)*

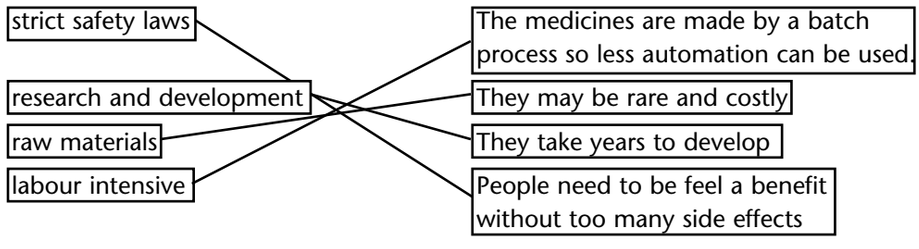
c If a chemical is needed in large amounts it is usually made by a continuous process which can be more highly automated

2 a Extracted from plants

b Chemicals are held in the plant cells; plant cells have tough walls, so to extract the compound the plant is crushed to break the cell walls; then the chemical must be dissolved. This only works if a suitable solvent is used; the solvent dissolves lots of different compounds, so the desired compound is then separated from the others; this can be done by chromatography *(Any 4)*

3 a Research and testing; labour costs; energy costs; raw materials; development time *(Any 3)*

b



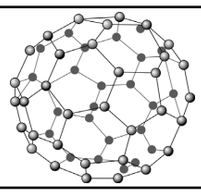
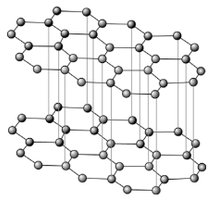
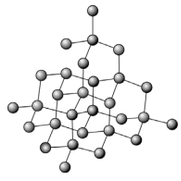
C4 answers

Page 100 Nanochemistry

1 a

	diamond	**graphite**	**buckminster fullerene**
appearance	lustrous and colourless	*black solid*	black and opaque
solubility	*insoluble in water*	*insoluble in water*	*deep red solution in petrol*
electrical conductivity	*does not conduct electricity*	conducts electricity	conducts electricity
uses	cutting tools/ jewellery	electrodes/pencil lead/lubricant	semiconductors in electrical circuits
reasons for use	very hard/lustrous and colourless	conduct electricity/ high melting point/ slipppery and black/ slippery	*can join together to make nanotubes*

b

carbon	**structure**
diamond	
graphite	
buckminster fullerene	

2 a Deep red

b Very strong; conduct electricity

c Semiconductors in electrical circuits; industrial catalysts; reinforcement of graphite in tennis rackets

C4 answers

Page 101 How pure is our water?

1 a Lakes; rivers; aquifers; reservoirs.

b A cheap raw material; a coolant; a valuable solvent

c Dissolved salts and minerals; pollutants; insoluble materials; microbes (killed by chlorination)

d Nitrate residues; lead compounds; pesticide residues

e Clean water saves more lives than medicines

2 Sedimentation → filtration → chlorination

Sedimentation: larger bits drop to the bottom; filtration: sand is used to filter out finer particles; chlorination: kills microbes

3 a

chlorides	white precipitate
iodides	yellow precipitate

b Add two drops of barium chloride solution

c Lead nitrate + potassium chloride ⟶ lead chloride + potassium nitrate

P4 answers

Remember: Check which grade you are working at.

Page 103 Sparks!

1 a Negative

b **i** Acetate/perspex
ii It will pick up the pieces of paper

c Copper is an electrical conductor so charges will not stay on it

2 a So that charge cannot pass through her

b So that she does not get an electric shock

c **i** Sally becomes charged
ii All her hairs gain the same charge; like charges repel so the hairs move away from each other

3 a The car becomes charged due to friction with the air on the journey; you are not charged so charge flows through you when you touch the car door

b Lightning may strike the tree as it is the tallest object around

c Cling film becomes charged due to friction as it is unrolled (as electrons are transferred from one part of the film to another, areas acquire opposite charges, so attract)

d Nylon is an electrical insulator; Priya becomes charged by friction as she walks

e Bare wire is highly charged; when Tom touches it charge flows through him to Earth (giving a serious electric shock)

Page 104 Uses of electrostatics

1 a To re-start a heart

b Makes the heart contract

c Place paddles firmly on chest; no clothes/hairs

d It only passes for a very short time

2 a Even coverage; less paint wasted; paint covers awkward places *(Any 1)*

b Paint droplets all have the same charge; like charges repel

c To attract the paint droplets to the frames; as opposite charges attract

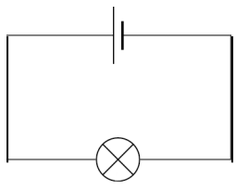
3 a To remove harmful particles that pollute the atmosphere

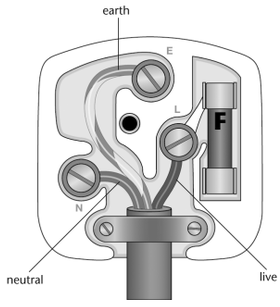
b Fossil fuel power stations

c Positive

P4 answers

Page 105 Safe electricals





1 a **i** Circuit incomplete
ii *(Complete circuit = 1 mark)*

b **i** Varying brightness
ii Ammeter in series; voltmeter in parallel with lamp
iii 24 ohms

2 a Live; neutral; earthed; power station

b Battery is dc, mains is ac; battery is lower voltage than mains

3 a *(Live: on right (to fuse); neutral: on left; earth: at top)*

c **i** *(See diagram)*
ii Breaks circuit if a fault occurs

d **i** Earth
ii It is connected to the metal case of an appliance to prevent it becoming charged if touched by a live wire; it provides a low resistance path to the ground

e 13 A

Page 106 Ultrasound

1 a Vibrations are in same direction as the wave

b The number of vibrations in a second

c **i** Vibrations set up pressure wave in air – compressions (higher pressure) and rarefactions (lower pressure); make eardrum vibrate
ii Frequency increases
iii Sound of a higher frequency than humans can hear

2 a To check the condition of the foetus

b 1 000 000 Hz (or 1 MHz)

c Measure speed of blood flow; clean teeth/old buildings/jeweller; break down stones in the body

(Any 2)

d Pulse; tissues; reflected; echoes; image; gel; probe; skin; ultrasound/pulse; reflected; skin

e **i** Very rapid ultrasound vibrations break the stones down into small pieces that are excreted from the body in the normal way
ii It needs to be powerful enough/carry enough energy; to break up the stones

P4 answers

Page 107 Treatment

1 a Diagnosis: finding out what is wrong with a patient; therapy: treatment

b Similarity: both electromagnetic radiation (of very short wavelength); difference: gamma rays emitted from the nucleus of an atom, X-rays are not (produced in an X-ray machine)

c Both very penetrating/can pass into the body to treat internal organs

d Alpha particles cannot penetrate skin; beta particles would be stopped by a small thickness of tissue and by bone

2 a It damages and destroys cancerous cells

b Destroying cancerous cells by exposing the affected area of the body to large doses of radiation

c To make sure all the cancerous cells are removed (by surgery) or destroyed (by radiotherapy)

d To sterilise equipment

3 a A tiny amount of a radioisotope introduced into the body

b To investigate a problem without surgery

c Occasionally beta but usually gamma radiation

b Thyroid

e X-rays are produced in an X-ray tube; gamma rays can be emitted inside the body and their progress monitored

Page 108 What is radioactivity?

1 a $\frac{\text{Average number of nuclei that decay every second}}{\text{rate of decay}}$

b **i** Geiger-Muller tube
ii Ratemeter

c The decay of one nucleus

d Activity = $\frac{\text{number of nuclei that decay}}{\text{time taken in s}}$

$= \frac{750}{30}$

$= 25$ Bq

e Decrease

f Radioactive decay is a random process; all experimental results should be repeated if possible

2 a

type of radiation	charge (+, – or 0)	what it is	particle or wave
alpha	+	helium nucleus	particle
beta	–	electron	particle
gamma	0	electromagnetic radiation	wave

b Gamma; alpha; alpha; gamma; beta

P4 answers

Page 109 Uses of radioisotopes

1 a Ionising radiation that is always present in the environment

b Radioactive substances present in rocks (especially granite) and soil; cosmic rays from space

2 Detect leaks in underground pipes; monitor the uptake of fertilisers in plants; check for a blockage in a patient's blood vessel; track the dispersal of waste material; track the route of underground pipes

(Any 3)

3 a It is highly ionising/short range in air

b Alpha particles ionise atoms in the air; + and – ions move towards – and + plates respectively; this creates a tiny current which is detected; if present smoke particles attach themselves to the ions neutralising them; current falls setting off alarm

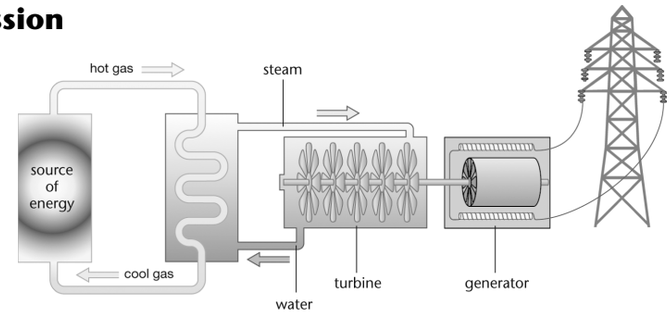
4 a Very little change in count rate over 200 year period

b Seeds; animal bone

c Rocks never contained living matter

Page 110 Fission

1 a



b Source of energy; water; steam; steam; turbine; generator

2 a i Uranium

ii The splitting of a large nucleus such as uranium with the release of energy

b i Chain reaction

ii Chain reaction controlled in nuclear power station, but is out of control in a nuclear bomb

3 a i Put the materials in a nuclear reactor

ii To produce artificial radioisotopes; in hospitals to diagnose/treat patients; in industry as tracers to detect leaks

(Any 1)

b i An uncharged particle found in the nucleus of an atom

ii Uncharged; so can penetrate deep inside nucleus easily; producing unstable isotope

4 a Embedded in glass discs and buried in the sea/incinerated under strict controls (very low waste only)

(Any 1)

b Reprocessed