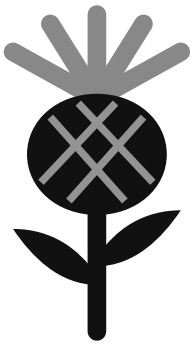
REAL-LIFE SCIENCE

Human Health

Teacher guide

For the National 3 and National 4 Science workbooks



C. Blewis

Blewis LEARNING

Using the workbooks

The National 3 and National 4 workbooks for **Human Health** are parallel: the same nine topics in the same order, the same contexts, and the same practical in every topic. Topic numbers match, so a mixed class can work together and each learner records the work at their own level.

HOW THE LEVELS DIFFER

N3	follows a given method, uses ready-made tables and graph frames, circles or ticks conclusions and improvements
N4	plans the investigation (variables, prediction, kit, risk, method), repeats readings, works out averages, draws graphs with their own scales, writes conclusions and evaluations

PRACTICAL SAFETY

Every practical has a Stay safe table and a teacher note with hazards, adapted versions and common problems. The Stay safe tables and these notes are a starting point, not a complete risk assessment: the teacher or school must risk assess every practical for their own learners, room and kit before use, following their employer's policies and national guidance (in Scotland, SSERC). Always check learners' care plans and medical information. Activities with flames or microbes are teacher demonstrations, with example results provided.

NO LAB, NO KIT, OR A LEARNER ABSENT

Each practical includes example results so learners can still complete the results, graph, conclusion and evaluation.

EVIDENCE

The practicals give evidence for the experiment and investigation outcome; the learn pages and check-ups give evidence for knowledge and problem solving. The skills tracker at the back of each workbook can be signed off as you go. Always check the latest course documents and your centre's arrangements.

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TEACHER NOTES

Practical 1: Taking your temperature

Time	One 50-minute lesson. N3 and N4 can work together; groups of four share one set of kit.
Kit	Per group: one digital thermometer (under-arm or oral type), disposable probe covers, a reusable forehead strip thermometer, alcohol-free cleaning wipes, a bin. Optional: an ear thermometer as a teacher check, with a new disposable tip cover for each person.
Prep	Check batteries and that thermometers read in °C. Use digital thermometers only (no glass). Check care plans and skin allergies.
Expected results	Under-arm digital readings of about 36 to 37 °C (a little lower than mouth or ear readings). Strips read to the nearest 0.5 °C and usually agree within about 0.5 °C, but vary more from go to go.
Levels	N3 follows the given method, records a group table and plots a dot plot on a ready-made frame. N4 plans a comparison of the two thermometers (variables, prediction, kit, risk, method), takes three repeats, averages and draws a bar chart with their own scale.

Safety and inclusion

- Hygiene: a new probe cover for each person, wipe thermometers between users, wash hands before and after. Under-arm readings avoid putting shared kit in mouths.
- Learners who do not want to be measured can take readings for others or use the sample data. Be sensitive: some learners dislike being touched or measured.
- A learner who feels unwell or has a high reading should be referred to the school's first aid procedures, not discussed in front of the group.
- Follow your school and local authority guidance on practical work.

Common problems

- **Reading too soon:** wait for the beep. Under-arm readings also need the arm held firmly against the side.
- **Hot or cold from outside:** learners who have just come in or been running give odd readings. Rest for 5 minutes first.
- **Strips on a damp or hairy forehead:** press flat on dry skin and read at the same time each go.

No lab, no time, or a learner absent?

The sample results let learners complete the table, graph, conclusion and evaluation without taking any readings.

Assessment link

Evidence for the experiment and investigation outcome of the Human Health unit: following a procedure safely, recording and presenting results, drawing a conclusion and evaluating (N3), plus planning the investigation (N4).

Answers: Topic 1

Topic 1: What does healthy mean? (N3)

1 The health triangle

1 Run: physical (also mental). Sleep: physical (also mental). Talking to a friend: mental and social. Football team: physical and social. Drawing: mental. Accept any sensible extra ticks.

2 mental

3 Any sensible answer, e.g. meeting friends, joining a club, helping at home, being kind.

2 Body temperature

1 A 37 °C B 38.5 °C C 36.5 °C

2 B (38 °C or more is a fever)

3 37 °C

3 Checking your body

1 How hot: A. How tall: E. Heart beat: B (stopwatch, counting the pulse). Breathe out: C.

2 normal

3 To check the baby is growing well and to spot any problems early.

Practical 1: Taking your temperature

Risk controls, e.g.: use a new probe cover or wipe the thermometer between people; keep wipes away from eyes and sore skin, wash hands after.

Expected results: under-arm digital readings about 36 to 37 °C; strip readings to the nearest 0.5 °C, usually within about 0.5 °C of the digital reading.

Dot plot: four names on the x axis; dots at the digital readings (sample: 36.6, 36.7, 36.4, 37.1) and crosses at the strip readings (36.5, 37, 36, 37.5).

Conclusion: close to; very similar. Why: steady; fever.

Improvement, e.g. averages make the results more reliable; waiting for the beep gives a full reading; one thermometer for everyone makes it fairer.

Check-up

1 physical; social; mental 2 a fever 3 37.5 °C

4 e.g. new probe cover for each person, or wipe it clean between people.

5 e.g. thermometer: temperature; stopwatch: pulse; peak flow meter: breathing out; scales: weight; height measure: height.

Topic 1: What does healthy mean? (N4)

1 The health triangle

1 Cycling with a friend: physical and social. Sleep: physical and mental. Drama club: social and mental. Worry diary: mental. Accept sensible extra ticks.

2 Key points: mental, e.g. bored, frustrated, low mood, worry about losing his place; social, e.g. misses seeing teammates, feels left out, harder to get out.

3 e.g. go to bed earlier (physical/mental); join a club or meet friends (social); go outside for a walk or sport (physical, mental).

2 Body temperature

1 A 36.8 °C B 38.3 °C C 37.4 °C

2 B, because it is 38 °C or above.

3 38.6 − 37.0 = 1.6 °C

3 A health check

1 Babies (under 1 year)

2 a 360 ÷ 450 × 100 = 80% b Peak flow depends on the person (height, age, their asthma); his own best shows what is normal for him, so a drop from it is easier to spot.

3 No. Fit people often have a lower resting pulse because their heart is stronger and pumps more blood with each beat. Compare with her own baseline and other checks.

Practical 1: Comparing thermometers

Variables: change the type of thermometer; measure body temperature in °C; keep the same: same person, same time, rested for the same time, same room, same place on the body, same time on the skin.

Prediction, e.g. the readings will be similar but the strip less precise, because it only reads to 0.5 °C.

Equipment: digital thermometer, strip, probe covers, wipes, pencil (stopwatch is useful for timing the strip and rest). Measuring cylinder and step not needed.

Hazards, e.g. wipes stinging eyes or sore skin (keep away from eyes, wash hands); coming in unwell (do not take part).

Headings under each thermometer: Trial 1 (°C), Trial 2 (°C), Trial 3 (°C), Average (°C).

Sample averages: Ruby digital 36.7, strip 36.8; Jay digital 36.9, strip 37.2; Amir digital 36.4, strip 36.5 (°C).

Bar chart: paired bars per person, y axis labelled Temperature (°C) with a break, key for digital and strip.

Conclusion: the two thermometers give similar averages (within about 0.3 °C), with the strip slightly higher in the sample.

Explain a: the strip measures skin on the forehead, which is affected by room temperature, sweat or hair; it only reads to 0.5 °C; the armpit reading is lower than the core. b: body temperature varies a little between people and through the day; all are within the normal range.

Evaluate a: the digital thermometer; its readings varied by about 0.2 °C, so it is more reliable/ precise. b: e.g. more repeats; more people; same rest time; read the strip at the same time each go; use a more accurate (ear or mouth) thermometer as a check.

Check-up

1 e.g. a long illness or injury stops someone doing activities they enjoy, so they feel low or anxious.

2 37.6 °C; no, a fever is 38 °C or above.

3 Your own normal reading when well. Changes from it show something may be wrong, even if the reading is within the normal range for your age.

4 (36.5 + 36.9 + 36.7) ÷ 3 = 110.1 ÷ 3 = 36.7 °C

5 To spot odd results and get a more reliable average.

TEACHER NOTES

Practical 2: Exercise and pulse rate

Time	One 50-minute lesson. N3 and N4 can run together in the same space.
Kit	Stopwatches or phone timers, chairs, clear floor space. Optional: pulse monitors or smart watches for comparison.
Prep	None beyond clearing space. Check care plans and medical information before the lesson.
Expected results	Resting pulse for teenagers is usually 60–100 bpm. After a minute of vigorous exercise it often reaches 120–160 bpm. Results should rise with harder or longer exercise.
Levels	N3 follows the given method, compares activities and draws a bar chart on a ready-made frame. N4 plans the test (variables, prediction, kit, risk, method), repeats readings, averages and draws a line graph with their own scales.

Safety and inclusion

- Learners with asthma should have inhalers to hand. Anyone with a heart condition or medical advice against exercise should take readings for a partner instead.
- For learners with limited mobility, swap the activities for seated arm circles or seated marching. The science is the same.
- Learners can stop at any time. Feeling dizzy or unwell is a reason to stop and tell an adult.
- Follow your school and local authority guidance on practical work.

Common problems

- **Using the thumb:** the thumb has its own pulse and gives false counts. Use two fingers.
- **Waiting too long to count:** the pulse starts falling within seconds. Count straight after the exercise.
- **Not resting between tests:** later readings start high. Allow time to return close to resting.

No lab, no time, or a learner absent?

Each practical includes a set of sample results, so learners can still complete the results, graph, conclusion and evaluation.

Assessment link

This practical gives evidence for the experiment and investigation outcome of the Human Health unit: following procedures safely, recording and presenting results, drawing a conclusion and evaluating (N3), plus planning the investigation (N4).

Answers: Topic 2

Topic 2: Your heart and pulse (N3)

1 The heart is a pump

1 muscle; blood. lungs.

2 oxygen and food

3 Back to the heart (then out to the body).

2 Finding your pulse

1 Wrist; side of the neck.

2 The thumb has its own pulse, so you may count the wrong beats.

3 60 to 100 bpm

3 What changes your pulse?

1 After PE (130 bpm), because he had been exercising and his muscles needed more oxygen.

2 up; down; up; up

3 lower

Practical 2: Exercise and your pulse

Risk controls, e.g.: clear space and move bags; go at your own pace and stop if dizzy; tell the teacher about any health condition.

Expected results: resting about 60 to 100 bpm, rising after walking, more after jogging and most after star jumps (often 120 to 160 bpm).

Bar chart (sample data): 72, 96, 124, 140 bpm.

Conclusion: up; higher. Why: oxygen; faster.

Improvement: averages of three tests are more reliable; a monitor counts more accurately; longer rest means each test starts from resting.

Check-up

1 heart; blood; oxygen 2 wrist or neck 3 35 × 2 = 70 bpm 4 faster

5 e.g. feeling scared or stressed, caffeine, being ill.

Topic 2: Your heart and pulse (N4)

1 Inside the heart

1 The left ventricle.

2 Body → right atrium → right ventricle → lungs → left atrium → left ventricle (→ body).

3 To stop blood flowing backwards, so it flows one way through the heart.

2 Arteries, veins and your pulse

1 Vein carries blood back to the heart. Artery wall thick (and muscular). Pressure: artery high, vein low.

2 Blood in arteries is under high pressure and surges with each heartbeat, stretching the wall; in veins the pressure is low and steady.

3 The thumb has its own pulse, which could be counted by mistake.

3 Heart rate and what changes it

1 Kai 72 bpm; Mia 80 bpm; Owen 100 bpm; Zara 66 bpm.

2 130 ÷ 4 = 32.5, so about 32 or 33 beats.

3 Caffeine raises heart rate, so the reading would not be a true resting rate; another variable has changed.

Practical 2: Exercise and pulse rate

Variables: change the exercise time (min); measure pulse rate (bpm); keep the same: type and speed of exercise, person, counting time, rest time, how the pulse is taken.

Prediction, e.g. the longer the exercise, the higher the pulse rate, because muscles need more oxygen.

Equipment: stopwatch, pulse monitor (optional), chair, pencil, partner; step or bench only if used for the exercise; measuring cylinder not needed.

Hazards, e.g. exercising too hard (own pace, stop if dizzy); asthma (inhaler nearby, tell teacher).

Headings: Exercise time (min), Trial 1, 2, 3 (bpm), Average (bpm).

Sample averages: 0 min 72; 1 min 107; 2 min 123; 3 min 140; 4 min 149 bpm.

Line graph: x axis exercise time (min), y axis pulse rate (bpm), sensible even scales, points joined.

Conclusion: as exercise time increased, the pulse rate increased, rising quickly at first then levelling off.

Explain: muscles respire faster and need more oxygen and glucose; the heart beats faster to pump more blood to them and remove carbon dioxide.

Evaluate: repeats close together (within about 6 bpm) shows results are reliable. Improvement, e.g. use a pulse monitor, more repeats, rest until back at resting rate, keep the exercise pace the same with a metronome.

Check-up

1 Left ventricle; it pumps blood all round the body, so needs more muscle to push it at high pressure.

2 e.g. arteries carry blood away from the heart, veins back to it; arteries have thick muscular walls, veins thin walls; veins have valves; arteries have higher pressure.

3 21 × 4 = 84 bpm

4 Muscles work harder and need more oxygen and glucose (food) for energy; the heart pumps faster to deliver more blood.

5 Their heart muscle is stronger and pumps more blood with each beat, so it needs fewer beats.

TEACHER NOTES

Practical 3: Step test recovery time

Time	One 50-minute lesson. Each test takes about 12 minutes; pairs swap roles. N3 and N4 can work side by side.
Kit	Low, stable steps (an aerobics step or box at 10 to 20 cm; steps no higher than 30 cm; not a staircase used by others), stopwatches or phone timers, chairs. N4: two step heights and a metre ruler. Optional: pulse monitors, a metronome app.
Prep	Check steps are stable on a non-slip floor. Check care plans and medical information before the lesson.
Expected results	Pulse is highest straight after stepping (often 110 to 140 bpm) and falls each minute. Most teenagers recover in 3 to 6 minutes; a higher step gives a higher peak and a longer recovery.
Levels	N3 follows the given method, records the pulse each minute and draws a line graph on a ready-made frame. N4 plans a fair comparison (step height, or two people), repeats the recovery time three times, averages and draws two lines with their own scales.

Safety and inclusion

- Keep steps low. Learners stop, sit down and tell an adult if they feel dizzy or unwell. Inhalers must be to hand for learners with asthma.
- Seated alternative: fast knee lifts or arm circles on a chair for 2 minutes. Anyone advised not to exercise can time and record for a partner.
- Avoid comparing learners' fitness publicly; the N4 "two people" option should be by choice.
- Follow your school and local authority guidance on practical work.

Common problems

- **Pace drifts:** a partner chanting "up, up, down, down" or a metronome keeps the work the same.
- **Counting late:** start the 0-minute count as soon as the learner sits.
- **Not truly rested:** a high "resting" pulse makes recovery look quick. Sit for the full 3 minutes first.

No lab, no time, or a learner absent?

Sample results are given at both levels, so learners can still draw the graph, conclude and evaluate.

Assessment link

Evidence for the experiment and investigation outcome of the Human Health unit: following procedures safely, recording and presenting results, drawing a conclusion and evaluating (N3), plus planning the investigation (N4).

Answers: Topic 3

Topic 3: Fitness and recovery (N3)

1 Fitness and recovery

1 130 bpm

2 Zara 4 minutes; Leo 6 minutes.

3 Zara; faster.

2 Blood pressure

1 arteries

2 Being active every day; not smoking; eating plenty of fruit and vegetables.

3 High blood pressure usually has no signs, so a check is the only way to find it and treat it early.

3 Exercise is good for you

1 Physical: stronger heart, stronger bones, healthy blood pressure. Mental: better mood, less stress.

2 a Saturday (110 minutes) b Tuesday and Thursday

3 Any sensible activity.

Practical 3: Step test recovery time

Risk controls, e.g.: use a low, stable step and trainers, clear the area; go at a steady pace and stop and sit down if dizzy.

Expected results: pulse highest at 0 minutes (often 110 to 140 bpm) and falling each minute; most learners recover in about 3 to 6 minutes.

Line graph (sample data): 124, 104, 90, 80, 74, 72, 72 bpm at 0 to 6 minutes; dotted resting line at 72 bpm. Sam recovered in 5 minutes.

Conclusion: higher; down. Why: faster.

Improvement: a monitor counts more accurately; a steady beat keeps the exercise the same; repeats give a more reliable average.

Check-up

1 lower 2 How long your pulse takes to get back to resting after exercise. 3 3 minutes

4 e.g. being active, less salt, not smoking, fruit and vegetables 5 e.g. better mood, less stress, better sleep, time with friends.

Topic 3: Fitness and recovery (N4)

1 Fitness and recovery

1 78 − 62 = 16 bpm

2 Zara 4 minutes; Leo 6 minutes.

3 150 − 78 = 72; 72 ÷ 6 = 12 bpm per minute.

4 Zara: lower resting pulse (62 vs 78), smaller rise after exercise (130 vs 150) and shorter recovery time (4 vs 6 minutes).

2 Blood pressure

1 a Amir's grandad (150/95 is above 140/90) b 115 mmHg

2 High blood pressure usually has no symptoms but strains the heart and damages arteries, raising the risk of heart attack and stroke. Changes, e.g. eat less salt, be more active, lose weight if overweight, stop smoking, drink less alcohol, reduce stress.

3 Exercise is good for you

1 a 60 + 35 + 75 + 45 + 60 + 110 + 70 = 455 minutes b 455 ÷ 7 = 65 minutes a day; yes, the average is at least 60 minutes.

2 e.g. improves mood, reduces stress and anxiety, helps sleep, builds confidence, time with friends; give the reason.

Practical 3: Step height and recovery

Variables: change step height (cm); measure recovery time (min) or pulse (bpm) each minute; keep the same: person, stepping time, pace, rest before, how and when the pulse is counted.

Prediction, e.g. the higher step will give a longer recovery time, because the muscles do more work and need more oxygen.

Equipment: two steps, stopwatch, pulse monitor (optional), chair, metre ruler to measure step heights. Thermometer and measuring cylinder not needed.

Hazards, e.g. feeling dizzy (stop and sit down, seated alternative); asthma (inhaler to hand); high step (keep both steps low, stable).

Headings: Time after stepping (min), Pulse on low step (bpm), Pulse on high step (bpm).

Sample averages: low step (4 + 3 + 5) ÷ 3 = 4 minutes; high step (6 + 7 + 8) ÷ 3 = 7 minutes.

Line graph: x axis time after stepping (min), y axis pulse (bpm); two lines with a key; the high step line starts higher and takes longer to fall to 72.

Conclusion: as the step height increased, the pulse rose higher and the recovery time increased (4 to 7 minutes on average).

Explain: a higher step needs more work from the leg muscles, so they need more oxygen and glucose; the heart beats faster and it takes longer to supply the extra oxygen and return to resting.

Evaluate: repeats varied by 2 minutes, so results are fairly reliable but could be better. Improvement, e.g. pulse monitor, metronome for pace, more repeats, full rest between tests, measure every 30 seconds.

Check-up

1 a The systolic pressure, 145 mmHg, when the heart beats. b Yes, it is above 140/90 mmHg.

2 It makes the heart work harder and can damage the arteries, raising the risk of heart attack, stroke and kidney disease; often no symptoms.

3 (5 + 4 + 6) ÷ 3 = 5 minutes

4 Finn. Keep the same, e.g. step height, stepping time, pace, rest before the test, how the pulse is measured.

TEACHER NOTES

Practical 4: How much air can you breathe out?

Time	One 50-minute lesson. N3 and N4 can run together; N4 groups need to measure heights first.
Kit	Latex-free balloons (one per learner, plus spares), flexible tape measures (or string and a metre ruler), a height chart, chairs, permanent pen to name balloons. Optional: a spirometer or lung volume bag for comparison, with a new disposable mouthpiece (and filter) for each learner; never shared.
Prep	Check care plans for asthma and other breathing conditions. Pre-stretch a few balloons for learners who find them hard to start.
Expected results	One full breath out from a teenager usually gives a circumference of about 45–65 cm (roughly 2–4 litres). Taller learners tend to breathe out more, but there is plenty of spread between people of similar height.
Levels	N3 follows the method, compares group members and draws a bar chart on a ready-made frame. N4 plans a fair test of height against breath volume, repeats three times, averages and draws a line graph with their own scales.

Safety and inclusion

- Latex-free balloons only. Each learner uses their own named balloon and bins it (or takes it home) afterwards. Never share.
- Learners stay seated. One breath per go, with a rest of at least a minute between goes. Anyone who feels dizzy or light-headed stops, sits quietly and breathes normally.
- Learners with asthma keep inhalers to hand. Any learner who should not blow forcefully can be the measurer and recorder, or use the sample results.
- Avoid sensitive comparisons: learners can compare by code (Person 1, 2, 3) rather than names, and heights need not be shared publicly.
- Follow your school and local authority guidance on practical work.

Common problems

- **Air escaping:** pinch the neck firmly or tie the balloon before measuring.
- **Measuring in the wrong place:** measure round the widest part, keeping the tape flat and not squashing the balloon.
- **Topping up:** learners take a second breath into the balloon. Stress one breath only.

No lab, no time, or a learner absent?

The sample results let learners complete the graph, conclusion and evaluation without blowing up a balloon.

Assessment link

Evidence for the experiment and investigation outcome: following a procedure safely, recording and presenting results, concluding and evaluating (N3), plus planning and repeat measurements (N4).

Answers: Topic 4

Topic 4: Breathing and lungs (N3)

1 Breathing in and out

1 bigger; out.

2 The chest rises and gets bigger as you breathe in, then falls as you breathe out.

3 Oxygen.

4 Your muscles need more oxygen (and you need to get rid of more carbon dioxide), so you breathe faster.

2 Inside your lungs

1 Windpipe: carries air to the lungs. Ribs: protect the lungs. Diaphragm: muscle that helps you breathe. Lungs: take oxygen into the blood.

2 more.

3 Oxygen.

3 Looking after your lungs

1 Thursday (lowest peak flow, 300).

2 Cigarette smoke and dust.

3 Any one: tar sticks in the lungs; causes coughing; makes you out of breath; can cause lung cancer.

Practical 4

Safety controls: use your own balloon only and bin it after; stay seated, one breath at a time, rest between goes and stop if dizzy.

Sample results: bars Ella 54, Finn 61, Isla 50, Owen 58 cm. Finn breathed out the most air.

Conclusion: more. Why: bigger, bigger.

Improvement: repeating three times and averaging makes results more reliable; the same type of balloon makes it a fairer test. Measuring top to bottom is not a better idea.

Check-up

1 1 windpipe, 2 lung, 3 rib, 4 diaphragm.

2 oxygen; carbon dioxide.

3 Any one: smoking, vaping, pollution, smoke, dust, traffic fumes.

4 It gives medicine that opens up (relaxes) the airways so it is easier to breathe.

Topic 4: Breathing and lungs (N4)

1 Breathing in and out

1 Ribs out: down and in. Diaphragm in: contracts and flattens (moves down). Space in chest: increases / decreases. Air out: out of the lungs.

2a 36 − 15 = 21 more breaths a minute.

2b His muscles were working harder and needed more oxygen (and produced more carbon dioxide to remove), so he breathed faster.

2 Inside your lungs

1 trachea, bronchus, bronchiole, alveolus.

2a 21 − 16 = 5 (percentage points).

3 Any two: huge surface area (millions of alveoli); walls one cell thick; good blood supply (capillaries); moist lining.

3 Looking after your lungs

1a 400 − 300 = 100; 100 ÷ 400 × 100 = 25% drop.

1b Use her reliever inhaler as in her asthma plan, avoid triggers, and tell an adult or get medical help if it does not improve.

2 The alveoli walls have broken down, so there is less surface for gas exchange; less oxygen gets into the blood, so the muscles cannot get enough oxygen.

3 Smoke damages the cilia, so mucus and dirt are not swept out; mucus builds up overnight and they cough to clear it.

Practical 4

Variables: change height; measure distance round the balloon (cm); keep the same: type and size of balloon, one breath only, sitting position, where the balloon is measured.

Prediction example: taller people will breathe out more air because they usually have bigger lungs.

Kit: balloon, tape measure, height chart, chair, pencil. Not needed: thermometer, stopwatch.

Hazards: e.g. dizziness from repeated hard breathing (sit down, rest between goes, stop if dizzy); latex allergy (latex-free balloons); asthma (inhaler to hand).

Table headings: Height (cm), Trial 1 (cm), Trial 2 (cm), Trial 3 (cm), Average (cm).

Sample averages: 145 cm → 50; 152 → 53; 164 → 58; 171 → 61; 178 → 63 cm.

Graph: height on x axis, average distance round on y axis; points show a rising trend.

Conclusion: as height increased, the amount of air breathed out (balloon size) increased.

Explain: taller people usually have a bigger chest and bigger lungs, so they can hold and breathe out more air.

Evaluate a: balloons that stretch differently or are not round give different sizes for the same air, making results less accurate; use the same type of balloon, or measure volume another way.

Evaluate b: e.g. test more people of each height; repeat more times; use a spirometer or a lung volume bag for a direct volume reading; measure balloons the same way each time.

Check-up

1 1 trachea (windpipe), 2 lung, 3 rib, 4 diaphragm, 5 bronchus, 6 bronchiole.

2 The intercostal muscles pull the ribs up and out; the diaphragm contracts and flattens. The chest gets bigger and air is drawn in.

3 There is more oxygen in the alveoli than in the blood, so oxygen passes (diffuses) through the thin walls into the blood.

4 Less oxygen reaches the muscles, so they cannot work as hard; the person gets out of breath sooner.

TEACHER NOTES

Practical 5: Which snack is healthier?

Time	One 50-minute lesson for the label comparison. Allow 15 more minutes if you run the demonstration.
Kit	The label cards are printed in the workbook. Optional: clean, empty snack packets. Red, amber and green pencils (N3), calculators (N4). **Demo:** boiling tube, clamp stand, thermometer, 10 cm^3 or 25 cm^3 measuring cylinder, mounted needle, heatproof mat, Bunsen burner, eye protection, 1 g pieces of nut-free snacks (e.g. puffed corn snack, rice cake).
Expected results	Snack D (rice cakes) has most green lights; snack C (chocolate bar) is high in fat, saturates and sugar. Demo: a 1 g piece usually raises 20 cm^3 of water by about 15–30 °C.
Levels	N3 colours the traffic lights, counts them, draws a bar chart of sugar on a ready-made frame and chooses a snack. N4 decides what to compare, calculates per-portion values, draws its own bar chart and evaluates per 100 g against per portion.

Safety and inclusion

- Use printed cards or clean, empty packets. No food is eaten in the lab. Check allergy information before bringing any packaging in.
- **Demo:** teacher only, nut-free foods only, eye protection, hair tied back, learners at a safe distance, good ventilation, a fire blanket to hand. Be aware the smoke may set off alarms. Never burn nuts or seeds.
- Keep language about food and bodies neutral and kind. Avoid calorie targets, weighing learners or labelling foods as good or bad; talk about foods to have more often and less often. Be aware some learners may have difficult relationships with food.
- Follow your school and local authority guidance on practical work.

Common problems

- **Mixing per 100 g and per portion:** stress that per 100 g is for fair comparison, per portion is what you actually eat.
- **Demo food goes out:** relight it and keep it directly under the tube; much heat is lost to the air, so rises are lower than the label suggests.

No lab, no time, or a learner absent?

All label data is in the workbook, and the demo has sample results so learners can still analyse it.

Assessment link

Evidence for the experiment and investigation outcome: following a procedure, recording and presenting results, concluding and evaluating (N3), plus planning a fair comparison and calculating (N4).

Answers: Topic 5

Topic 5: Food and energy (N3)

1 A balanced diet

1 Fruit and veg: apple, carrots. Starchy: rice, bread. Beans, fish, eggs, meat: eggs. Dairy: yoghurt.

2 a third; 5.

3 Water keeps the body working: e.g. it replaces water lost in sweat and urine, and stops you getting dehydrated.

2 Nutrients

1 Protein: growth and repair. Carbohydrate: gives you energy. Calcium: strong bones and teeth. Fibre: keeps your gut healthy.

2 C.

3 Carbohydrate.

4 Any one: meat, fish, eggs, beans, lentils, milk, cheese.

3 Energy and food labels

1 Salt.

2 high.

3 Yes: fat has a green (LOW) light.

Practical 5

Safety controls: use empty packets or cards and check for allergies (no nuts); do not eat anything in the science room.

Lights: A 1 green, 1 amber, 2 red; B 1 green, 3 amber, 0 red; C 0 green, 1 amber, 3 red; D 3 green, 1 amber, 0 red. Sugar per 100 g: A 3, B 20, C 45, D 0.5 g.

Bar chart: A 3, B 20, C 45, D 0.5.

Conclusion: snack D (rice cakes) is healthiest. Snack C has the most sugar and 3 red lights.

Why: teeth; heart.

Improvement: comparing more snacks gives a better choice; checking portion size shows how much you actually eat. The packet colour does not help.

Demo: rises 26 °C and 21 °C; puffed corn snack; more.

Check-up

1 Any two fruits or vegetables.

2 digestion; grow and repair.

3 Red.

4 It is fine to have crisps sometimes, in small amounts, as part of a balanced diet. No food needs to be banned.

Topic 5: Food and energy (N4)

1 A balanced diet

1a Fruit and vegetables.

1b e.g. wholemeal bread; add salad or fruit; swap fizzy juice for water or milk; swap crisps for fruit or vegetable sticks.

2a 4 portions (banana, carrot, juice, peas). 2b 1 more.

3 Different foods contain different nutrients; no single food has all the nutrients the body needs.

2 Nutrients

1a Scurvy. 1b Fresh fruit and vegetables (e.g. citrus fruit) give vitamin C, which prevents scurvy.

2 Fibre keeps the gut healthy and helps food move through, preventing constipation; it also helps you feel full.

3 Energy and food labels

1 45 × 4.2 = 189, about 188 kJ (labels use 4.184).

2 Salt: 0.7 × 300 ÷ 100 = 2.1 g. Energy: 45 × 300 ÷ 100 = 135 kcal.

3 Salt is the only amber light, and a large 300 g portion means quite a lot of salt (2.1 g) in one go; too much salt raises blood pressure.

Practical 5

Compare: snacks A to D. Calculate: e.g. sugar, fat or salt per portion (and per 100 g). Keep the same: compare the same nutrients, use the same units (g), use per 100 g for all, or per portion for all.

Kit: label cards, calculator, pencil (ruler for the chart, coloured pencils optional). Not needed: thermometer, stopwatch.

Hazards: eating food in the lab (do not eat anything); teacher demo flame and smoke (stand back, teacher only).

Headings e.g. Sugar per 100 g (g), Sugar per portion (g), Fat per 100 g (g), Fat per portion (g).

Per portion: A sugar 0.75 g, fat 7.0 g, salt 0.4 g, 126 kcal; B sugar 7.0 g, fat 4.9 g, salt 0.09 g, 141 kcal; C sugar 18 g, fat 8.8 g, salt 0.16 g, 196 kcal; D sugar 0.1 g, fat 0.56 g, salt 0.18 g, 77 kcal.

Bar chart of sugar per portion: A 0.75, B 7.0, C 18, D 0.1 g.

Conclusion: snack D (rice cakes) is healthiest: three green lights, no red, and the least fat, sugar and energy per portion. C is the least healthy.

Evaluate a: snack A's portion (25 g) is smaller than snack B's (35 g), so although 100 g of A has more energy, one portion has less (126 kcal against 141 kcal).

Evaluate b: e.g. compare more snacks; use real packets for up-to-date values; compare all nutrients, not just one; consider fibre and protein too.

Demo averages: corn snack 26 °C, rice cake 20 °C. Energy = 20 × 4.2 × 26 = 2184 J (about 2.2 kJ). Much lower because most of the heat goes into the air, the tube and the thermometer, and the food may not burn completely.

Check-up

1 a carbohydrate b protein c fibre.

2a Iron. 2b Any two: red meat, beans, lentils, leafy green vegetables, fortified cereals.

3 22 × 30 ÷ 100 = 6.6 g.

4 150 × 4.2 = 630 kJ (627.6 kJ using 4.184).

5 Per 100 g lets you compare different foods fairly; per portion tells you how much you actually eat in one serving.

TEACHER NOTES

Practical 6: Which hand-washing works best?

Time	One 50-minute lesson. Learners work in pairs: one washes, one times. N3 and N4 run together.
Kit	Fragrance-free hand gel or cream mixed with biodegradable glitter only (or a UV "germ" gel with a low-power UV-A torch sold for germ-gel kits, held by the teacher and pointed only at hands), liquid soap, sinks with warm water, paper towels, stopwatches, printed hand outlines, magnifying glasses (optional).
Prep	Mix the glitter gel in advance and put it in pump bottles so each squirt is the same. Check allergy information for every learner.
Expected results	Water only leaves most glitter (8–10 sections); soap for 5 s removes some; soap for 20 s leaves very little (0–3). Nails, thumbs and between fingers are usually missed.
Levels	N3 follows the method, shades hand outlines and draws a bar chart on a ready-made frame. N4 plans a fair comparison, repeats each method three times, averages and draws a bar chart with their own scale.

Safety and inclusion

- Check for skin allergies and conditions such as eczema. Learners who should not use the cream can time, record and shade for a partner, or wear a nitrile (latex-free) disposable glove for the test.
- Keep glitter away from eyes; no touching faces until hands are clean. Wipe up spills at once to avoid slips. Never shine a UV torch into anyone's eyes. Catch glitter in a sink strainer.
- **Agar demo (teacher only):** use sterile plates; tape the lid with a few strips (do not seal all the way round); label the base; incubate upside down at room temperature, below 25 °C; plates are never opened; dispose of them following your local authority guidance (normally by autoclaving).
- Follow your school and local authority guidance on practical work.

Common problems

- **Not starting clean:** glitter left from the last test inflates scores. Wash fully with soap before each new application.
- **Different amounts of gel:** use one pump each time.
- **Rubbing on towels:** rubbing can remove glitter; pat dry for every test.

No lab, no time, or a learner absent?

Sample results are given for both the glitter test and the agar plates, so learners can complete the analysis.

Assessment link

Evidence for the experiment and investigation outcome: following a procedure safely, recording and presenting results, concluding and evaluating (N3), plus planning and repeat measurements (N4).

Answers: Topic 6

Topic 6: Germs and hygiene (N3)

1 Microbes

1 virus; fungus, bread.

2 Some microbes are helpful.

3 Any one: cold, flu, chickenpox, COVID-19.

2 How germs spread

1 Any two: after using the toilet; before cooking or eating; after touching raw meat; after coughing, sneezing or blowing your nose; after touching animals or bins.

2 20.

3 Germs from the sneeze get onto his hand, then onto the door handle; the next person touches it and picks them up.

3 Fighting germs

1 To stop germs getting in through the broken skin.

2 fight; fight.

3 Any one, e.g. HPV, tetanus, diphtheria, polio, meningitis, MMR (measles, mumps, rubella), flu.

Practical 6

Safety controls: glitter: keep hands away from your face and eyes; water: wipe up spills straight away.

Sample results: water 5 s 9, soap 5 s 6, soap 20 s 2.

Conclusion: soap for 20 s. Why: grease and dirt; longer.

Improvement: repeating three times and averaging, or using the same amount of gel, makes it fairer and more reliable. Using a different person each time is not fair.

5 Soap for 20 s (9 colonies): washing with soap for 20 seconds removes the most microbes. (The untouched control shows the plates were sterile.)

Check-up

1 Bacteria: makes yoghurt. Virus: causes colds and flu. Fungus: makes bread rise (yeast).

2 Wet hands, add soap, scrub for 20 seconds, rinse and dry.

3 Any two: touch, coughs and sneezes, food, water.

4 It teaches your body to fight a germ, so you do not get ill (or are less ill) if you catch it.

Topic 6: Germs and hygiene (N4)

1 Microbes

1 Any one: a virus is much smaller; it is not a cell; it can only reproduce inside another living cell.

2 A cold is caused by a virus; antibiotics only kill bacteria, so they would not help (and overusing them helps bacteria become resistant).

3 e.g. yeast (a fungus) makes bread rise; bacteria make yoghurt or cheese.

2 How germs spread

1 Raw chicken can carry bacteria such as those that cause food poisoning; salad is not cooked, so bacteria transferred to it would not be killed (cross-contamination).

2 Soap breaks up the grease and oil on skin that germs stick to, so they rinse away; water alone leaves the grease behind.

3 Any two: everyone washes hands before cooking and after the toilet; separate boards for raw meat; cook food until steaming hot; keep food chilled; clean surfaces; anyone who is ill stays home.

3 Fighting germs

1 Antibodies fit and stick to the virus, which stops it working and makes it easy for white blood cells to destroy it.

2 After the first infection the body keeps memory cells, so if it meets the virus again it makes antibodies very quickly and destroys it before you get ill (you are immune).

3 If most people around the baby are vaccinated, the pathogen cannot spread through the community, so the baby is less likely to meet it.

Practical 6

Variables: change the washing method; measure the number of sections (out of 10) with glitter left; keep the same: amount of gel, time left on, water temperature, how hands are dried, the person, how sections are scored.

Prediction example: soap for 20 s will remove most glitter because soap lifts grease and longer scrubbing reaches more of the hand.

Kit: glitter gel, soap, stopwatch, paper towels, hand outlines. Not needed: thermometer, tape measure.

Hazards: glitter in eyes (keep hands away from face); wet floor (wipe spills); UV torch if used (never shine at eyes).

Headings: Method, Trial 1 (sections), Trial 2 (sections), Trial 3 (sections), Average (sections).

Sample averages: water 5 s (9 + 8 + 10) ÷ 3 = 9.0; soap 5 s (6 + 4 + 5) ÷ 3 = 5.0; soap 20 s (2 + 1 + 1) ÷ 3 = 1.3.

Conclusion: soap for 20 s was best (fewest sections with glitter left).

Explain: soap breaks up the grease the glitter sticks to; scrubbing for longer reaches all parts of the hands.

Evaluate a: good model: it sticks to skin and spreads like germs, and you can see it. Not so good: real germs are invisible, much smaller and can multiply; glitter does not.

Evaluate b: e.g. more repeats; use the same amount of gel from a pump; use a UV gel and torch for clearer scoring; have the same person score every hand.

c (86 − 9) ÷ 86 × 100 = 89.5%, about 90% of colonies removed.

Check-up

1 a fungus (yeast) b virus c bacteria.

2 Flu is caused by a virus; antibiotics only work against bacteria.

3 Any two with reasons, e.g. wash hands before handling food (removes germs from hands); keep raw meat separate (stops cross-contamination); cook food thoroughly (kills bacteria); chill food below 5 °C (slows bacteria growing).

4 They surround and digest (engulf) pathogens; they make antibodies that stick to pathogens; (memory cells give a fast response next time).

5 If most people are immune the pathogen cannot spread, so it protects people who cannot be vaccinated, e.g. babies and people who are very unwell.

TEACHER NOTES

Practical 7: Ruler-drop reaction test

Time	One 50-minute lesson. N3 and N4 can work side by side in pairs.
Kit	One 30 cm plastic ruler per pair (with a clear 0 cm at one end), tables and chairs. N4 needs nothing extra: the distraction is mental counting.
Prep	Check rulers start at 0 cm at the very end, or mark the 0 line clearly. Model the hand position and how to read the top of the thumb.
Expected results	Most teenagers catch at about 8–20 cm (about 0.13–0.20 s). The dominant hand is often a little faster, but differences are small and may not show. A mental distraction usually adds several centimetres. The conversion table comes from $d = \frac{1}{2}gt^2$ with $g = 9.8\ m/s^2$.
Levels	N3 follows the method, compares dominant and other hand, averages 3 tries and draws a bar chart on a ready frame. N4 plans the distraction test (variables, prediction, kit, risk, method), takes 5 repeats, averages, draws a bar chart with their own scale and converts distances to reaction times.

Safety and inclusion

- Use plastic rulers only. Drop over the table with feet tucked away; keep fingers clear of the falling end.
- Seated activity, suitable for wheelchair users. Learners with limited grip can catch by trapping the ruler against the table edge with a flat palm; record the same distance.
- Some learners dislike being timed or compared. Results can stay private; the class only needs averages.
- Handle the drugs and alcohol content factually and calmly. If a learner discloses a concern about themselves or someone at home, follow your school's child protection procedures.
- Follow your school and local authority guidance on practical work.

Common problems

- **Anticipating the drop:** catchers watch the dropper's hand. Vary the wait before dropping and tell catchers to watch the ruler.
- **Hand moving down:** the forearm must rest on the table so the hand cannot follow the ruler.
- **Missed catches:** record "missed" and repeat that try rather than writing 30 cm.

No lab, no time, or a learner absent?

Each level includes sample results, so learners can still complete the averages, chart, conclusion and evaluation.

Assessment link

Evidence for the experiment and investigation outcome of the Human Health unit: following procedures safely, recording and presenting results, drawing a conclusion and evaluating (N3), plus planning the investigation and processing data (N4).

Answers: Topic 7

Topic 7: Smoking, alcohol and drugs (N3)

1 What is a drug?

1 Medicine: asthma inhaler. Legal drug: caffeine, nicotine. Illegal drug: cannabis.

2 Say no, and ask a trusted adult or pharmacist.

3 illegal

2 Smoking and vaping

1 Nicotine: is addictive. Tar: coats the lungs. Carbon monoxide: means the blood carries less oxygen.

2 harder

3 No, most vapes have addictive nicotine and vaping is not harmless.

3 Alcohol and your reactions

1 32 − 23 = 9 m further.

2 slower; liver

3 e.g. young people's brains and bodies are still growing so alcohol harms them more; to protect young people.

Practical 7

Safety controls, e.g. use a plastic ruler and keep feet tucked under the chair; keep fingers clear and only catch with thumb and finger.

Results: most catches 8–20 cm. Sample data: averages 14 cm (dominant) and 19 cm (other).

Bar chart: two bars to the averages (sample: 14 and 19).

Conclusion: usually dominant; faster. (Accept the hand their own results show.)

Why: nerves; more. Alcohol makes messages slower.

Improvement: any ticked idea with a reason, e.g. more tries gives a more reliable average; same partner keeps the test fair; practice catches mean you learn the method before recording.

Check-up

1 Something that changes how your body or mind works.

2 addictive; lungs; slower

3 e.g. follow the label; never share prescription medicine; ask a pharmacist if unsure.

4 Leo (shorter distance).

5 e.g. a parent or carer, teacher, key worker, school nurse, doctor.

Topic 7: Smoking, alcohol and drugs (N4)

1 What is a drug?

1 Medicine: paracetamol, asthma inhaler. Legal drug: caffeine, alcohol, nicotine. Illegal drug: cannabis.

2 It was prescribed for another person's illness, body size and age; it may be the wrong medicine or amount, may cause an allergic reaction or clash with other medicines; sharing it is illegal.

3 e.g. poor sleep, feeling jittery or anxious, fast heartbeat, headaches.

2 Smoking and vaping

1 Carbon monoxide reduces the oxygen the blood carries, and tar damages the lungs so less oxygen gets in; the muscles get less oxygen, so the smoker breathes harder and tires sooner.

2 You cannot tell it is there, so people do not know they are breathing it in (it can also come from faulty boilers and fires).

3 Any two: most vapes contain nicotine, which is addictive; not harmless; long-term effects still unknown; can lead to smoking; illegal to sell to under-18s.

3 Alcohol and your reactions

1 a Thinking 18 m; total 18 + 14 = 32 m. b e.g. the car travels 9 m further before stopping, so it could hit a child who steps out.

2 Alcohol is a depressant; it slows the nervous system, so messages between brain and muscles take longer.

Practical 7

Variables: change: distraction or no distraction; measure: catch distance (cm) / reaction time; keep the same: same ruler, same hand, same person dropping, same starting position, same seat and arm position.

Prediction, e.g. the distraction will increase the catch distance because the brain is busy with another task.

Kit: ruler, chair, table, pencil, partner (stopwatch and scales not needed).

Extra hazards, e.g. fingers near the ruler: keep fingers clear and catch only with thumb and finger; leaning on chair: sit flat with arm on table.

Method: arm rests on table, 0 cm level with top of thumb; partner drops without warning; read top of thumb; 5 catches with no distraction, then 5 while counting back from 100 in 3s aloud; same hand and dropper throughout.

Table headings: Test | Trial 1 (cm) ... Trial 5 (cm) | Average (cm).

Sample averages: no distraction 65 ÷ 5 = 13 cm; counting 102 ÷ 5 = 20.4 cm.

Reaction times: 13 cm is nearest 15 cm ≈ 0.17 s (or between 0.14 and 0.17 s); 20.4 cm ≈ 0.20 s.

Conclusion: with a distraction, reaction time increased (catch distance got longer).

Explain: a The brain is busy with another task so it takes longer to notice and respond. b A distracted driver reacts later, so thinking distance and stopping distance increase.

Evaluate: comment on spread of repeats (close = reliable); improvements, e.g. more repeats, practice catches, same dropper, random wait before dropping, use class averages.

Check-up

1 e.g. medicine: paracetamol; legal: caffeine; illegal: cannabis.

2 Carbon monoxide joins red blood cells more easily than oxygen, so blood carries less oxygen and the heart works harder.

3 It was chosen for someone else and may harm you; it is against the law.

4 0.20 s.

5 Alcohol increases reaction time, so thinking distance and total stopping distance increase.

TEACHER NOTES

Practical 8: Does slow breathing lower your pulse?

Time	One 50-minute lesson. N3 and N4 can run together; a calm, quiet room helps.
Kit	Stopwatches or phone timers, chairs. Optional: pulse monitors, and a 4-count breathing animation on the board for pacing.
Prep	Check care plans and medical information. Practise finding the wrist pulse (Practical 2). Model slow breathing first: gentle, not deep or forced.
Expected results	Resting pulse for teenagers is about 60–100 bpm. After 3 minutes of slow breathing many learners drop by a few beats (often 2–10 bpm); some show no change. A normal-breathing control usually changes by 0–2 bpm. Small differences are within counting error: a good evaluation point.
Levels	N3 follows the method, records before and after, draws a bar chart on a ready frame. N4 plans the test with a control, uses class data to calculate changes and averages, and evaluates reliability.

Safety and inclusion

- Slow breathing should be gentle. Anyone who feels dizzy stops and breathes normally. Learners with asthma keep inhalers to hand.
- Results are personal. Nobody has to share; collect class data anonymously. Learners can use the sample results instead.
- Focusing on breathing can feel uncomfortable for some learners, especially if anxious. Offer the timer or recorder role, or eyes-open counting.
- Keep the tone supportive. If a learner discloses distress, follow your school's wellbeing and child protection procedures. Have the school's named wellbeing or guidance contact ready before the lesson.
- Follow your school and local authority guidance on practical work.

Common problems

- **Not truly resting at the start:** learners who have just walked in have a raised pulse, which then falls whatever they do. Insist on 2 minutes' rest first; this is also why the control matters.
- **Counting errors and chatter:** one missed beat in 30 s is 2 bpm, and talking raises the pulse. Use monitors if you have them, and run the 3 minutes in silence with a visible timer.

No lab, no time, or a learner absent?

Each level includes sample results, so learners can still complete the chart, conclusion and evaluation.

Assessment link

Evidence for the experiment and investigation outcome of the Human Health unit: following procedures safely, recording and presenting results, drawing a conclusion and evaluating (N3), plus planning with a control and processing class data (N4).

Answers: Topic 8

Topic 8: Stress and mental health (N3)

1 Mental health is health

1 Everyone; change

2 How you feel; How you cope with problems; How you get on with other people.

3 Open answer, e.g. seeing friends, sport, music, being outdoors, a good sleep.

2 Stress and your body

1 Any two: faster heartbeat, faster breathing, sweaty or shaky hands, tense muscles, butterflies, worried thoughts.

2 Zara: good stress. Owen: bad stress.

3 Talk to someone he trusts.

3 Looking after your mind

1 9 hours. Yes, it is within 8 to 10 hours.

2 better; worse

3 Any two from the toolkit (sleep, move, outdoors, talk, breathe, hobbies, screens off).

Practical 8

Safety controls, e.g. breathe gently, not too deep; stop and breathe normally if dizzy. Nobody has to share results; keep results private.

Results: sample data 80 bpm before, 72 bpm after. Most learners fall by a few beats; some show no change.

Bar chart: two bars (sample: 80 and 72).

Conclusion: usually down (accept what their results show). Why: calm down; slowly.

Improvement: any ticked idea with a reason, e.g. repeats and an average are more reliable; a normal-breathing comparison shows whether slow breathing made the difference; a monitor avoids counting mistakes.

Check-up

1 True 2 Any two signs from the body page. 3 About 8 to 10 hours.

4 Down, by 8 beats per minute.

5 e.g. parent or carer, teacher, key worker, friend, school nurse, doctor.

Topic 8: Stress and mental health (N4)

1 Mental health is health

1 Any two, e.g. exam pressure, loss or change at home, falling out with friends, poor sleep, illness, bullying, loneliness.

2 Physical to mental, e.g. exercise lifts mood; illness or poor sleep lowers mood. Mental to physical, e.g. worry causes headaches, stomach aches, poor sleep.

3 People feel less embarrassed, so they ask for help earlier and support each other.

2 Stress and your body

1 More blood and oxygen (and glucose) reach the muscles, so they have the energy to act quickly (fight or flight).

2 A little stress raises alertness and focus, so performance improves (top of the curve); too much makes it hard to think and performance falls.

3 Looking after your mind

1 7.5 hours (7 h 30 min). Not enough: teenagers need about 8 to 10 hours.

2 e.g. harder to concentrate and remember in lessons, more irritable or low mood, lower marks.

3 Any two, e.g. switch off an hour before bed, mute notifications, limit time, remember images are edited, unfollow accounts that make you feel bad, report unkind comments.

Practical 8

Variables: change: type of breathing (slow or normal); measure: pulse rate (bpm) / change in pulse; keep the same: rest time first, 3 minutes, sitting position, how the pulse is counted (30 s × 2), quiet room.

Prediction, e.g. slow breathing will lower the pulse more than normal breathing because it helps the body relax.

Kit: stopwatch, pulse monitor (optional), chair, pencil, partner (step and measuring cylinder not needed).

Extra hazards, e.g. sharing results: keep results private / anonymous; asthma or other condition: tell teacher, inhaler to hand.

Method: rest 2 minutes; measure pulse; 3 minutes slow breathing (in 4, out 4); measure again straight away; control: same but breathing normally; repeat or pool class results and average.

Table headings, e.g. Learner | Before (bpm) | After (bpm) | Change (bpm).

Sample: changes −8, −4, −10, −4, −9; average before 410 ÷ 5 = 82 bpm, after 375 ÷ 5 = 75 bpm, average change −35 ÷ 5 = −7 bpm. Control −1 bpm.

Conclusion: slow breathing lowered the pulse by about 7 bpm on average, much more than the control (1 bpm).

Explain: slow breathing calms the stress response (less adrenaline), so the heart slows down.

Evaluate: a The control shows how much the pulse falls just from sitting still, so we can tell the slow breathing caused the extra fall. b Missing one beat in 30 s gives a 2 bpm error, similar in size to the change; use a pulse monitor, count for 60 s, repeat. c One person's result may be unusual; averaging many results reduces the effect of errors and odd results.

Check-up

1 Short-term stress helps you focus and passes quickly; long-term stress goes on for weeks and harms sleep, mood, concentration and health.

2 Adrenaline; any two of faster heart rate, faster breathing, tense muscles, sweating, slowed digestion.

3 Any two: mood, concentration, memory, controlling emotions, coping with stress.

4 Sitting still alone lowers the pulse by only 1 bpm, so most of the 7 bpm fall was caused by slow breathing.

5 e.g. exercise (lowers stress hormones, lifts mood), good sleep, talking, slow breathing, planning revision with breaks.

TEACHER NOTES

Practical 9: Does music help you remember?

Time	One 50-minute lesson. N3 and N4 can run together, pooling results for a class average.
Kit	The two trays printed in the workbook (or real trays of 20 objects), scrap paper to cover the trays and write lists, a timer, and a speaker or headphones for quiet music.
Prep	Choose the music in advance: the same track for everyone, at a low volume. Instrumental and songs with lyrics may give different results, which N4 learners could explore.
Expected results	Most learners recall 8–14 of 20 objects. Research is mixed: background music, especially with lyrics, often makes little difference or slightly lowers recall. Class averages usually differ by less than 1–2 objects, which is a good discussion point about whether a small difference matters.
Levels	N3 follows the method (Tray A without music, Tray B with), draws a bar chart and decides if the claim is supported for them, then sees why one person is not enough. N4 designs the fair test (variables, timings, counterbalancing the trays), averages class results, judges the claim and discusses limitations.

Safety, fairness and inclusion

- Keep volume low; offer headphones at a set volume if a learner prefers. Learners with sound sensitivity can be timers or recorders, or use the sample results.
- Scores are private. This is not a competition; class data can be collected without names.
- Learners with literacy difficulties can say the objects aloud to a partner who ticks them off, or point to them on a second copy of the tray. Keep the method the same for both tests.
- Follow your school and local authority guidance on practical work.

Common problems

- **Peeking:** learners see the second tray early. Keep it covered from the start.
- **Order effects:** learners get better at the task on the second go. N4 learners should counterbalance: half do music first or swap trays.
- **Scoring:** agree in advance that close names count (e.g. "mug" for cup).

No lab, no time, or a learner absent?

Each level includes sample results, so learners can still complete the chart, conclusion and evaluation.

Assessment link

Evidence for the experiment and investigation outcome of the Human Health unit: following procedures, recording and presenting results, drawing a conclusion and evaluating (N3), plus designing the fair test and processing class data (N4).

Answers: Topic 9

Topic 9: Can you believe it? (N3)

1 Health claims everywhere

1 It says you can lose 5 kg in 7 days; the only proof is what Jade says.

2 B, e.g. scientists tested 2,000 people for two years; other teams found the same; it is not selling anything.

3 No. Anyone can post anything online; you need to check the evidence.

2 Evidence and fair tests

1 Only one person was tested; he only tried it once.

2 one thing; more

3 The company makes money from sweets, so it may want a good result (it may be biased).

3 Risk and vaccines

1 10 in 100

2 The crowd where few people are vaccinated: the illness can spread from person to person.

Practical 9

Safety control for comparing scores, e.g. keep scores private; it is not a competition.

Results: most learners remember 8–14 objects. Sample: 11 without music, 9 with music.

Bar chart: two bars (sample: 11 and 9).

Conclusion depends on results (sample: more without music; claim not supported for Sam).

Can we be sure: one person; more.

Improvement: any ticked idea with a reason, e.g. class averages are more reliable; swapping tray order makes it fair if one tray is easier; changing the order shows whether practice helped.

Check-up

1 "This cream cures spots overnight! Buy now!"

2 lots of; one thing 3 5 in 100

4 It trains your body to fight the disease before you catch it.

5 No: he remembered more without music (but one person is not enough to be sure).

Topic 9: Can you believe it? (N4)

1 Health claims everywhere

1 Any three: too good to be true (5 kg in 7 days, no exercise); "amazing", "melts fat", "100% natural"; selling a product; evidence is one person's story; pressure ("offer ends tonight"); sponsored; no scientific test.

2 Any two: large sample (2,000); long time (two years); repeated by other teams; scientists did it; funder does not profit from a product.

3 People who walk may differ in other ways (e.g. more free time, already healthier, more time outdoors or with friends); a link does not prove cause.

2 Evidence and fair tests

1 Believing you are treated can make people feel better (placebo effect); a placebo means both groups believe they may be treated, so the only difference is the real treatment.

2 a Vaccine 10 ÷ 10,000 × 100 = 0.1%; placebo 100 ÷ 10,000 × 100 = 1%. b Yes: ten times fewer people caught the disease in the vaccine group; large random groups with a placebo control make this a fair test.

3 Risk and vaccines

1 a 5% b 0.3%

2 No: the risk is still tiny, 2 in 50,000 = 0.004%. "Doubled" sounds scary but the actual risk is very small.

3 When most people are vaccinated, the microbe cannot spread from person to person, so it is unlikely to reach the baby.

Practical 9

Variables: change: music or no music; measure: number of objects remembered (out of 20); keep the same: looking time (1 min), writing time (2 min), number of objects, volume and track, room, scoring rules.

Kit: trays, music player, stopwatch, paper, pencil (pulse monitor and measuring cylinder not needed).

Extra row, e.g. comparing scores: someone upset: keep scores private / anonymous.

Method: look 1 minute, cover, write for 2 minutes, score; once with music and once without; half the class does Tray A with music and half Tray B with music (or swap order) to balance tray difficulty and practice; pool whole class results.

Table headings, e.g. Learner | Objects remembered without music (out of 20) | with music (out of 20).

Sample averages: no music 110 ÷ 10 = 11.0; music 104 ÷ 10 = 10.4.

Conclusion: with music the class remembered 0.6 fewer objects on average.

Judge: a Not supported: the average was slightly lower with music. b The difference is less than 1 object and individual results vary a lot, so it could be due to chance; we would need more people or repeats.

Evaluate: limitations, e.g. one type of music; trays may not be equally hard; small sample; practice effect; noise; people know the claim.
Improvement with reason, e.g. test more classes, counterbalance order, use several music types, repeat with new trays.

Check-up

1 e.g. Who tested it? How many people? Was there a control group? Who paid? Has anyone else found the same? Is the company selling it?

2 With more people, unusual results even out, so the average is closer to the true effect.

3 4%; 1 in 20 = 5% is bigger.

4 When enough people are vaccinated, a disease cannot spread easily, protecting those who are not immune.

5 No: the average was slightly lower with music (10.4 vs 11.0), and the difference is small so music made little or no difference.

About the author

C. Blewis has taught for 17 years, including 10 years in Additional Support Needs (ASN) provision, teaching sciences, maths, PE and more.

In many schools, especially smaller and specialist settings, teachers are often asked to teach outside their own subject. These books are written for them, and for the young people they teach: clear, practical and ready to use from the first lesson.