

PRACTICE WORKSHEET + FULL ANSWER KEY

Scientific enquiry and explanations

Lower secondary science. Work through the sections in order, or choose the one that matches this week's topic.

QUESTIONS	SECTIONS	ANSWER KEY	WORKING SPACE
103	10	At the back	Ruled

Name _____ Class _____ Date _____

Before you start

Separate observations from explanations. Identify what is measured, record units, and use the pattern in the results to support a conclusion with an appropriate limitation.

WORKED EXAMPLE

A student tests how water temperature affects dissolving time. What should stay the same?

- 1 Change temperature as the independent variable.
- 2 Measure the time for a fixed amount of solute to dissolve.
- 3 Keep the solute mass, water volume and stirring method the same.

Use this method as your model. Set out your own working the same way.

Common mistakes to avoid

- Calling every variable an independent variable
- Drawing a conclusion without referring to results

There are 103 questions across 10 sections. Write in the ruled space, then mark your work against the answer key at the back. Topics covered: Particles, Forces, Variables and data.

SECTION A Particles and materials

Explain what the particles are doing before you describe what is seen.

1

Describe the particles in a gas.

2

Describe the particles in a solid.

3

Name the change of state from liquid to gas.

4

Name the change of state from gas to liquid.

5

Explain diffusion in terms of particles.

6

Why does a gas exert pressure on its container?

7

Explain why a solid keeps its shape but a liquid does not.

8

State the difference between a mixture and a compound.

9

Name a method for obtaining salt from salt solution.

10

Name a method for separating sand from water.

11

Explain why the total mass does not change when ice melts.

SECTION B Life processes

Connect each structure to the job it does.

12

State the role of roots in a plant.

13

Write the word equation for photosynthesis.

14

Write the word equation for aerobic respiration.

15

Name the organ that pumps blood around the body.

16

Name two components of blood and give one function of each.

17

State one function of the skeleton.

18

Explain why breathing rate increases during exercise.

19

Name the type of cell division used for growth and repair.

- 20 State one difference between a plant cell and an animal cell.

- 21 In a plant growth test, what is the dependent variable if you measure height?

- 22 Explain why a food chain usually has only a few links.

SECTION C Forces, energy and electricity

Identify the forces or the energy stores before you calculate anything.

- 23 A runner covers 100 m in 20 s. Find the average speed.

- 24 A car travels at 12 m/s for 30 s. Find the distance travelled.

- 25 State the unit of force and what force measures.

- 26 Explain why a parachute slows a falling object.

- 27 Name the energy store of a stretched spring.

- 28 Describe the main energy transfer when a torch is switched on.

- 29 State one difference between a series and a parallel circuit.

- 30 In a series circuit, what happens if one bulb breaks?

- 31 Name the instrument used to measure current and say how it is connected.

- 32 State the law of reflection.

- 33 Explain why a small light source gives a shadow with a sharp edge.

SECTION D Earth and space

Use scale and time to explain what is observed from Earth.

34 Explain why we have day and night.

35 Explain why we have seasons.

36 How long does Earth take to orbit the Sun?

37 Name the force that keeps a planet in orbit.

38 Explain why the Moon appears to change shape.

39 State one difference between a star and a planet.

40 Name the three main types of rock.

41 Describe one way a sedimentary rock forms.

42 Name two greenhouse gases.

43 Explain one effect of burning fossil fuels on the atmosphere.

SECTION E Working scientifically

Separate what you observed from what you concluded.

44 A student tests how water temperature affects dissolving time. Name the independent variable.

45 For that test, name two control variables.

46 Why should the axes of a graph be labelled with units?

47 Explain the difference between accuracy and precision.

48 Explain why a larger sample can help an investigation.

49 What is an anomalous result, and what should you do with one?

- 50 State the difference between a hypothesis and a conclusion.

- 51 A student concludes that plants like light. Rewrite that scientifically.

- 52 Name two hazards when heating a solution and one control for each.

- 53 Write a conclusion for data showing dissolving time falling as temperature rises.

SECTION F Atoms, reactions and the periodic table

Start from the structure of the atom, then explain the property it produces.

- 54 Name the particles found in the nucleus of an atom.

- 55 State the charge of an electron.

- 56 What does the group number tell you about a main-group element?

- 57 What does the period number tell you?

- 58 Name the group of the noble gases and explain why they are unreactive.

- 59 Write the word equation for magnesium burning in oxygen.

- 60 Name the gas produced when an acid reacts with a metal.

- 61 Name the three products when an acid reacts with a carbonate.

- 62 State the colour of universal indicator in a strong acid.

- 63 Explain what happens to the total mass in a sealed container during a reaction.

SECTION G Cells, reproduction and health

Link every structure to its function, and every habit to its effect.

64 Name the part of a cell that controls its activities.

65 Name the part of a plant cell where photosynthesis happens.

66 State one function of the cell membrane.

67 Name the male and female gametes in humans.

68 Explain what a specialised cell is and give one example.

69 Name the system that transports substances around the body.

70 State one effect of smoking on the lungs.

71 Name one component of a balanced diet and state its role.

72 Explain why vaccination protects a whole population.

73 Name the type of reproduction that involves two parents.

SECTION H Waves, light and sound

Say what is vibrating and in which direction before describing the wave.

74 State the speed of light in a vacuum to 2 significant figures.

75 State the approximate speed of sound in air.

76 Explain why you see lightning before you hear thunder.

77 Name the property of a sound wave that determines its pitch.

78 Name the property that determines loudness.

79 Explain why sound cannot travel through a vacuum.

80 State what happens to light passing from air into water.

81 Name the colours of the visible spectrum in order.

82 Explain why a red object looks red in white light.

83 State one use of ultrasound.

SECTION I Energy resources and the environment

Name the energy store at the start and the end, and say what is wasted.

84 Name three renewable energy resources.

85 Name two non-renewable energy resources.

86 State one advantage and one disadvantage of wind power.

87 Explain the greenhouse effect in two sentences.

88 State one consequence of rising global temperatures.

89 Name one way a household can reduce its energy use.

90 State the energy transfers in a hydroelectric power station.

91 Explain what is meant by wasted energy.

92 Name one air pollutant from burning fossil fuels and state one effect.

93 Explain why recycling metal saves energy.

SECTION J Mixed review and data questions

Convert units before calculating, and describe what a graph shows in words.

- 94** A student measures 24, 25, 25 and 31 °C. Identify the anomaly and say what to do.

- 95** Find the mean of those readings without the anomaly.

- 96** Convert 2.5 kilometres to metres.

- 97** Convert 750 grams to kilograms.

- 98** A distance-time graph is a straight sloping line. Describe the motion.

- 99** A distance-time graph is horizontal. Describe the motion.

- 100** Name the independent and dependent variables when testing how mass affects a spring's extension.

- 101** Explain why the same equipment should be used throughout an investigation.

- 102** State one reason to use a line graph rather than a bar chart.

- 103** Write a risk assessment line for using a Bunsen burner.

Answer key

Work each section before you check it. These are model answers: an equivalent method, or a different well-supported interpretation, can be just as correct.

SECTION A - PARTICLES AND MATERIALS

1. Far apart relative to their size, moving quickly and randomly, filling the container.
2. Closely packed in a fixed arrangement, vibrating about fixed positions.
3. Evaporation, or boiling at the boiling point.
4. Condensation.
5. Particles move randomly and spread from a region of higher concentration to one of lower concentration.
6. Particles collide with the walls and each collision exerts a small force.
7. Solid particles are held in fixed positions; liquid particles can slide past one another.
8. A mixture is not chemically joined and can be separated physically; a compound has elements chemically bonded in fixed proportions.
9. Evaporating the water, or distillation if the water is also to be collected.
10. Filtration.
11. The same particles are present; only their arrangement and energy change.

SECTION B - LIFE PROCESSES

12. They absorb water and mineral ions and anchor the plant.
13. Carbon dioxide + water → glucose + oxygen, using light energy.
14. Glucose + oxygen → carbon dioxide + water, releasing energy.
15. The heart.
16. For example red blood cells carry oxygen, and plasma transports dissolved substances.
17. Support, protection of organs, or movement when muscles pull on bones.
18. Muscles need more oxygen and produce more carbon dioxide, so gas exchange must increase.
19. Mitosis.
20. Plant cells have a cell wall, chloroplasts and a large permanent vacuole; animal cells do not.
21. The plant height, or the change in height.
22. Energy is lost at each transfer, so less is available to support the next level.

SECTION C - FORCES, ENERGY AND ELECTRICITY

23. 5 m/s.
24. 360 m.
25. The newton (N); it measures a push or a pull.

26. It increases air resistance, so the upward force balances weight sooner and the object falls at a lower steady speed.
27. Elastic potential energy.
28. From the chemical store in the battery to light, with some energy transferred to the surroundings as heat.
29. In series there is one path and the current is the same everywhere; in parallel the current splits between branches.
30. The circuit is broken, so all the bulbs go out.
31. An ammeter, connected in series.
32. The angle of incidence equals the angle of reflection.
33. Light travels in straight lines, so an opaque object blocks a well-defined region.

SECTION D - EARTH AND SPACE

34. Earth rotates about once every 24 hours, so a place faces the Sun and then turns away.
35. Earth's axis is tilted, so the intensity and the hours of sunlight change through the orbit.
36. About 365.25 days, which is one year.
37. Gravity.
38. We see different amounts of its sunlit half as the Moon orbits Earth.
39. A star emits its own light from nuclear fusion; a planet reflects light and orbits a star.
40. Igneous, sedimentary and metamorphic.
41. Sediment is deposited in layers, then compacted and cemented over long periods.
42. Carbon dioxide and methane.
43. It releases carbon dioxide, which strengthens the greenhouse effect and contributes to warming.

SECTION E - WORKING SCIENTIFICALLY

44. The water temperature.
45. For example the mass of solute, the volume of water and the stirring method.
46. So the measured quantities and the scale can be read and interpreted correctly.
47. Accuracy is closeness to the true value; precision is how closely repeated measurements agree.
48. It reduces the influence of unusual results and better shows the range of variation.
49. A result that does not fit the pattern. Check it, repeat the measurement and state how you treated it.
50. A hypothesis is a testable prediction made beforehand; a conclusion is what the evidence supports afterwards.

- 51. For example: plants grown at higher light intensity were taller on average after 14 days.
- 52. For example hot glassware, handled with tongs, and an open flame, with hair tied back and a heatproof mat used.
- 53. As temperature increased, dissolving time decreased, supporting the prediction; state the range tested and any anomalies.

SECTION F - ATOMS, REACTIONS AND THE PERIODIC TABLE

- 54. Protons and neutrons.
- 55. Negative, -1.
- 56. The number of electrons in its outer shell.
- 57. The number of occupied electron shells.
- 58. Group 0 (also called group 18); their outer shells are already full.
- 59. Magnesium + oxygen → magnesium oxide.
- 60. Hydrogen.
- 61. A salt, water and carbon dioxide.
- 62. Red.
- 63. It stays the same, because atoms are rearranged rather than created or destroyed.

SECTION G - CELLS, REPRODUCTION AND HEALTH

- 64. The nucleus.
- 65. The chloroplast.
- 66. It controls what enters and leaves the cell.
- 67. Sperm cells and egg cells.
- 68. A cell adapted for one job, for example a red blood cell shaped to carry oxygen.
- 69. The circulatory system.
- 70. It damages the alveoli and the cilia, reducing gas exchange.
- 71. For example protein, which is used for growth and repair.
- 72. Fewer people can spread the disease, so outbreaks are less likely even among those not vaccinated.
- 73. Sexual reproduction.

SECTION H - WAVES, LIGHT AND SOUND

- 74. About 3.0×10^8 m/s.
- 75. About 330 to 340 m/s.
- 76. Light travels far faster than sound.
- 77. Its frequency.
- 78. Its amplitude.
- 79. There are no particles to carry the vibrations.
- 80. It slows down and refracts, bending towards the normal.
- 81. Red, orange, yellow, green, blue, indigo and violet.
- 82. It reflects red light and absorbs the other colours.

- 83. Medical imaging, or measuring distance underwater.

SECTION I - ENERGY RESOURCES AND THE ENVIRONMENT

- 84. For example wind, solar and hydroelectric.
- 85. Coal and natural gas; oil and nuclear fuel also count.
- 86. It produces no fuel emissions, but its output varies with the weather.
- 87. Gases in the atmosphere absorb infrared radiation from Earth and re-emit some of it downwards. This keeps the surface warmer than it would otherwise be.
- 88. For example melting ice and rising sea levels, or more frequent extreme weather.
- 89. Insulate the loft, or switch to LED lighting.
- 90. Gravitational potential energy to kinetic energy to electrical energy.
- 91. Energy transferred to the surroundings in a form that is no longer useful, usually as heat.
- 92. Sulfur dioxide, which contributes to acid rain.
- 93. Melting recycled metal uses far less energy than extracting it from its ore.

SECTION J - MIXED REVIEW AND DATA QUESTIONS

- 94. 31 °C. Check the method, repeat the reading and exclude it from the mean with a stated reason.
- 95. About 24.7 °C.
- 96. 2,500 m.
- 97. 0.75 kg.
- 98. Constant speed.
- 99. The object is stationary.
- 100. Independent: the mass added. Dependent: the extension.
- 101. Different equipment can read slightly differently, which adds a systematic error.
- 102. Both variables are continuous, so the line shows the trend between measured points.
- 103. Hazard: hot flame and apparatus. Control: tie hair back, use a heatproof mat and set the safety flame when not heating.

Review and next steps

Mark your work against the answer key, record your score for each section, then answer the three questions below. Bring this page to your next lesson so your tutor can start from what actually blocked you.

Which question did you find hardest, and what exactly stopped you?

Rewrite the corrected working for that question here.

Which section do you want to practise again before your next lesson?

Score record

SECTION	QUESTIONS	NUMBER CORRECT	PRACTISE AGAIN?
A. Particles and materials	11		
B. Life processes	11		
C. Forces, energy and electricity	11		
D. Earth and space	10		
E. Working scientifically	10		
F. Atoms, reactions and the periodic table	10		
G. Cells, reproduction and health	10		
H. Waves, light and sound	10		
I. Energy resources and the environment	10		
J. Mixed review and data questions	10		
Total	103		

Keep going with one-to-one support.

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