Exploration: Entering the World of Secondary Science

Standard difficulty · 20 questions · 40 marks · Time: 41 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. A person breathes about 17 times a minute, taking in about 0.6 litre of air each time. Roughly how much air is breathed in a day? Choose the best estimate.

(a) about 100,000 litres **(b)** about 1,000,000 litres
(c) about 1,000 litres **(d)** about 10,000 litres

2. "Every object attracts every other object with a force." This is best described as:

(a) a law **(b)** a theory **(c)** a principle **(d)** a guess

3. The SI unit of frequency is:

(a) watt (W) **(b)** second (s) **(c)** kilogram (kg) **(d)** hertz (Hz)

4. The number of days a store of food lasts a family depends on the number of people eating, inversely. If the number of people eating becomes 4 times as much, the number of days becomes:

(a) 1/4 of what it was **(b)** the same as before
(c) 8 times as much **(d)** 4 times as much

5. A scientific model is:

(a) a simplified picture that keeps only the features needed for a question
(b) a small toy version of a machine
(c) an exact copy of the real thing
(d) a guess that cannot be tested

6. To study a pendulum, scientists use a model: a heavy point on a light string. What does this model leave out?

(a) the mass of the string and air resistance
(b) its size, shape and turning wheels
(c) what is inside each atom
(d) the wave nature of light

7. A bus moves at 54 km/h. In metres per second, this is:

(a) 900 m/s **(b)** 194.4 m/s **(c)** 15 m/s **(d)** 54 m/s

8. Assertion (A): For the question "A person drinks about 3 litres of water a day. Roughly how much do they drink in 70 years?", a good estimate is about 800,000 litres.
Reason (R): A rough estimate, made by multiplying sensible round numbers, gives the right power of ten.

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. People blink about 20 times a minute while awake, and are awake about 16 hours a day. Roughly how many times do they blink in a day? Show your working and round to one non-zero digit (like 30,000).

10. Convert 6.6 km into m.

11. Is this a law, a theory or a principle? Give a reason. "Living things have changed over many generations, and today's species came from earlier ones."

12. The kinetic energy of a moving ball is 80 units, and it depends on its speed, as its square. Find the new kinetic energy if its speed becomes 1/2 of what it was.

13. An aircraft needs 16,700 kg of fuel. The fuel has a density of 0.8 kg per litre. How many litres must be loaded? Why must everyone use the same units?

14. Scientists often model a pendulum as a heavy point on a light string. What does the model leave out, and when would it not work well?

15. A message says: "Hot water freezes faster than cold water." Write a testable question about this claim.

16. What does the prefix micro mean? Write it as a power of ten and give its symbol.

Section C — Word problems — 4 × 4 = 16 marks

17. Meera wants a rough answer. A resting heart beats about 84 times a minute. Roughly how many times does it beat in a day? (a) Write the calculation. (b) Round it to one non-zero digit. (c) Why is a rough estimate useful here?

18. You read: "Food cooked during a solar eclipse becomes harmful." (a) Write a testable question. (b) Describe a fair test. (c) What should you do if the results do not support the claim?

19. A school has 2,100 students. A poster says the school uses 1,680,000 litres of water a day. Each student uses about 8 litres a day at school. (a) Estimate the school's daily use. (b) Is the poster's figure reasonable? Explain.

20. Scientists model the flow of blood in the body as water flowing through branching pipes. (a) What does a scientific model do? (b) What does this model leave out? (c) When would it not be good enough? (d) Why is it still useful?

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Answer key

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Q	Answer	Working
1	**(d) about 10,000 litres**	17 × 0.6 × 1,440 minutes = 14,688 litres, which is about 10,000 litres
2	**(a) a law**	It describes a regular pattern (the universal law of gravitation).
3	**(d) hertz (Hz)**	—
4	**(a) 1/4 of what it was**	inversely: 1 ÷ 4 = 1/4
5	**(a) a simplified picture that keeps only the features needed for a question**	—
6	**(a) the mass of the string and air resistance**	a model keeps only the features that matter for the question
7	**(c) 15 m/s**	× 1,000 m ÷ 3,600 s, that is × 5/18: 54 × 5/18 = 15
8	**(d) A is false, but R is true.**	A is false: 3 × 365 × 70 = 76,650 litres, about 80,000 litres, not about 800,000 litres. R is true.
9	**about 20,000 blinks**	20 × 60 × 16 = 19,200
10	**6,600 m**	1 km = 1,000 m
11	**A theory. It explains why living things show patterns of similarity (theory of evolution).**	—
12	**20 units**	squared: $(1/2)^2$ = 1/4; new = 80 × 1/4 = 20
13	**20,875 litres; mixing units (such as pounds and kilograms) can leave a plane short of fuel**	16,700 ÷ 0.8 = 20,875
14	**It leaves out the mass of the string and air resistance; it fails when the swings are very large or the string is heavy.**	—
15	**Does a cup of hot water freeze before an identical cup of cold water in the same freezer?**	—
16	**× 1/1,000,000 = 10^{-6}; symbol μ**	—
17	**(a) 84 × 60 × 24 = 120,960; (b) about 100,000 beats; (c) it quickly shows the size of the answer and helps catch big mistakes**	—
18	**(a) Does food cooked during an eclipse differ in any measurable way from food cooked at other times? (b) Cook the same food during and outside an eclipse and compare it for germs, taste and nutrients. (c) Reject or change the claim; a claim is**	—

Q	Answer	Working
	accepted only if the evidence supports it	
19	**(a) 2,100 × 8 = 16,800 litres, about 20,000 litres; (b) No: it is about 100 times too large**	2,100 × 8
20	**(a) It keeps only the features needed for a question; (b) the changing width of blood vessels and the cells in blood; (c) when you study how blood clots; (d) it makes the problem simple enough to reason about and test**	—

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