Grade 9 Final Exam Model Paper 1

ANSWER KEY

Full marks 75 · 3 hours

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

A practice paper by Science Playground, made to CDC's Specification Grid 2078, Grade 9 Science and Technology; not an official CDC or exam board paper.

Section A

10 × 1 = 10

a. **(ii)** Protista

b. **(ii)** analogous organs, because they do the same job but differ in structure and origin

c. **(ii)** The message is turned back by the spinal cord, without waiting for the brain.

d. **(i)** 3 m/s²

e. **(iii)** so that a small effort on the large wheel turns the axle with a large force

f. **(iii)** coulomb

g. **(iii)** about 35,786 km

h. **(i)** The statement and argument 1 are correct, but argument 2 is incorrect.

i. **(ii)** Copper is a good conductor of electricity and can be drawn into thin wires.

j. **(ii)** graphite

Section B

9 × 1 = 9

a. Every single reading has a small error (from reaction time, the eye or the instrument). Some readings are a little too high and some too low, so their average is closer to the true value than any one reading.

Marking scheme

- The errors of single readings partly cancel, so the average is closer to the true value (more reliable).

b. A body at rest stays at rest, and a moving body keeps moving in a straight line with uniform velocity, unless an unbalanced (external) force acts on it.

Marking scheme

- Rest stays rest, uniform motion stays uniform motion in a straight line, unless an unbalanced force acts.

c. $$\lambda = \frac{v}{f} = \frac{3 \times 10^8}{96 \times 10^6} = 3.125 \text{ m}$$

Marking scheme

- λ = v ÷ f = 3 × 10⁸ ÷ (96 × 10⁶) = 3.125 m (about 3.1 m).

d. Nichrome has a high resistance, so a current heats it strongly, and a high melting point, so it glows red-hot without melting; it also doesn't oxidize (burn away) in air when hot.

Marking scheme

- High resistance and high melting point (or does not oxidize when red-hot).

e. The TV satellite is geostationary: it goes round once in the time the Earth takes to turn once, in the same direction, above the equator, so it stays above the same place and seems still in the sky.

Marking scheme

- The satellite is geostationary: it turns with the Earth and stays above the same point, so it seems fixed in the sky.

f. He should not send the OTP (or any PIN or password) to anyone: it is a trick to get into his bank or wallet account. He should ignore or delete the message, and may report it.

Marking scheme

- Never share the OTP; ignore, delete or report the message.

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g. Manganese dioxide (MnO_2).

Marking scheme

- Manganese dioxide (MnO_2).

h. Gold is a very unreactive metal (near the bottom of the reactivity series): it does not react with the oxygen and water around it, so it keeps its shine. Iron is more reactive and slowly reacts with oxygen and water to form rust.

Marking scheme

- Gold is very unreactive and does not react with air and water, while the more reactive iron reacts with them and rusts.

i. Compost adds humus to the soil, which holds water and air, keeps the soil loose and feeds useful microbes, and it gives its nutrients slowly over a long time, while chemical fertilizer only adds a few nutrients quickly and, used alone for years, harms the soil.

Marking scheme

- It adds humus (improves soil structure and microbes) and releases nutrients slowly.

Section C

14 × 2 = 28

3. 0.0000075 m: move the point 6 places right to get 7.5; the number is less than 1, so the power is −6: **7.5×10^{-6} m**. **[2]**
384,000,000 m: move the point 8 places left to get 3.84; the power is +8: **3.84×10^{8} m**.

Marking scheme

- 7.5×10^{-6} m.
- 3.84×10^{8} m.

4. Any two: **[2]**

a. They have no chlorophyll, so they can't make their own food (heterotrophic).
b. Most are saprophytic: they absorb food from dead and decaying matter; some are parasites.
c. Their cell wall is made of chitin.
d. The body of most is made of thread-like hyphae, forming a mycelium (yeast is unicellular).
e. They store food as glycogen and reproduce mainly by spores.

Marking scheme

- One correct characteristic.
- A second correct characteristic.

5. No, she is not right. **[2]**

a. Insects and other animals eat mushrooms that are poisonous to people, so insect bites prove nothing.
b. The silver spoon test is a myth: deadly mushrooms do not blacken silver, and cooking does not destroy the most dangerous mushroom poisons. Only an expert or a laboratory test can tell; she should eat only farmed or expertly identified mushrooms.

Marking scheme

- Insects eating a mushroom does not show it is safe for people.
- The silver spoon (or cooking) test is a myth; only an expert or a laboratory can tell, so she should not eat them.

6. **[2]**

a. Fossils are the remains or marks of living things of long ago, preserved in sedimentary rocks. In the deeper (older) layers there are fossils of simpler organisms, and in the upper (newer) layers more complex ones, which shows that complex living things came later from simpler ones.
b. Some fossils show a mixture of features of two groups (such as *Archaeopteryx*, part reptile, part bird), and some, such as the ammonites found as *shaligram*, are of organisms that no longer exist: living things have changed over time.

Marking scheme

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- Older (deeper) rock layers hold simpler organisms and newer layers more complex ones.
- Fossils show organisms that have died out or that link two groups, so living things changed over time.

7. The **intercalary meristem**. It is a meristematic tissue at the base of the internodes (near the nodes) in grasses, and its cells keep dividing, so the stem grows again in length from below even after its top has been cut off. **[2]**

Marking scheme

- Intercalary meristem.
- It lies at the base of the internodes and its cells keep dividing, so the cut grass grows again from below.

8. **[2]**

Distance	Displacement
The length of the whole path travelled.	The shortest distance from the starting point to the final point, in a stated direction.
It is a scalar quantity (has size only).	It is a vector quantity (has size and direction).
It can never be zero or negative for a moving body.	It can be zero (back at the start) or negative.

Marking scheme

- One correct difference.
- A second correct difference.

9. When the jumper lands, her body must be brought to rest. On hard ground she stops in a very short time, so her retardation is very large, and by $F = ma$ the force on her body is very large, which hurts. The soft mattress sinks under her and makes her stop over a longer time, so her retardation, and so the force on her (F = ma), is much smaller, and she is not hurt. **[2]**

Marking scheme

- The mattress makes the jumper stop over a longer time (distance), so the retardation is smaller.
- By F = ma, a smaller retardation means a smaller force on the body, so she is not hurt.

10. The pulse goes down and comes back, so it travels twice the depth: **[2]**

$$d = \frac{v \times t}{2} = \frac{1500 \times 2.4}{2} = 1800 \text{ m}$$

Marking scheme

- d = v × t ÷ 2 (the sound travels to the bed and back).
- d = 1500 × 2.4 ÷ 2 = 1,800 m.

11. **[2]**

Astronomical unit (AU)	Light-year
The average distance between the Earth and the Sun.	The distance light travels in one year.
1 AU = 1.5 × 10^{11} m.	1 light-year = 9.46 × 10^{15} m.
Used for distances inside the Solar System.	Used for distances to stars and galaxies.

Marking scheme

- One correct difference.
- A second correct difference.

12. **[2]**

Uplink	Downlink
Sent up from a ground station on the Earth to the satellite.	Sent down from the satellite to the Earth.
Received by the satellite's transponder.	Received by dishes and ground stations, over a wide area.
Sent at one frequency.	Amplified by the satellite and sent back at a different frequency.

Marking scheme

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- One correct difference.
- A second correct difference.

13. Any two: **[2]**

a. Open the site by typing the bank's address himself (or use the bank's official app), never from a link in an SMS, email or social media message.

b. Check that the address is exactly the bank's own, spelled correctly, and that it starts with https and shows a padlock (connection is secure).

c. Do it on his own device, not a shared computer, and sign out afterwards.

Marking scheme

- One correct check or action (typing the address himself or using the official app).
- A second (the correct address with https and a padlock, or his own device and signing out).

14. Symbols: Ca, Cl; valencies 2 and 1. Criss-crossing the valencies gives Ca_1Cl_2, that is **$CaCl_2$**. **[2]**
Molecular mass = 40 + 2 × 35.5 = 40 + 71 = **111 amu**.

Marking scheme

- $CaCl_2$.
- Molecular mass = 40 + 2 × 35.5 = 111 amu.

15. No. The match only starts the reaction. Once the wood is burning, it gives out much more heat and light than it took in, and keeps burning by itself, so burning is an **exothermic** reaction. In an endothermic reaction, heat must be taken in all the time (as when limestone is decomposed by heating), and the reaction stops when the heating stops. **[2]**

Marking scheme

- No: burning wood is exothermic.
- Reason: it gives out more heat than it takes in and carries on by itself once started (an endothermic reaction keeps taking in heat).

16. The gas is **nitrogen**. It neither burns nor supports burning, so the splint goes out; carbon dioxide would do the same, but it would turn lime water milky, so the gas is not carbon dioxide. Burning magnesium reacts with nitrogen to form magnesium nitride, the yellowish powder: $3Mg + N_2 \rightarrow Mg_3N_2$. **[2]**

Marking scheme

- Nitrogen.
- The splint goes out and lime water stays clear (not CO_2), and burning magnesium forms yellowish magnesium nitride.

Section D

7 × 4 = 28

17. **[4]**

i. Insulin: the pancreas (its islets of Langerhans). Thyroxine: the thyroid gland. Adrenaline: the adrenal glands.

ii. It works as both kinds of gland: it sends digestive juice through a duct to the intestine (exocrine), and releases the hormones insulin and glucagon straight into the blood (endocrine).

Marking scheme

- Insulin: pancreas.
- Thyroxine: thyroid gland.
- Adrenaline: adrenal gland.
- It is both exocrine (digestive juice through a duct) and endocrine (hormones into the blood).

18. **[4]**

i. Any one: rice plant → rat → snake → eagle; rice plant → grasshopper → frog → snake (or rice → grasshopper → frog → snake → eagle, five links, also shows it).

ii. The rats will increase, because their predator is gone, and they will eat more rice, so the harvest will fall. (The frogs will increase too, and the grasshoppers then fall.)

iii. At each step of a food chain only about 10% of the energy passes on to the next level; the rest is used for life processes or lost as heat. The eagle is at the end of the chain, so it gets the smallest

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share.

iv. Let the snakes (and owls and eagles) live, since they keep the rats in check for free, and keep rats down in other ways, such as clearing their hiding places and storing grain safely, rather than with poison. This keeps the food web balanced, while rat poison also kills the animals that eat the poisoned rats and can harm people.

Marking scheme

- A correct food chain of four links.
- Rats increase (no predator) and eat more rice, so the harvest falls.
- Only about 10% of energy passes to each next level, and the eagle is at the end.
- One sensible way that keeps the snakes (natural control) with a reason (balanced food web, no poison).

19. **[4]**

i. Any two: biogas burns with a clean blue flame and gives no smoke, so the kitchen stays clean and the family's eyes and lungs are protected; it saves the time and work of collecting firewood and saves the forest; it uses dung that is otherwise wasted and is renewable; it is cheap once the plant is built; the spent slurry is a good fertilizer.

ii. Put it in the compost pit and use it as manure in the fields, because it is an excellent fertilizer that returns nutrients to the soil.

iii. Biogas is made by bacteria that break down the dung in the absence of oxygen; if air got in, they would not make the gas (and the gas would escape).

Marking scheme

- One correct advantage (no smoke, a healthier kitchen).
- A second correct advantage (saves forest and the work of collecting firewood, uses waste, renewable, cheap).
- Use the slurry as manure (fertilizer) for the fields.
- The bacteria make biogas only without oxygen (air), and no gas should escape.

20. i. **[4]**

Transverse wave	Longitudinal wave
The particles of the medium vibrate at right angles to the direction of the wave.	The particles vibrate back and forth along the direction of the wave.
It travels as crests and troughs.	It travels as compressions and rarefactions.
Examples: a wave on a rope, ripples on water, light.	Example: sound, a push along a slinky.
ii. Sound is a mechanical wave: it needs a medium to travel through, and the space between the Sun and the Earth is nearly empty. Light is an electromagnetic wave, which needs no medium.	
iii. Infrared rays.	

Marking scheme

- Direction of vibration: at right angles (transverse) and along the wave (longitudinal).
- Crests and troughs against compressions and rarefactions, with one correct example of each.
- Sound needs a medium (mechanical wave) and space has none, but light does not need one.
- Infrared.

21. **[4]**

i. In series: $R = R_1 + R_2 = 4 + 6 = 10\ \Omega$. Current $I = \dfrac{V}{R} = \dfrac{12}{10} = 1.2\ \text{A}$.

ii. In parallel: $\dfrac{1}{R} = \dfrac{1}{4} + \dfrac{1}{6} = \dfrac{3+2}{12} = \dfrac{5}{12}$, so $R = \dfrac{12}{5} = 2.4\ \Omega$. Current $I = \dfrac{12}{2.4} = 5\ \text{A}$ (3 A through the 4 Ω and 2 A through the 6 Ω).

Marking scheme

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- Series resistance = 4 + 6 = 10 Ω.
- Series current = 12 ÷ 10 = 1.2 A.
- Parallel resistance: 1/R = 1/4 + 1/6, R = 2.4 Ω.
- Parallel current = 12 ÷ 2.4 = 5 A.

22. **[4]**

i. A magnesium atom has two valence electrons and gives both to an oxygen atom. Magnesium becomes Mg^{2+} (2, 8: an octet) and oxygen becomes O^{2-} (2, 8: an octet). The oppositely charged ions attract each other strongly, and this electrostatic attraction is the electrovalent bond in MgO.

ii. Oxygen (2, 6) needs two more electrons for an octet, and each hydrogen atom (1) needs one more for a duplet. The oxygen atom shares one pair of electrons with each of two hydrogen atoms: two single covalent bonds (H–O–H). Then oxygen has an octet and each hydrogen a duplet.

Marking scheme

- Mg gives its two valence electrons to O, forming Mg^{2+} and O^{2-}, each with an octet.
- The oppositely charged ions are held by electrostatic attraction (electrovalent bond).
- O (2, 6) needs two electrons and each H one.
- O shares one electron pair with each of two H atoms (two single covalent bonds), giving O an octet and each H a duplet.

23. **[4]**

i. 20% of 50 kg = $\frac{20}{100} \times 50 = 10\ \text{kg}$ of nitrogen.

ii. $40 \div 10 = 4$ bags.

iii. Nitrogen (the plant moves its scarce nitrogen to the young leaves, so the older leaves turn yellow first).

iv. Potassium.

Marking scheme

- 20% of 50 kg = 10 kg of nitrogen.
- 40 ÷ 10 = 4 bags.
- Nitrogen.
- Potassium.

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