Grade 9 Final Exam Model Paper 3

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)** It has no chlorophyll, its cell wall is made of chitin, and it absorbs food from dead matter.

b. **(ii)** that it is a connecting link between reptiles and mammals

c. **(i)** Insulin lets the body's cells take in sugar from the blood and stores the extra in the liver, so without it the sugar stays in the blood.

d. **(iii)** 2,400 N

e. **(ii)** because some of the input work is used up against friction and in moving its parts

f. **(iv)** a voltmeter, in parallel with the bulb

g. **(iii)** 2019

h. **(iii)** Two X atoms share three pairs of electrons, forming X_2 with a triple bond.

i. **(i)** malleability

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

Section B

9 × 1 = 9

a. A hypothesis is only a possible answer to a question. Only the data from an experiment show whether it is right: if they support it, it is reported; if not, it is changed and tested again.

Marking scheme

- A hypothesis is only a possible (testable) answer; the experiment's data show whether it is supported.

b. Elasticity is the property of a body by which it regains its original shape and size when the force that deformed it is removed (as a rubber band or a spring does).

Marking scheme

- The property of regaining the original shape and size when the deforming force is removed.

c. $\lambda = \frac{v}{f} = \frac{340}{425} = 0.8\ \text{m}$

Marking scheme

- λ = v ÷ f = 340 ÷ 425 = 0.8 m.

d. A thick wire has a larger cross-section, so it gives the free electrons more room to flow, like a wide road for traffic: resistance decreases as the thickness increases.

Marking scheme

- A larger cross-sectional area gives the current (electrons) more room to flow, so the resistance is less.

e. If she leaves it open, the next person to use the computer can read her emails, send messages in her name or change her password.

Marking scheme

- Otherwise the next user can open and misuse her account.

f. cdc.gov.np: addresses ending in .gov.np can be registered only by government offices in Nepal, while anyone can buy a .com address. (He can also check with his school.)

Marking scheme

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- cdc.gov.np, because .gov.np is given only to government offices (anyone can buy .com).

g. Sodium nitrite ($NaNO_2$) and ammonium chloride (NH_4Cl), heated gently as a solution.

Marking scheme

- Sodium nitrite and ammonium chloride.

h. Mercury in water is turned by microbes into methylmercury, which builds up in fish and in the people who eat them and damages the brain and nerves (as at Minamata, Japan); its vapor is poisonous too. The drops should be collected carefully, kept in a closed container and given for safe disposal.

Marking scheme

- Mercury in water becomes poisonous methylmercury, which builds up in fish and people and harms the brain and nerves.

i. Lime is a base: it neutralizes the acidity of the soil, so the crops can take up their nutrients and grow well.

Marking scheme

- Lime (a base) neutralizes the acidic soil.

Section C

14 × 2 = 28

3. Mega = 10^6: 456 MW = 456 × 10^6 W = **4.56×10^8 W**. **[2]**
Nano = 10^{-9}: 100 nm = 100 × 10^{-9} m = **1×10^{-7} m**.

Marking scheme

- 456 MW = 4.56×10^8 W.
- 100 nm = 1×10^{-7} m.

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

a. Most are unicellular, with a eukaryotic cell (a true nucleus with a nuclear membrane).
b. Most live in water or in damp places, and some are parasites (such as the one that causes malaria).
c. Some make their own food (plant-like protists, such as *Euglena* and diatoms), some eat food (animal-like protists, such as *Amoeba* and *Paramecium*), and some absorb it (fungus-like protists).
d. They move with flagella, cilia or pseudopodia.

Marking scheme

- One correct characteristic.
- A second correct characteristic.

5. Yes, it is a good choice (any two reasons): **[2]**

a. It needs no farmland: the bags of straw are kept in a dark room.
b. It uses cheap paddy straw, a waste of rice farming.
c. The first mushrooms can be picked in about 25 days, so he earns quickly.
d. Mushrooms are in demand and sell at a good price, fresh or as *sukuti*, pickle and soup, which keep for months.

(He must keep the room clean and boil the straw, or molds will spoil the bags.)

Marking scheme

- One correct reason (no land needed, cheap straw).
- A second correct reason (quick harvest, good demand and price, can be stored and sold later).

6. **[2]**

a. Lamarck said that an organ that is used a lot grows stronger and bigger, and one that is not used becomes weaker and disappears, and that these acquired changes are passed on to the young. For example, he said giraffes got long necks because their ancestors stretched to reach leaves high on trees.
b. It was rejected because acquired characters are not inherited: Weismann cut off the tails of mice for five generations, and every new mouse was still born with a full tail.

Marking scheme

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- Organs used grow stronger and unused ones weaken, and the changes are passed on (with an example).
- Acquired characters are not inherited (Weismann's mice still had tails after five generations).

7. **Tissue culture**, with **auxin and cytokinin** added to the nutrient jelly. More **auxin** makes roots start (more cytokinin makes shoots grow). **[2]**

Marking scheme

- Tissue culture, with auxin and cytokinin.
- Increase auxin for roots.

8. $v = u + at$, where u is the initial velocity, v the final velocity, a the acceleration and t the time taken. **[2]**

Marking scheme

- v = u + at.
- u: initial velocity, v: final velocity, a: acceleration, t: time.

9. Bus A gains 4 m/s every 2 s: its acceleration is uniform, $a = \frac{12 - 0}{6} = 2\ \mathrm{m/s^2}$. **[2]**

Bus B gains 6 m/s, then 3 m/s, then 1 m/s in each 2 s: its acceleration is not uniform. In the first 2 s it is 3 m/s², more than A's, but then it falls to 1.5 m/s² and 0.5 m/s². Over the whole 6 s it is $\frac{10}{6} \approx 1.7\ \mathrm{m/s^2}$, less than A's. So Rizwan is right only for the first 2 seconds.

Marking scheme

- A has uniform acceleration of 2 m/s² (4 m/s every 2 s).
- B's acceleration is greater only at first (3 m/s²) and then falls (average about 1.7 m/s²), so Rizwan is only partly right.

10. $d = \frac{v \times t}{2} = \frac{340 \times 0.01}{2} = 1.7\ \mathrm{m}$ **[2]**

Marking scheme

- d = v × t ÷ 2 (the sound goes to the wall and back).
- d = 340 × 0.01 ÷ 2 = 1.7 m.

11. **[2]**

a. Stars are born in a nebula, a giant cloud of gas (mostly hydrogen and helium) and dust. Gravity pulls part of the cloud together; as it shrinks, it gets hotter and forms a protostar.

b. When the center of the protostar reaches about 10 million K (10^7 K), hydrogen nuclei begin to fuse into helium, giving out light and heat: a star is born.

Marking scheme

- Gravity pulls gas and dust in a nebula together into a hot protostar.
- When its core reaches about 10 million K, fusion of hydrogen into helium begins and it shines as a star.

12. **[2]**

a. The audio signal from the microphone has low frequencies (about 20–20,000 Hz) and is weak: it can't be sent far on its own, and its antenna would have to be kilometers long.

b. Every station's sound would also get mixed up with the others. So each station modulates its own high, fixed-frequency carrier wave with the sound, which travels far and can be tuned in separately.

Marking scheme

- The audio signal is low-frequency and weak, so it can't travel far (it would need a huge antenna).
- Each station's own carrier frequency keeps the stations apart and carries the sound far (modulation).

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

a. Strangers could copy his passport number and personal details and misuse them (to cheat others in his name, or to cheat him).

b. It tells everyone when he, and perhaps his family, will be away from home.

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c. It becomes part of his digital footprint: even if he deletes it later, others may have saved it or taken screenshots.

Marking scheme

- One correct reason (his personal details can be misused).
- A second correct reason (shows when he is away, or stays online as his digital footprint).

14. Configuration: 2, 8, 6. It needs 2 more electrons for an octet, so its valency is **2**. With hydrogen (valency 1), criss-crossing gives **H_2S** (hydrogen sulfide). **[2]**

Marking scheme

- 2, 8, 6, valency 2.
- H_2S.

15. No. 4 g of hydrogen ($2H_2 = 2 \times 2 = 4$ g) reacts with 32 g of oxygen ($O_2 = 2 \times 16 = 32$ g), making 36 g of water ($2H_2O = 2 \times 18 = 36$ g). The mass of the reactants, 4 + 32 = 36 g, equals the mass of the product. The 32 g came from the oxygen: mass is neither created nor destroyed in a reaction (the law of conservation of mass). **[2]**

Marking scheme

- No: 4 g of hydrogen reacts with 32 g of oxygen, and 4 + 32 = 36 g of water.
- The mass of the reactants equals the mass of the products (law of conservation of mass).

16. a. Hydrogen is colorless, so a jar of air can't be seen to fill with it; over water, the jar can be seen to fill as the water is pushed out. **[2]**

b. Over water the gas collected is pure, while a jar filled by displacing air would hold a mixture of hydrogen and air, which explodes when lit. (Hydrogen hardly dissolves in water, so little is lost.)

Marking scheme

- Over water, one can see when the jar is full (hydrogen is colorless).
- The gas collected is pure, not mixed with air (a hydrogen–air mixture is explosive).

Section D

7 × 4 = 28

17. **[4]**

- **Cerebrum:** the center of thinking, memory, intelligence and voluntary actions; it receives the messages of the senses (sight, hearing and so on).
- **Cerebellum:** keeps the body's balance and posture, and coordinates the muscles in movements such as walking and riding a bicycle.
- **Medulla oblongata:** controls involuntary actions such as breathing, heartbeat, swallowing, coughing and sneezing.
- **Spinal cord:** carries messages between the brain and the body, and controls reflex actions.

Marking scheme

- Cerebrum: thinking, memory, voluntary actions or the senses.
- Cerebellum: balance and coordination of movements.
- Medulla oblongata: involuntary actions such as breathing and heartbeat.
- Spinal cord: carries messages between the brain and the body (and controls reflex actions).

18. **[4]**

i. Producer: phytoplankton. Tertiary consumer: the kingfisher (phytoplankton → zooplankton → small fish → kingfisher).

ii. About 10% of the energy passes to each next level: 10,000 kJ → 1,000 kJ (zooplankton) → 100 kJ (small fish) → **10 kJ** (kingfishers).

iii. With fewer phytoplankton there is less food for the zooplankton, so they decrease, then the small fish decrease, and the kingfishers get too little food and decrease or leave the pond: harm to the first link passes up the whole chain.

iv. They are decomposers: they break down dead plants and animals and their wastes, returning nutrients to the water for the phytoplankton, and keep the pond clean.

Marking scheme

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- Producer: phytoplankton; tertiary consumer: kingfisher.
- 10% at each level: 10,000 → 1,000 → 100 → 10 kJ.
- Kingfishers decrease, because the loss of producers reduces the food of every level above.
- Decomposers break down dead matter and return nutrients (recycling).

19. **[4]**

i. The Sun's heat evaporates water from the seas and land; the vapor rises, forms clouds and falls as rain and snow on the hills; the rivers it feeds flow down and turn the turbines. Without the Sun lifting the water up, no river would flow.

ii. Diesel is made from petroleum, a fossil fuel formed over millions of years from the remains of plants and animals buried under the ground; those living things got their energy, through food chains, from sunlight caught by photosynthesis.

iii. No. The hot spring's energy is geothermal: it comes from the heat inside the Earth (much of it from radioactive atoms in the rocks), not from the Sun. (Firewood, diesel, wind and water power do come from the Sun.)

iv. Thermonuclear fusion: hydrogen nuclei join to form helium. It needs a very high temperature (about 15 million K in the core), or a very high pressure, or a huge amount of hydrogen (any one).

Marking scheme

- The Sun evaporates water that falls as rain on the hills, and the rivers turn the turbines.
- Petroleum formed from ancient living things that got their energy from sunlight (photosynthesis).
- No: the hot spring is geothermal energy, from the Earth's own heat.
- Thermonuclear fusion (hydrogen into helium), with one condition: very high temperature or very high pressure.

20. **[4]**

i. Radio waves → microwaves → visible light → X-rays.

ii. Ultraviolet rays kill the germs (bacteria and viruses) in the water. (In SODIS, clear bottles of water are left in sunlight for this.)

iii. A probe placed on the mother's belly sends pulses of ultrasound into her body. Part of the sound is reflected back as echoes from the boundaries between tissues and organs; the probe picks up the echoes, and a computer turns their timing and strength into a picture, the sonogram. Ultrasound is harmless sound, while X-rays are radiation that can harm the growing baby's cells; ultrasound also shows soft tissues, which X-rays don't show well.

Marking scheme

- Radio waves, microwaves, visible light, X-rays.
- UV rays kill germs in the water.
- The probe sends ultrasound into the body and its echoes from the organs are made into a picture (sonogram) by a computer.
- Ultrasound is harmless to the baby (X-rays can harm its cells), and it shows soft tissues.

21. **[4]**

i. $R = \frac{V}{I} = \frac{1.5}{0.3} = 5\ \Omega$, the same for every row.

ii. Ohm's law: at a constant temperature, the current through a conductor is directly proportional to the potential difference across it (V ÷ I stays constant).

iii. $I = \frac{V}{R} = \frac{9}{5} = 1.8\ \mathrm{A}$

iv. $P = V \times I = 6 \times 1.2 = 7.2\ \mathrm{W}$

Marking scheme

- R = V ÷ I = 5 Ω.
- Ohm's law: at constant temperature, current is directly proportional to potential difference.
- I = 9 ÷ 5 = 1.8 A.
- P = 6 × 1.2 = 7.2 W.

22. **[4]**

i. A **cation** is a positively charged ion, formed when an atom loses electrons: a sodium atom (2, 8, 1) loses one electron and becomes Na^+. An **anion** is a negatively charged ion, formed when an

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atom gains electrons: a chlorine atom (2, 8, 7) gains one electron and becomes Cl^-.

ii. Some elements have more than one valency, depending on the compound they form; this is variable valency. Iron has valencies 2 and 3: in ferrous oxide, FeO, its valency is 2, and in ferric oxide, Fe_2O_3 (rust), it is 3. The lower valency gets the ending -ous and the higher -ic.

Marking scheme

- Cation: a positive ion formed by losing electrons, with an example (Na^+).
- Anion: a negative ion formed by gaining electrons, with an example (Cl^-).
- Variable valency: an element showing more than one valency.
- Iron: valency 2 in FeO (ferrous) and 3 in Fe_2O_3 (ferric).

23. i. Agricultural lime, a base that neutralizes the acidity. **[4]**

ii. Build terraces: flat steps of land that hold the rain and the soil instead of letting them wash down the slope.

iii. Any one: add compost or farmyard manure; grow a green manure crop such as *dhaincha* and plow it into the soil. Either adds humus, which holds water and nutrients and keeps the soil loose and alive with microbes.

iv. No. Burning stubble kills the useful microbes and earthworms in the soil; the stubble should be left to rot or put in compost.

Marking scheme

- Agricultural lime.
- Terraces.
- Compost, manure or green manure, which adds humus (organic matter).
- No: burning kills the useful microbes and earthworms in the soil.

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