Grade 9 Final Exam Model Paper 2

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. **(i)** Monera

b. **(ii)** A few mosquitoes were already able to survive the poison; they lived and bred, and their young inherited this.

c. **(ii)** Auxin collects on the shaded side, so that side grows faster.

d. **(iii)** 19.6 m/s

e. **(ii)** A smaller effort is needed, though it acts over a longer distance.

f. **(iii)** kilowatt-hour

g. **(ii)** Medium Earth Orbit

h. **(i)** Its formula is XY, and it has an electrovalent bond.

i. **(iii)** They are sonorous.

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

Section B

9 × 1 = 9

a. Mixing gives out a lot of heat. If water is poured into concentrated acid, the first drops boil at once and spit the acid out, which can burn the skin and eyes; adding acid slowly to plenty of water spreads the heat safely.

Marking scheme

- Much heat is given out; water added to acid boils and splashes acid, while acid added slowly to water spreads the heat safely.

b. The acceleration of a body falling freely under the Earth's gravity; its average value near the surface is 9.8 m/s².

Marking scheme

- The acceleration of a freely falling body due to gravity, 9.8 m/s².

c. $d = \frac{v \times t}{2} = \frac{340 \times 0.8}{2} = 136 \text{ m}$

Marking scheme

- d = v × t ÷ 2 = 340 × 0.8 ÷ 2 = 136 m.

d. So that each gets the full mains voltage and can be switched on and off on its own; if one stops working, the others keep working.

Marking scheme

- Each gets the full voltage and works (or is switched) independently; one failing does not stop the others.

e. Noise from lightning and electrical sparks mostly changes the height (amplitude) of a wave. In FM the sound is carried in the frequency, and the receiver ignores the amplitude, so the noise is not heard.

Marking scheme

- Noise changes the amplitude; FM carries the sound in the frequency, so the noise is ignored.

f. Keep the account private (or leave out the location and the school's name), because strangers could use them to find her: what is posted publicly stays as part of her digital footprint.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

Marking scheme

- Make it private or remove the location and school name, because strangers could find her (her digital footprint).

g. When a burning splint (matchstick) is brought to the mouth of a jar of hydrogen, the gas burns with a squeaky "pop" sound.

Marking scheme

- A burning splint gives a "pop" sound.

h. Sodium is a very reactive metal: it reacts quickly with the oxygen and the water vapor in air (and violently with water), so it is kept under kerosene, with which it doesn't react. Gold is very unreactive and doesn't react with air or water.

Marking scheme

- Sodium is very reactive with air and moisture (so kerosene shuts them out), while gold is unreactive.

i. Legumes have bacteria in their root nodules that fix nitrogen from the air, so they add nitrogen to the soil for the next crop.

Marking scheme

- The bacteria in their root nodules add nitrogen to the soil.

Section C

14 × 2 = 28

3. **[2]**

i. Least count = (60 − 50) mL ÷ 5 = **2 mL**.

ii. Volume = 50 mL + 3 × 2 mL = **56 mL**.

Marking scheme

- i. (60 − 50) ÷ 5 = 2 mL.
- ii. 50 + 3 × 2 = 56 mL.

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

a. Every species has one scientific name, used by scientists all over the world, whatever its local names are.

b. No two species have the same scientific name, so there is no confusion.

c. The genus name shows which other species it is closely related to.

d. The names follow fixed rules (genus with a capital letter, species with a small letter, both in italics), so they are easy to recognize.

Marking scheme

- One correct advantage.
- A second correct advantage.

5. Her bags are likely to be spoiled by green and black molds and bacteria, and give few or no mushrooms. Straw from the field carries the spores of other fungi and bacteria, and in the warm, damp bag they grow faster than the mushroom spawn. She should boil the straw for about 15–20 minutes (or soak it in hot water) to kill them and soften the straw, then cool it before adding the spawn. **[2]**

Marking scheme

- The bags will be spoiled by other molds and bacteria from the unboiled straw, which grow faster than the spawn.
- She should boil the straw (about 15–20 minutes) to kill them, and cool it before adding the spawn.

6. *Archaeopteryx* had features of two groups: **[2]**

a. like a bird, it had **feathers and wings**;

b. like a reptile, it had **teeth** in its jaws, **claws** on its wings and a long **bony tail**.

So it links reptiles and birds, and shows that birds evolved from reptiles.

Marking scheme

- Bird features: feathers and wings.
- Reptile features (teeth, claws, a bony tail), so it links reptiles and birds.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

7. It is a **reflex action**. **[2]**
Receptors in the skin of the finger → sensory nerve → spinal cord (connecting neuron) → motor nerve → muscles of the arm (effector), which pull the hand back.

Marking scheme

- Reflex action.
- Receptor → sensory nerve → spinal cord → motor nerve → effector (arm muscles).

8. To every action there is an equal and opposite reaction, and the two act on different bodies. **[2]**
Example (any one): a gun recoils when it fires a bullet; a swimmer pushes the water back and moves forward; a rocket pushes gases down and rises; when you jump off a boat, the boat moves back.

Marking scheme

- The law: every action has an equal and opposite reaction.
- One correct example.

9. No. The loaded truck has much more mass, so it has more inertia of motion. By $F = ma$, the same braking force gives it a smaller retardation ($a = F/m$), so it takes longer, and goes farther, before it stops. To stop it in the same time, a larger force is needed. **[2]**

Marking scheme

- No: the loaded truck has more mass (more inertia).
- By F = ma, the same force gives it less retardation, so it takes longer to stop (it needs a larger force).

10. **[2]**

i. $f = \dfrac{n}{t} = \dfrac{5}{2} = 2.5\ \text{Hz}$

ii. $v = f\lambda = 2.5 \times 0.4 = 1\ \text{m/s}$

Marking scheme

- i. f = 5 ÷ 2 = 2.5 Hz.
- ii. v = 2.5 × 0.4 = 1 m/s.

11. **Sirius.** The color of a star shows the temperature of its surface: blue stars are the hottest, then white and yellow ones, and red stars are the coolest. Sirius is bluish white, so its surface is much hotter than that of reddish Betelgeuse, a red supergiant. **[2]**

Marking scheme

- Sirius is hotter.
- A star's color shows its surface temperature: blue (white) hottest, red coolest.

12. **[2]**

a. **Transmitter:** Muna's phone. Its microphone takes in her voice (the input), and the phone turns it into a signal fit for sending.
b. **Channel:** the radio waves from her phone to the nearest tower, and the cables, optical fibers or microwave links between the towers, which carry the signal to Kathmandu.
c. **Receiver:** her brother's phone, which picks up the signal and turns it back into sound in its earpiece (the output).

Marking scheme

- Transmitter: Muna's phone (turns her voice into a signal); receiver: her brother's phone (turns the signal back into sound).
- Channel: the radio waves to the tower and the cables, fibers or microwave links between towers.

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

a. Not reply or hit back, which usually makes it worse.
b. Keep a record: save the messages and take screenshots, with dates.
c. Block the person and report the posts to the app.
d. Tell a parent or teacher she trusts; if it is serious, report it to the Nepal Police Cyber Bureau.

Marking scheme

- One correct action (don't reply, keep records or screenshots).

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

- A second correct action (block and report, tell a trusted adult, Cyber Bureau).

14. Symbols: Al, O; valencies 3 and 2. Criss-crossing gives **Al_2O_3**. **[2]**
Molecular mass = 2 × 27 + 3 × 16 = 54 + 48 = **102 amu**.

Marking scheme

- Al_2O_3.
- Molecular mass = 2 × 27 + 3 × 16 = 102 amu.

15. No. There are 2 oxygen atoms on the left but only 1 on the right, so the equation breaks the law of conservation of mass: atoms are neither made nor destroyed in a reaction, so each element must have the same number of atoms on both sides. The balanced equation is **$2Mg + O_2 \rightarrow 2MgO$** (2 Mg and 2 O on each side). **[2]**

Marking scheme

- No: the oxygen atoms are not equal on both sides (2 and 1), against the law of conservation of mass.
- $2Mg + O_2 \rightarrow 2MgO$.

16. Yes, I agree. **[2]**

a. CFCs release chlorine high in the atmosphere, which destroys ozone; HFCs contain no chlorine, so they don't harm the ozone layer.
b. But HFCs are strong greenhouse gases that add to global warming, so they too are now being phased out (the Kigali Amendment to the Montreal Protocol) in favor of gases such as isobutane.

Marking scheme

- HFCs have no chlorine, so they don't destroy ozone as CFCs do.
- But HFCs are strong greenhouse gases (global warming), so they are being replaced too.

Section D **7 × 4 = 28**

17. **[4]**

- **Parenchyma:** stores food and water (and, as chlorenchyma with chlorophyll, makes food by photosynthesis).
- **Collenchyma:** gives the plant flexible support and mechanical strength, in young stems and leaf stalks, so they bend without breaking.
- **Sclerenchyma:** gives the plant strength and hardness (its dead, thick-walled cells form the fibers and hard shells).
- **Xylem:** carries water and minerals from the roots up to the leaves (and gives support).

Marking scheme

- Parenchyma: stores food (or makes food, chlorenchyma).
- Collenchyma: flexible support (mechanical strength) to young parts.
- Sclerenchyma: strength and hardness.
- Xylem: carries water and minerals from the roots to the leaves.

18. **[4]**

i. **Mutualism (symbiosis):** both benefit. The alga makes food by photosynthesis for both, and the fungus gives it shelter, water and minerals.
ii. **Commensalism:** the egret benefits (an easy meal of insects), and the buffalo is neither helped nor harmed.
iii. **Competition:** both need the same food, which is limited, so each gets less.
iv. **Parasitism:** the tapeworm (parasite) benefits by taking digested food from the intestine, and the human (host) is harmed.

Marking scheme

- Lichen: mutualism, both benefit.
- Egret and buffalo: commensalism, one benefits and the other is unaffected.
- Goats: competition for the same limited food.
- Tapeworm: parasitism, the parasite benefits and the host is harmed.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

19. [4]

i. Any two: briquettes give less smoke, so the kitchen and the children's air stay cleaner; they reduce the cutting of firewood and save the forests; they give more heat and are easy to store and carry; they use weeds and crop waste; they give income to the local group.

ii. They are made from biomass (weeds, husk, crop waste), which grows again every season, so the supply does not run out.

iii. No. Burning charcoal makes carbon monoxide, a poisonous gas with no color or smell; in a closed room without ventilation it can kill a person, often in their sleep. Briquettes must be used only where there is fresh air.

Marking scheme

- One correct advantage (less smoke, cleaner air).
- A second correct advantage (saves forests, more heat, uses waste, easy to store, income).
- Made from biomass that grows again, so it doesn't run out.
- No: in a closed room it gives poisonous carbon monoxide, which can kill.

20. [4]

i. By echolocation: a bat sends out ultrasound and listens to the echoes that come back from insects and obstacles, which tell it where they are.

ii. For acoustic protection: soft, rough materials absorb sound instead of reflecting it, so there are no echoes to mix with the sound and spoil it, and the sound in the hall stays clear.

iii. The ship sends a pulse of ultrasound down to the sea bed and records the time the echo takes to come back. Knowing the speed of sound in water, the depth is worked out as depth = speed × time ÷ 2, because the sound has gone down and up again.

Marking scheme

- Bats send out ultrasound and use its echoes (echolocation).
- Soft boards and curtains absorb sound, preventing echoes (acoustic protection).
- SONAR sends ultrasound to the sea bed and times its echo.
- Depth = speed of sound in water × time ÷ 2.

21. Using $E = P \times n \times t$, with P in kW and t in hours: [4]

i. Bulbs: $\frac{9}{1000} \times 5 \times 6 = 0.27\ \mathrm{kWh}$

ii. Television: 0.1 × 1 × 5 = 0.5 kWh; rice cooker: 0.6 × 1 × 1.5 = 0.9 kWh; iron: 1 × 1 × 0.5 = 0.5 kWh.

Total in a day = 0.27 + 0.5 + 0.9 + 0.5 = **2.17 kWh**

iii. In a month = 2.17 × 30 = **65.1 units**

iv. Bill = 65.1 × Rs 10 = **Rs 651**

Marking scheme

- Bulbs: 0.009 × 5 × 6 = 0.27 kWh.
- Total in a day: 0.27 + 0.5 + 0.9 + 0.5 = 2.17 kWh.
- In a month: 2.17 × 30 = 65.1 units.
- Bill: 65.1 × 10 = Rs 651.

22. [4]

i. Nuclear fission is the splitting of a heavy, unstable nucleus into two smaller nuclei. When a neutron hits a uranium-235 nucleus, the nucleus splits into two middle-sized nuclei (such as barium and krypton), giving out two or three new neutrons and a great deal of energy. The new neutrons can split more nuclei, a chain reaction.

$${}^{235}_{92}\mathrm{U} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{141}_{56}\mathrm{Ba} + {}^{92}_{36}\mathrm{Kr} + 3\,{}^{1}_{0}\mathrm{n} + \mathrm{energy}$$

ii. Nuclear fusion is the joining of light nuclei to make a heavier nucleus. In the Sun's core, at a temperature of millions of degrees and a huge pressure, four hydrogen nuclei join to make one helium nucleus. The helium formed is slightly lighter than the four hydrogen nuclei, and the lost mass becomes energy (E = mc²), which the Sun gives out as light and heat.

Marking scheme

- Fission: a heavy nucleus splits into two smaller nuclei.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

- Uranium-235 hit by a neutron splits (e.g. into barium and krypton) giving 2 or 3 neutrons and energy (chain reaction).
- Fusion: light nuclei join to make a heavier nucleus.
- In the Sun four hydrogen nuclei fuse into helium at very high temperature and pressure; the lost mass becomes energy.

23. i. Any two: **[4]**

a. Shorts and sandals: he should wear protective clothing (gloves, long sleeves, boots, a mask and goggles).

b. Spraying on a windy day, into the wind: the spray will blow into his face; he should spray on a calm day, with the wind behind him.

c. Selling the next morning: he should wait the number of days given on the label before harvesting, so the poison breaks down and doesn't reach people's food.

ii. Jholmol: chop strong-smelling local plants (such as neem, *timur*, *asuro*, *titepati*, garlic), mix them with cow urine and a little dung, keep it covered for about 15 days, then mix one part with three to five parts of water and spray it. (Neem leaves or ash also work.)

iii. DDT does not break down for years. It pollutes soil and water, kills useful insects and fish, and builds up along food chains, harming birds and fish and human health.

Marking scheme

- One mistake with the correct practice (protective clothing).
- A second mistake with the correct practice (spray on a calm day with the wind behind him, or wait the days on the label before harvesting).
- Jholmol (or another bio-insecticide) with how it is made.
- DDT does not break down and builds up in food chains, harming living things and health.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking