FINALS REVIEW · GRADE 8

8th Grade Science Final Exam Review

Everything on a typical 8th grade science final, one unit at a time: the facts you need, the mistakes that cost the most points, and three practice questions per unit with answers. Start with the quick checks to find your weak units, then use the linked lessons to fix them.

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What’s on the 8th Grade Science final

Many schools teach matter, chemical reactions, forces and waves in the first semester, then space, weather and climate, ecosystems, cells and heredity in the second. Some courses start with life science instead, so the order varies by school. In Texas, the same Grade 8 science standards are tested on the STAAR science test in the spring, so this guide doubles as STAAR review.

Unit	Usually on	Lessons
1. Matter and chemical reactions	Semester 1	Grade 8 Science: Matter, Chemical Reactions, Acids and Bases
2. Water, acids, bases and pH	Semester 1	Grade 8 Science: Matter, Chemical Reactions, Acids and Bases
3. Newton’s laws of motion	Semester 1	Grade 8 Science: Newton’s Laws, Waves and the Electromagnetic Spectrum
4. Waves and the electromagnetic spectrum	Semester 1	Grade 8 Science: Newton’s Laws, Waves and the Electromagnetic Spectrum
5. Stars, galaxies and the universe	Semester 2	Grade 8 Science: Stars, Galaxies and the Universe
6. Weather, winds and hurricanes	Semester 2	Grade 8 Science: Weather, Climate and the Carbon Cycle
7. Climate change and the carbon cycle	Semester 2	Grade 8 Science: Weather, Climate and the Carbon Cycle

Unit	Usually on	Lessons
8. Changing ecosystems and biodiversity	Semester 2	Grade 8 Science: Ecosystems, Cells and Heredity
9. Cells, heredity and adaptations	Semester 2	Grade 8 Science: Ecosystems, Cells and Heredity

A two-week study plan

> DAY 14
>
> **Find your weak units**
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> Do the quick checks for all 9 units without notes. Mark each unit solid, shaky or lost. This tells you where your study time goes.

> DAYS 13–6
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> **Fix the lost and shaky units, one a day**
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> Start with the units you marked lost, then shaky. For each one, read the must-know list, work through the linked lesson, and redo that unit's quick checks until you get all three right.

> DAYS 5–3
>
> **Mixed practice**
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> Finals mix units together, so practice that way: answer quick checks from different units in random order, and explain each answer in a full sentence with the science word that fits.

> DAY 2
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> **Vocabulary and mistakes**
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> Review every "common mistakes" list, and quiz yourself on the word pairs that are easy to mix up. Write any formulas, like density or speed, from memory with their units.

> DAY 1
>
> **Light review and sleep**
>
> Redo only the questions you missed before. Then stop: a full night of sleep helps your memory more than a late cram session.

UNIT 1 · SEMESTER 1

Matter and chemical reactions

MUST KNOW

- Matter is a pure substance or a mixture. An element has one kind of atom (gold); a compound is elements chemically joined in a fixed ratio (water, $\mathrm{H_2O}$). A homogeneous mixture looks the same throughout (salt water); a heterogeneous mixture has parts you can see (trail mix).
- In a chemical reaction, the atoms of the reactants rearrange to make new products. No atoms are created or destroyed.
- In a formula, a subscript counts atoms of the element before it, and a coefficient in front counts whole molecules: $\mathrm{2H_2O}$ has 4 hydrogen and 2 oxygen atoms.
- Conservation of mass: in a closed system, the mass of the products equals the mass of the reactants. In an open container, escaping gas makes the mass seem to drop.
- Photosynthesis: $\mathrm{6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2}$, using light energy. Every atom balances: 6 carbon, 12 hydrogen and 18 oxygen on each side.

COMMON MISTAKES

- Balancing an equation by changing subscripts. Change only the coefficients in front; changing a subscript makes a different substance.
- Saying mass is lost when baking soda and vinegar fizz in an open cup. The carbon dioxide gas escaped; seal the bag and the mass stays the same.

QUICK CHECK

1.1 Classify each: oxygen gas, table salt, a salad, apple juice.

1.2 Methane burns: $\mathrm{CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O}$. How many oxygen atoms are on each side?

1.3 A sealed bag of baking soda and vinegar has a mass of 150 grams before the reaction. What is its mass after?

UNIT 2 · SEMESTER 1

Water, acids, bases and pH

MUST KNOW

- Cohesion is water sticking to water (a bead on a leaf); adhesion is water sticking to other materials (water climbing a glass tube). Together they move water up plants.
- Surface tension is the stretchy skin cohesion makes at the water's surface, strong enough to hold up a water strider. Soap weakens it.
- Acids taste sour, turn blue litmus red and react with some metals to give off hydrogen. Bases taste bitter, feel slippery and turn red litmus blue.
- The pH scale runs from 0 to 14. Pure water is neutral at 7, below 7 is acidic and above 7 is basic.
- Each pH step is ten times stronger: vinegar at pH 3 is $10 \times 10 \times 10 \times 10 = 10{,}000$ times more acidic than water at pH 7.

COMMON MISTAKES

- Thinking a higher pH means a stronger acid. Lower pH is more acidic; higher pH is more basic.
- Mixing up cohesion and adhesion. Cohesion: water to water. Adhesion: water to something else.

QUICK CHECK

2.1 A cleaner has a pH of 12. Is it an acid, a base or neutral?

2.2 How many times more acidic is a solution with pH 4 than one with pH 6?

2.3 Why can a paper clip float on water but sink when soap is added?

UNIT 3 · SEMESTER 1

Newton’s laws of motion

MUST KNOW

- First law (inertia): an object keeps doing what it is doing, at rest or moving at a steady speed in a straight line, unless an unbalanced force acts on it.
- Second law: $F = ma$, so acceleration is net force divided by mass, $a = \frac{F}{m}$. Force is in newtons, mass in kilograms and acceleration in meters per second squared.
- With the same force, more mass means less acceleration; with the same mass, more force means more acceleration.
- Third law: every action force has an equal and opposite reaction force. A rocket pushes exhaust down and the exhaust pushes the rocket up.
- Seat belts, airbags and crumple zones stretch out a stop, which lowers the acceleration and so the force on your body.

COMMON MISTAKES

- Using the applied force instead of the net force. A 10 newton push against 4 newtons of friction leaves only 6 newtons to accelerate the object.
- Thinking action and reaction forces cancel. They act on different objects, so they do not cancel.
- Thinking a rocket needs air to push against. It pushes on its own exhaust, so it works in space.

QUICK CHECK

3.1 A 2 kilogram skateboard gets a net force of 10 newtons. What is its acceleration?

3.2 The same 12 newton force pushes a 2 kilogram cart and a 6 kilogram cart. Which accelerates more, and by how much?

3.3 In a crash, why does a passenger without a seat belt keep moving forward?

UNIT 4 · SEMESTER 1

Waves and the electromagnetic spectrum

MUST KNOW

- In a transverse wave, the medium moves up and down while the wave travels sideways. The top is a crest and the bottom is a trough.
- Amplitude is the height from the rest line to a crest; more amplitude carries more energy. Wavelength is crest to crest. Frequency is waves per second, in hertz.
- For the same kind of wave, higher frequency means shorter wavelength.
- The electromagnetic spectrum from longest wavelength and lowest energy to shortest and highest: radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays. All travel at the speed of light, about 300,000 kilometers per second.
- Uses: radio waves and microwaves for wireless and cooking, infrared and light for fiber optics, ultraviolet to kill germs, and X-rays and gamma rays for medical images, cancer therapy and astronomy.

COMMON MISTAKES

- Thinking higher frequency means longer wavelength. It is the opposite: frequency up, wavelength down.
- Thinking radio waves are sound. They are electromagnetic waves; a radio turns them into sound.

QUICK CHECK

4.1 Put in order from lowest to highest energy: X-rays, radio waves, visible light.

4.2 Which property of a wave tells you how much energy it carries: amplitude or wavelength?

4.3 Why are X-rays useful for seeing broken bones?

UNIT 5 · SEMESTER 2

Stars, galaxies and the universe

MUST KNOW

- A star’s color shows its surface temperature. Coolest to hottest: red, orange, yellow, white, blue.
- A Sun-like star goes from nebula to protostar to main sequence to red giant, sheds a planetary nebula and ends as a white dwarf. A massive star becomes a red supergiant, explodes as a supernova and leaves a neutron star or black hole.
- The Hertzsprung-Russell diagram plots temperature (hottest on the left) against brightness. Most stars, including the Sun, are on the main sequence; giants are upper right and white dwarfs lower left.
- Galaxies are spiral (disk and arms, like the Milky Way), elliptical (smooth oval of old stars) or irregular (no clear shape). The solar system is in the Orion Arm, about 26,000 light-years from the center.
- Evidence for the Big Bang, about 13.8 billion years ago: distant galaxies are redshifted and moving apart, the cosmic microwave background glows from every direction, and the universe is about three quarters hydrogen and one quarter helium.

COMMON MISTAKES

- Thinking red stars are the hottest. Red stars are the coolest; blue stars are the hottest.
- Treating a light-year as a time. It is a distance: how far light travels in a year.
- Saying the Sun will explode as a supernova. It does not have enough mass; it will become a white dwarf.

QUICK CHECK

5.1 Star A is orange and star B is blue. Which is hotter?

5.2 A star is very hot but very dim. Where is it on the H-R diagram, and what is it?

5.3 Name two pieces of evidence for the Big Bang theory.

UNIT 6 · SEMESTER 2

Weather, winds and hurricanes

MUST KNOW

- Uneven heating by the Sun drives weather: sunlight hits the tropics more directly than the poles, warm air rises (low pressure, clouds and rain) and cool air sinks (high pressure, clear skies).
- Weather is the air at one place and time; climate is the average over 30 or more years.
- The Coriolis effect, caused by Earth’s rotation, bends winds into three belts per hemisphere: trade winds (0 to 30 degrees), westerlies (30 to 60) and polar easterlies (60 to 90). Most of the United States is in the westerlies, so weather moves west to east.
- Air masses take on the place they form: maritime (ocean) or continental (land), tropical (warm) or polar (cold). At a cold front, storms then cooler, drier air; at a warm front, steady rain then warmer air.
- Hurricanes, typhoons and cyclones are the same storm, fueled by ocean water at least 26.5 °C and spun by the Coriolis effect. Winds of 74 miles per hour or more make a hurricane; over land or cool water it weakens.

COMMON MISTAKES

- Naming winds by where they go. Winds are named for where they come from: westerlies blow from the west.
- Calling one cold week proof that the climate is not warming. That is weather; climate is the long-term pattern.

QUICK CHECK

6.1 A cold front passes through tonight. Will tomorrow be warmer or cooler, and more or less humid?

6.2 What kind of air mass forms over the Gulf of Mexico?

6.3 A hurricane moves over water at 24 °C. Will it strengthen or weaken?

UNIT 7 · SEMESTER 2

Climate change and the carbon cycle

MUST KNOW

- Natural causes change climate: big volcanic eruptions and asteroid impacts block sunlight and cool Earth (Mount Pinatubo cooled the world about half a degree Celsius for about two years), and ocean currents like El Niño and the Gulf Stream move heat around.
- The greenhouse effect: sunlight warms the ground, the ground gives off heat, and greenhouse gases (water vapor, carbon dioxide, methane) trap part of it. Without it Earth would average about minus 18 °C instead of about 15 °C.
- Burning coal, oil and gas and cutting forests have raised carbon dioxide from about 280 parts per million before the 1800s to about 427 in 2025, and Earth is more than 1 °C warmer than in the late 1800s.
- Cities form urban heat islands: dark pavement and roofs soak up sunlight, so downtowns stay warmer than the countryside.
- The carbon cycle: photosynthesis takes carbon dioxide out of the air; respiration, decay, volcanoes and burning fuels put it back. The ocean absorbs and releases carbon, and over millions of years carbon is buried as fossil fuels and rock like limestone.

COMMON MISTAKES

- Thinking the greenhouse effect is all bad. A natural greenhouse effect keeps Earth livable; the problem is adding extra gases.
- Mixing up the ozone hole and global warming. They are separate problems.
- Thinking volcanoes are the main cause of today's warming. Big eruptions usually cool Earth briefly, and volcanoes release far less carbon dioxide than people do.

QUICK CHECK

7.1 Which process takes carbon dioxide out of the air: photosynthesis or respiration?

7.2 Name two human activities that add carbon dioxide to the air.

7.3 A huge volcano erupts. Will the next year be a little warmer or a little cooler worldwide?

UNIT 8 · SEMESTER 2

Changing ecosystems and biodiversity

MUST KNOW

- A change in one population ripples through a food web. On Isle Royale, a disease cut wolves from about 50 to 16, moose boomed to about 2,400, overate their food and crashed.
- Natural disasters, invasive species, overfishing and adding or removing predators all change how energy flows. Removing sea otters lets urchins destroy kelp forests; wolves returning to Yellowstone rippled down to elk, willows and beavers.
- Primary succession starts on bare rock with no soil (new lava), led by pioneer species like lichens and mosses. Secondary succession starts on soil left after a fire, flood or cleared field and is much faster.
- Each stage of succession adds species, so populations and biodiversity grow over time.
- Biodiversity gives an ecosystem many paths for energy. If one species is lost, others take its place, so diverse ecosystems stay stable and recover after a disturbance.

COMMON MISTAKES

- Thinking a change affects only the two species involved. Effects ripple through the whole food web.
- Mixing up primary and secondary succession. The question to ask: was there soil left?

QUICK CHECK

8.1 A disease kills most of the foxes that eat rabbits. What happens to the rabbits, then the grass?

8.2 An abandoned farm field is left alone. Is this primary or secondary succession?

8.3 Why is a farm with one crop riskier than a farm with five crops?

UNIT 9 · SEMESTER 2

Cells, heredity and adaptations

MUST KNOW

- Plant and animal cells both have a cell membrane (controls what enters and leaves), cytoplasm, a nucleus (holds DNA) and mitochondria (release energy from food). Only plant cells have a cell wall, chloroplasts (make sugar from sunlight) and one large central vacuole.
- DNA is coiled into chromosomes in pairs, one of each pair from each parent; humans have 23 pairs. A gene is a section of DNA with instructions for a trait, and its versions are alleles.
- A dominant allele (B) hides a recessive allele (b). Genotype is the alleles (BB, Bb, bb); phenotype is the trait you see. BB is homozygous, Bb is heterozygous.
- A Punnett square shows every way parents' alleles combine. For $Bb \times Bb$: BB, Bb, Bb, bb, a 3 in 4 chance of the dominant trait and 1 in 4 of the recessive one.
- Adaptations are structural (a body part, like webbed feet), behavioral (an action, like migrating) or physiological (a body process, like making venom). They spread because individuals with helpful variations survive and reproduce more.

COMMON MISTAKES

- Thinking plant cells have chloroplasts instead of mitochondria. They have both.
- Thinking a 1 in 4 chance means exactly one of every four offspring. Each offspring is a separate chance.
- Thinking animals change their bodies because they need to. Helpful traits spread over generations through variation and survival.

QUICK CHECK

9.1 A cell has a cell wall and chloroplasts. Is it a plant cell or an animal cell?

9.2 Two black guinea pigs, both Bb, have babies. What is the chance of a white (bb) baby?

9.3 Classify each adaptation: a bear hibernating, a cactus's waxy stem, a snake's venom.

Answer key

Unit 1: Matter and chemical reactions

1.1 Element, compound, heterogeneous mixture, homogeneous mixture.

1.2 4 on each side: 2 times 2 in the reactants, and 2 in $\mathrm{CO_2}$ plus 2 in the two waters in the products.

1.3 150 grams. In a closed system no atoms escape, so mass is conserved.

Unit 2: Water, acids, bases and pH

2.1 A base, because its pH is above 7.

2.2 100 times. Two steps, and each step is ten times: $10 \times 10 = 100$.

2.3 Surface tension, made by cohesion, holds it up. Soap weakens the surface tension, so the clip breaks through.

Unit 3: Newton's laws of motion

3.1 $a = \dfrac{10}{2} = 5$ meters per second squared.

3.2 The 2 kilogram cart: 6 meters per second squared, three times the heavy cart's 2 meters per second squared.

3.3 Inertia, Newton's first law: the passenger keeps moving until a force, like a belt, airbag or windshield, stops them.

Unit 4: Waves and the electromagnetic spectrum

4.1 Radio waves, visible light, X-rays.

4.2 Amplitude. A taller wave carries more energy.

4.3 X-rays pass through skin and soft tissue but are blocked by bone, so bones show up on the image.

Unit 5: Stars, galaxies and the universe

5.1 Star B. Blue stars are hotter than orange stars.

5.2 The lower left. It is a white dwarf: hot but small.

5.3 Any two of: redshifted galaxies moving apart, the cosmic microwave background, and the mix of about three quarters hydrogen and one quarter helium.

Unit 6: Weather, winds and hurricanes

6.1 Cooler and less humid, because cold, dry air moves in behind the front.

6.2 Maritime tropical (mT): warm and humid.

6.3 Weaken. Hurricanes need water at least 26.5 °C for fuel.

Unit 7: Climate change and the carbon cycle

7.1 Photosynthesis. Respiration puts carbon dioxide back into the air.

7.2 Any two of: burning coal, oil or gas, driving gas-powered cars, and cutting and burning forests.

7.3 A little cooler, because the sulfur haze reflects sunlight back to space.

Unit 8: Changing ecosystems and biodiversity

8.1 Rabbits increase because fewer are eaten, then grass decreases because more rabbits eat it.

8.2 Secondary, because the soil is still there.

8.3 One pest or disease could destroy the single crop; with five crops, the others survive. Diversity spreads the risk.

Unit 9: Cells, heredity and adaptations

9.1 A plant cell. Animal cells have neither.

9.2 1 in 4, or 25 percent. The Punnett square shows BB, Bb, Bb and bb.

9.3 Behavioral, structural, physiological.