

Mr. Brown's Science Labs

Earth & Space Science Regents Review — Cluster Questions

Rocks, Minerals, Mineral Resources & Human Impact

Name: _____

Class Period: _____ Date: _____

Teacher: Mr. Brown

Format	5 Clusters x 5 Questions = 25 Total Questions
Scoring	1 point per question • Total: 25 points
Question Types	Multiple Choice • Short Response • Constructed Response • Row/Sequence
Sources Referenced	NYS Earth & Space Science Reference Tables (2024 Edition)

Cluster Topics:

Cluster 1: Mineral Properties & Identification

Cluster 2: The Rock Cycle & Igneous Rocks

Cluster 3: New York State Mineral Resources & Mining Impacts

Cluster 4: Sedimentary Rocks, Particles & Fossils

Cluster 5: Human Impact — Mining, Recycling & Conservation

CLUSTER 1 — Mineral Properties & Identification

Base your answers to questions 1 through 5 on the readings, data table, and diagram below.

Reading 1: What Is a Mineral?

A **mineral** is a naturally occurring, inorganic solid with a definite chemical composition and an orderly internal arrangement of atoms called a crystalline structure. Because of these requirements, materials like coal (which forms from once-living plants) and obsidian (a volcanic glass with no internal crystal structure) are not classified as true minerals, even though both are found in rocks. Minerals are identified using physical properties such as **hardness, luster, color, streak**, and the way they **break**. The way a mineral breaks reveals its internal atomic bonding: minerals with planes of weak bonds break along smooth, flat surfaces called **cleavage**, while minerals with equally strong bonds in all directions break along uneven, curved surfaces called **fracture**.

1. According to the reading, which characteristic is **required** for a substance to be classified as a mineral?

- (A) It must be a colorful solid.
- (B) It must form deep underground.
- (C) It must have a crystalline structure.
- (D) It must be useful to humans.

2. Using information from the reading, explain why **coal** and **obsidian** are **not** classified as minerals. State **one** reason for each.

Data Table 1: Properties of Five Unknown Minerals

Mineral	Hardness	Luster	Color	Streak	Breakage
W	2.5	Metallic	Silver-gray	Gray-black	Cleavage (cubic)
X	7	Glassy	Colorless	White	Fracture
Y	3	Glassy	Colorless or pink	White	Cleavage (3 directions)
Z	5–6	Metallic	Black	Black	Fracture
Q	2	Earthy	Yellow-brown	Yellow-brown	No cleavage

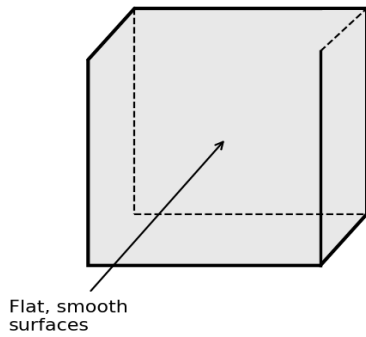
3. Which mineral in the data table is **most likely halite** (rock salt), based on its hardness of 2.5, metallic luster, and cubic cleavage?

- (A) Mineral W
- (B) Mineral X
- (C) Mineral Y
- (D) Mineral Q

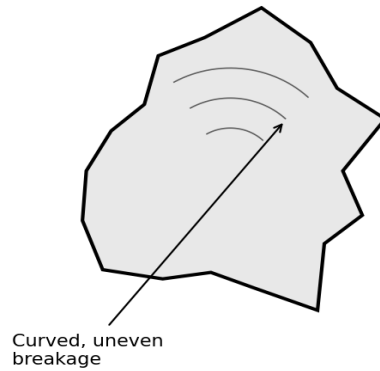
4. A student finds an unknown mineral. It has a hardness of 7, breaks with uneven curved surfaces, and leaves a white streak. Identify the mineral, then state the property that would **best** distinguish it from Mineral Y in the table.

Diagram 1: How Two Minerals Break

Mineral A – Smooth Flat Surfaces



Mineral B – Uneven Curved Surfaces

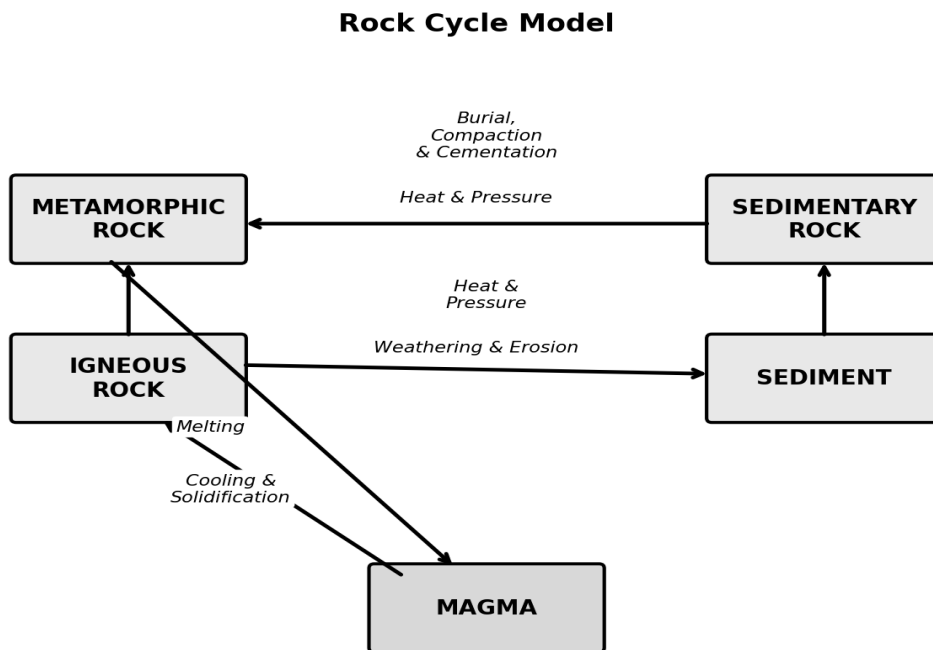


5. Which mineral in **Diagram 1** shows **cleavage**, and what does the way a mineral breaks tell scientists about the **arrangement of its atoms**?

CLUSTER 2 — The Rock Cycle & Igneous Rocks

Base your answers to questions 6 through 10 on the diagram, reading, and chart below.

Diagram 2: The Rock Cycle



6. According to **Diagram 2**, which process is **most directly** responsible for converting **sedimentary rock** into **metamorphic rock**?

- (A) Weathering and erosion
- (B) Heat and pressure
- (C) Cooling and solidification
- (D) Burial and cementation

7. Using **Diagram 2**, place the following four stages in the correct order, starting with **magma**. Write the letter in each numbered box below.

- A. Sediment is buried, compacted, and cemented.
- B. Magma cools and solidifies into igneous rock.
- C. Igneous rock is weathered into sediment at Earth's surface.
- D. Sedimentary rock is exposed to heat and pressure deep underground.

1st	2nd	3rd	4th

Reading 2: How Igneous Rocks Form

When molten rock material cools and hardens, it forms **igneous rock**. Where the melt cools determines the size of the mineral crystals that form. **Intrusive** igneous rocks cool slowly, deep below Earth's surface — giving atoms enough time to organize into **large, visible crystals**. Granite is a common example. **Extrusive** igneous rocks erupt onto the surface during volcanic activity and cool rapidly in contact with air or water. Because cooling is so fast, the crystals are **tiny or even glassy**. Basalt and rhyolite are common examples. Granite and rhyolite have nearly the **same chemical composition**, yet they form different rocks because of where they cooled.

8. Based on the reading, a sample of **granite** has **large, visible crystals**. Which statement **best** explains why?

(A) The magma cooled slowly deep below Earth's surface.

(B) The magma cooled rapidly at Earth's surface.

(C) The rock was exposed to high pressure after cooling.

(D) The rock was deposited as sediment over many years.

9. Two igneous rock samples are tested. **Sample 1** has very small crystals that cannot be seen without a hand lens. **Sample 2** has large, easily visible crystals. **Check the TWO** statements below that are **supported** by these observations.

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(A) Sample 1 most likely cooled quickly near Earth's surface.

(B) Sample 1 most likely formed deep underground.

(C) Sample 2 most likely cooled slowly deep underground.

(D) Sample 2 most likely cooled in seconds during a lava flow.

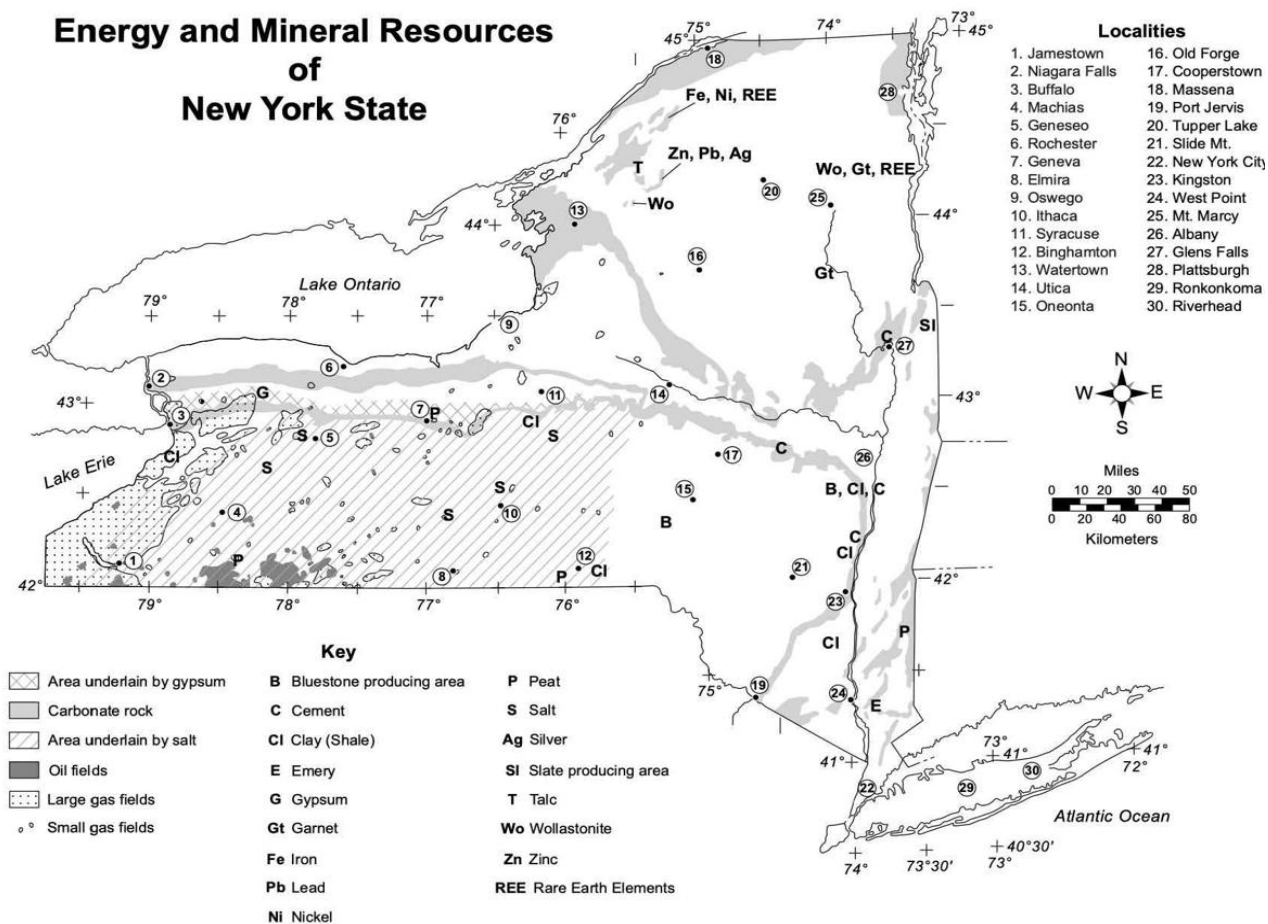
(E) Both samples must be sedimentary rocks.

10. Granite and rhyolite have nearly the **same chemical composition**, yet they form different rocks. Using the reading, explain **why** these two rocks look different even though they are chemically similar.

CLUSTER 3 — NYS Mineral Resources & Mining Impacts

Base your answers to questions 11 through 15 on the map, reading, and data table below.

Map 1: Energy and Mineral Resources of New York State (ESRT, Page 9 — 2024 Edition)



11. According to **Map 1** (ESRT, page 9), which combination of mineral resources is found near **locality 18 (Massena)**?

- | | |
|----------------------------------|---|
| (A) Salt and Bluestone | (B) Iron, Nickel, and Rare Earth Elements |
| (C) Garnet and Wollastonite only | (D) Peat and Clay |

Reading 3: Salt Mining in New York State

For more than 150 years, salt has been mined from underground deposits in central and western New York State. These salt beds formed roughly 400 million years ago, when shallow seas evaporated and left behind thick layers of halite. Today, the salt is removed by two methods: **solution mining**, in which water is pumped down to dissolve the salt and the brine is pumped back up, and **traditional shaft mining**, where workers excavate solid salt deep below the surface. Salt is sold for road de-icing, food processing, and industrial chemicals. However, the industry creates several environmental issues. Empty underground mines can collapse, causing **land subsidence** at the surface. Salt brine accidentally released into rivers can **raise the salinity** of fresh water and harm aquatic organisms. In addition, large amounts of road salt used in winter eventually **run off into local groundwater**, increasing chloride levels above safe drinking water standards in some communities.

12. According to **Reading 3**, which is **one** environmental issue caused by salt mining and salt use in New York?

- (A) Increased volcanic activity
- (B) Higher chloride levels in groundwater
- (C) Faster weathering of limestone bedrock
- (D) Loss of natural gas reserves

13. Identify **one specific way** that salt mining or road-salt runoff harms a New York State ecosystem, and describe **one action** communities can take to **reduce** that harm.

Data Table 2: New York State Mineral and Resource Production (2000–2023)

Year	Salt (thousand tons)	Crushed Stone (thousand tons)	Sand & Gravel (thousand tons)	Natural Gas (million m ³)
2000	5,200	37,800	30,400	765
2005	5,610	42,150	32,100	1,420
2010	5,980	39,600	27,250	2,890
2015	6,840	44,200	29,500	640
2020	7,310	46,300	30,900	420
2023	7,820	47,800	31,750	310

14. Based on **Data Table 2**, which resource shows the **greatest overall increase** in production from 2000 to 2023?

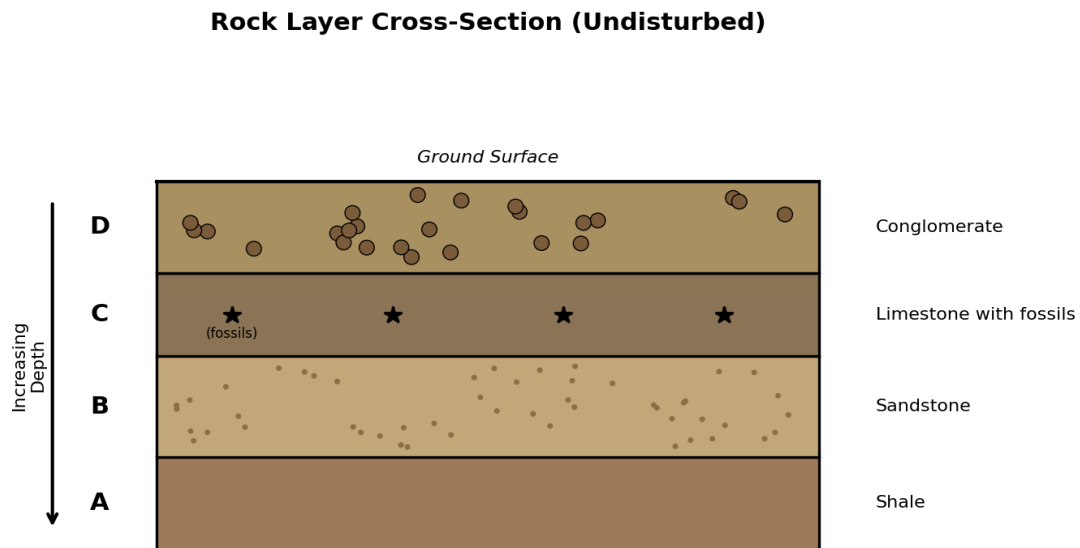
- (A) Salt
- (B) Crushed Stone
- (C) Sand and Gravel
- (D) Natural Gas

15. Natural gas production in New York **rose sharply from 2000 to 2010**, then **declined** to its lowest level by 2023. State **one possible reason** for the rise and **one possible reason** for the decline (consider economic, environmental, or policy factors).

CLUSTER 4 — Sedimentary Rocks, Particles & Fossils

Base your answers to questions 16 through 20 on the diagrams, reading, and graph below.

Diagram 3: Cross-Section of Undisturbed Sedimentary Rock Layers



16. According to the **Law of Superposition** and **Diagram 3**, which layer is the **oldest**?

- (A) Layer A (shale at the bottom)
- (B) Layer B (sandstone)
- (C) Layer C (limestone with fossils)
- (D) Layer D (conglomerate at the top)

17. Layer C contains **fossils**. Check the **TWO** statements that are **best supported** by the rock layers shown in Diagram 3.

- (A) Layer C was once at or near the surface in an environment where organisms lived.
- (B) Layer C formed before Layer A was deposited.
- (C) Layer D is younger than Layer C.
- (D) Layer A formed in a high-energy river with rounded pebbles.
- (E) All four layers formed at the same time.

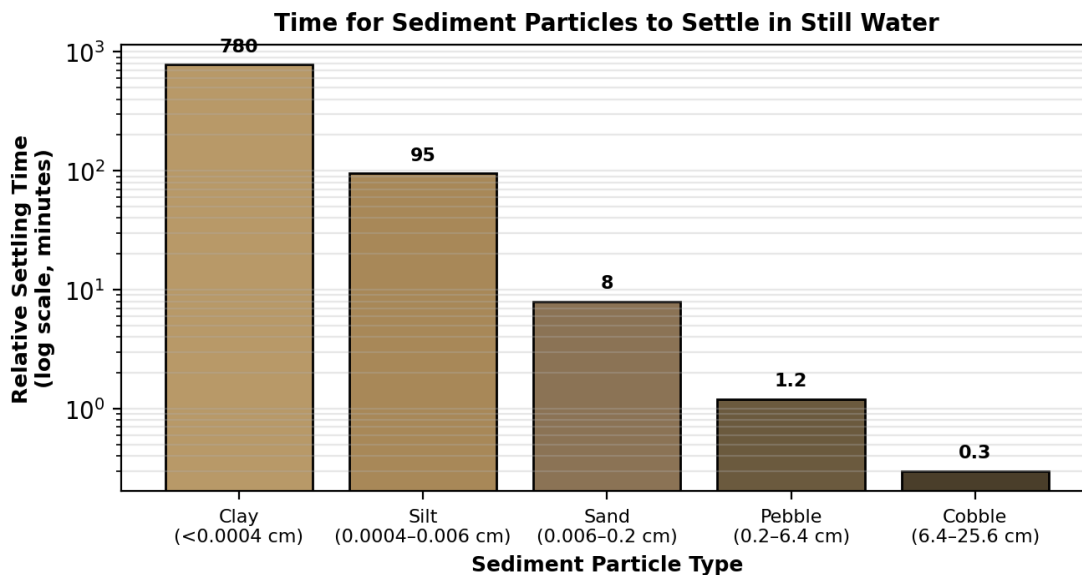
Reading 4: Sediment Particles and Sedimentary Rocks

Sediments are loose particles that have been broken off larger rocks by weathering. As rivers and streams transport these particles, the **size** of the particles determines how they travel and where they finally settle. The largest particles — **cobbles** and **pebbles** — are heavy and settle quickly, even in fast-moving water. **Sand** is smaller and stays suspended longer. **Silt** and **clay** are the smallest and can stay suspended for hours or even days in calm water. When these particles are buried, compacted, and cemented together, they form **sedimentary rock**: cobbles and pebbles cement into **conglomerate**, sand particles into **sandstone**, silt into **siltstone**, and clay into **shale**.

18. A sample of sedimentary rock is made of **rounded particles ranging from 0.5 cm to 5 cm** cemented together. Based on Reading 4, this rock is **most likely**:

- (A) Shale
- (B) Siltstone
- (C) Sandstone
- (D) Conglomerate

Graph 1: Time for Sediment Particles to Settle in Still Water



19. According to **Graph 1**, approximately how many **times longer** does **clay** take to settle compared to **sand**?

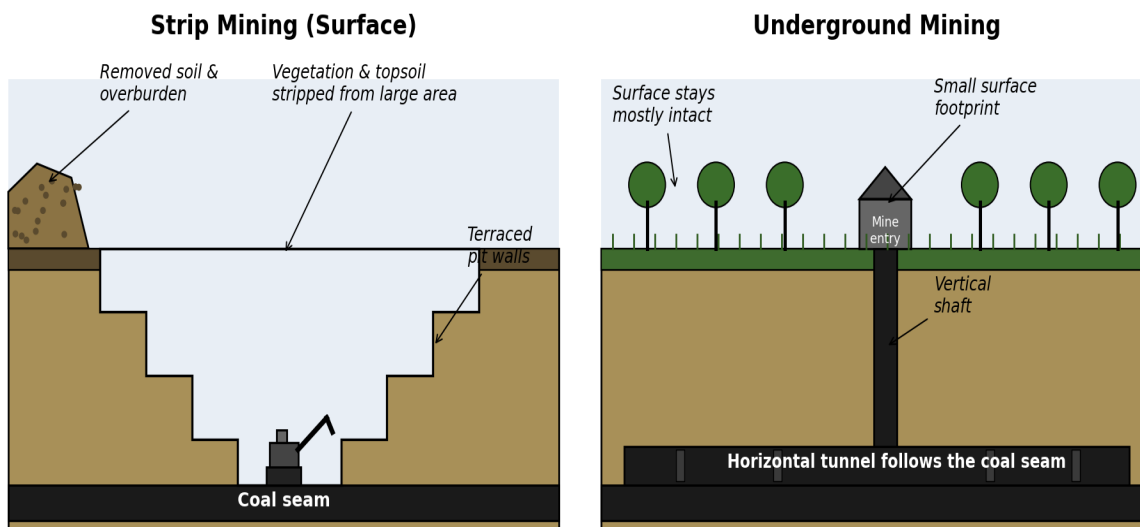
- (A) About 2 times
- (B) About 10 times
- (C) About 100 times
- (D) About 1,000 times

20. After a flood, a lake is filled with cloudy water carrying mixed sediments. Using **Graph 1**, describe the **order** in which the different particle sizes will settle to the bottom, and explain **why** the smallest particles take so much longer.

CLUSTER 5 — Human Impact: Mining, Recycling & Conservation

Base your answers to questions 21 through 25 on the diagram, reading, and graph below.

Diagram 4: Two Methods of Mining Coal



21. Based on **Diagram 4**, which is the **most direct** environmental impact of **strip mining** compared to underground mining?

- (A) It releases more greenhouse gases per ton of coal.
- (B) It removes vegetation, soil, and surface rock from a large area.
- (C) It produces deeper tunnels and shafts.
- (D) It uses less heavy machinery than underground mining.

Reading 5: Reclamation and Reducing Mining's Impact

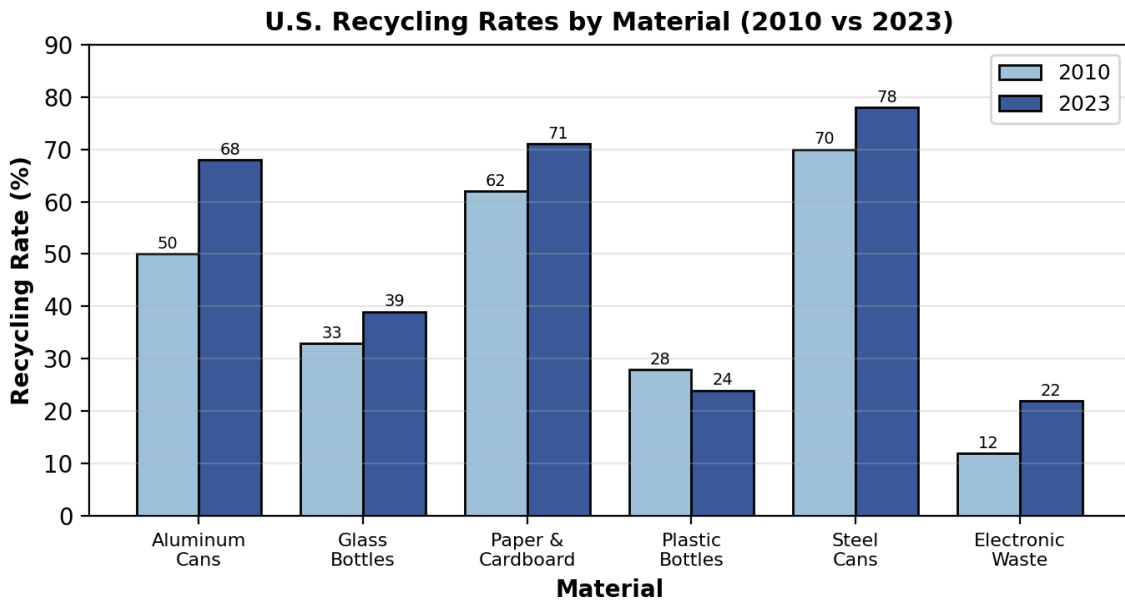
Mining provides essential resources — building stone, metals, fuels, and the rare earth elements used in cell phones and electric car batteries — but it also disturbs ecosystems. After the resource is removed, mining sites can be left as exposed pits with no soil, no vegetation, and acidic runoff that pollutes nearby streams. To reduce these impacts, U.S. law now requires mining companies to perform **reclamation**: the process of restoring mined land to a stable, productive state. Reclamation may include refilling pits with rock and soil, regrading the surface, replanting native vegetation, neutralizing acidic water, and monitoring the site for years after mining ends. Other ways to reduce mining's impact are to **recycle** metals already in circulation (which reduces the need for new mining) and to **design products to last longer** so that fewer resources must be extracted.

22. According to **Reading 5**, the process of restoring mined land so it becomes stable and productive again is called:

- (A) Smelting
- (B) Reclamation
- (C) Subduction
- (D) Sedimentation

23. Describe **two specific steps** a mining company can take during **reclamation** to reduce the long-term environmental damage of a closed mine site. Use information from Reading 5 and/or Diagram 4 in your answer.

Graph 2: U.S. Recycling Rates by Material (2010 vs 2023)



24. According to **Graph 2**, which material's recycling rate **decreased** from 2010 to 2023?

- (A) Aluminum cans
- (B) Glass bottles
- (C) Plastic bottles
- (D) Electronic waste

25. Recycling aluminum cans uses about **95% less energy** than mining and refining new aluminum. Using **Graph 2** and what you have learned in this packet, explain **two reasons why** increasing the U.S. recycling rate is important for protecting Earth's mineral resources and the environment.

Final Score Sheet

Each question is worth **1 point**. Total possible: **25 points**.

Cluster	Topic	Questions	Points Earned
1	Mineral Properties & Identification	1–5	___ / 5
2	The Rock Cycle & Igneous Rocks	6–10	___ / 5
3	NYS Mineral Resources & Mining Impacts	11–15	___ / 5
4	Sedimentary Rocks, Particles & Fossils	16–20	___ / 5
5	Human Impact: Mining & Recycling	21–25	___ / 5
	TOTAL		___ / 25

Final Percentage: (Total ÷ 25) × 100 = _____ %

Letter Grade: _____

Teacher Comments:

ANSWER KEY — Teacher Use Only

Cluster 1 — Mineral Properties & Identification

1. C — A mineral must have a crystalline structure (orderly arrangement of atoms). [Reading 1]
2. Coal: it forms from organic plant material (not inorganic); Obsidian: it is volcanic glass with no internal crystalline structure. Either explanation accepted per substance.
3. A — Mineral W (hardness 2.5, metallic luster, cubic cleavage matches halite).
4. Mineral X. Best distinguishing property: Mineral X has fracture and a hardness of 7, while Mineral Y has cleavage (3 directions) and a hardness of 3. Either 'breakage type' or 'hardness' is acceptable.
5. Mineral A shows cleavage. The way a mineral breaks reflects the arrangement and strength of bonds between its atoms — flat breaks indicate planes of weak bonds (cleavage); uneven curved breaks indicate equally strong bonds in all directions (fracture).

Cluster 2 — The Rock Cycle & Igneous Rocks

6. B — Heat and pressure convert sedimentary rock into metamorphic rock.
7. Order: B, C, A, D (Magma → cools to igneous → weathered to sediment → buried/compacted → exposed to heat & pressure).
8. A — Magma cooled slowly deep below Earth's surface, allowing large crystals to form.
9. A and C — Sample 1 cooled quickly near the surface; Sample 2 cooled slowly underground.
10. Granite cooled slowly deep underground, producing large visible crystals (intrusive); rhyolite cooled rapidly at the surface, producing tiny crystals (extrusive). Their appearance differs because of cooling rate / location, not composition.

Cluster 3 — NYS Mineral Resources & Mining Impacts

11. B — Iron, Nickel, and Rare Earth Elements (Fe, Ni, REE) are labeled on the ESRT page 9 map near locality 18 (Massena).
12. B — Higher chloride levels in groundwater.
13. Acceptable answers: harm includes road-salt runoff raising salinity of streams/lakes and killing aquatic organisms, brine spills contaminating fresh water, or mine collapse causing land subsidence. Action: using less road salt, switching to sand/brine alternatives, sealing brine pipelines, or refilling old mines.
14. B — Crushed Stone shows the greatest absolute increase (from 37,800 to 47,800 thousand tons).
15. Rise reason: increased use of hydraulic fracturing (fracking) in the Marcellus Shale boom of the late 2000s. Decline reason: New York's 2014/2015 ban on high-volume hydraulic fracturing, lower gas prices, or environmental restrictions. Other reasonable economic/policy answers accepted.

Cluster 4 — Sedimentary Rocks, Particles & Fossils

16. A — Layer A (shale at the bottom) is the oldest by the Law of Superposition.
17. A and C — Layer C was at the surface where organisms lived (fossils present); Layer D is younger because it lies on top.
18. D — Conglomerate (rounded particles 0.2–6.4 cm = pebbles).
19. C — About 100 times longer (clay ≈ 780, sand ≈ 8; ratio ≈ 97×).
20. Order largest to smallest: cobbles → pebbles → sand → silt → clay (largest settle first). Smallest particles settle slowest because they have very small mass relative to surface area, so water resistance keeps them

suspended much longer.

Cluster 5 — Human Impact: Mining, Recycling & Conservation

- 21.** B — Strip mining removes vegetation, soil, and surface rock from a large area.
- 22.** B — Reclamation.
- 23.** Two of the following: refill pits with rock and soil, regrade the surface, replant native vegetation, neutralize acidic runoff, monitor the site for years after closure. Each = 1 point.
- 24.** C — Plastic bottles (28% → 24%).
- 25.** Acceptable 2 reasons (any two): (1) recycling reduces the need for new mining, which preserves Earth's finite mineral resources; (2) recycling uses far less energy (95% for aluminum), reducing fossil fuel use and greenhouse gas emissions; (3) recycling reduces habitat destruction from strip mining; (4) recycling reduces solid waste in landfills; (5) recycling reduces toxic runoff and water pollution. Full credit: two distinct, accurate reasons.

Tags: NYS Regents Earth and Space Science, Rocks Minerals Review, Rock Cycle, Igneous Sedimentary Metamorphic, Mineral Identification, Mineral Resources NY, Mining Human Impact, Reclamation, Recycling, Earth Science Reference Tables, ESRT 2024, Mr. Brown's Science Labs, Regents Review Cluster Questions, Jan 2026 Earth Space Regents, June 2025 Earth Space Regents.