2.7 Metals, Reactivity and the Rock Cycle: 30-minute Pack

Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Explain why recycling metals saves energy compared with extracting metals from ores.

(2)

2 A piece of granite (an igneous rock) has a mass of 2.7 kg and a volume of 1.0 L. Calculate its density in g/cm^3. (1 L = 1000 cm³).

(4)

3 Extended response: A local council is deciding whether to support a new small metal recycling plant near a town. Using your knowledge of metal extraction, corrosion and the rock cycle, evaluate the advantages and disadvantages for people and the environment. Write a balanced answer and give a reasoned conclusion.

(6)

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4 What is the test for hydrogen gas? Choose one: A) A glowing splint relights B) A lit splint gives a squeaky pop C) The gas turns limewater cloudy D) The gas bleaches damp litmus paper

- [ ] A) A glowing splint relights
- [ ] B) A lit splint gives a squeaky pop
- [ ] C) The gas turns limewater cloudy
- [ ] D) The gas bleaches damp litmus paper

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5 Complete the sentence: The reactivity series is a list of metals arranged from most reactive to least reactive. Place these metals in order from most reactive to least reactive: copper, potassium, iron.

(2)

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6 A strip of magnesium ribbon is burned in air. Describe what you would see and name the product formed.

(2)

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7 Sodium is more reactive than magnesium. A student puts a small piece of sodium into water and, in a separate test, a small piece of magnesium into water. Describe the differences the student should see between the two tests.

(3)

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8 A student places a strip of zinc into a blue copper(II) sulfate solution. Predict the colour change of the solution and explain why.

(2)

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9 State one method used to extract iron from its ore in a blast furnace and name one reactant used in the process.

(3)

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10 A student investigates how quickly different metals corrode in salty water. Suggest four variables they must keep the same to make the test fair and explain why.

(4)

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Mark scheme · 2.7 Metals, Reactivity and the Rock Cycle: 30-minute Pack

Question 1

state that extracting from ore requires heating, smelting and chemical processes that use lots of energy	M1
recycling uses less processing and lower temperatures so less energy is needed cao	A1

Answer: **Extracting from ores needs high-temperature smelting and chemical processing which uses lots of energy; recycling uses lower temperature processes and less processing, so it saves energy.**

Question 2

convert mass to grams: 2.7 kg = 2700 g and volume to cm^3: 1.0 L = 1000 cm^3	M1
substitute into density = mass / volume: 2700 / 1000	M1
answer 2.7 g/cm^3 cao	A1
correct unit g/cm^3	A1

Answer: **2.7 g/cm^3**

Question 3

Level 3 Detailed evaluation with several advantages and disadvantages linked to science. Clear, justified conclusion that weighs environmental and social factors and refers to energy savings and pollution control.	5-6
Level 2 Some relevant advantages and disadvantages with some linked reasons. A conclusion is given but it may be partially supported.	3-4
Level 1 Simple statements of advantage or disadvantage with little or no scientific explanation. No supported conclusion.	0-2

Indicative content:

- Advantages: recycling reduces need to extract metal from ores, saving energy and lowering CO_2 emissions; reduces mining damage to landscapes and habitats; can reduce landfill; creates local jobs.
- Disadvantages: recycling plant may produce noise, dust or local air pollution; risk of contamination of water if not managed; increased traffic for collection and processing; energy still needed for melting.
- Scientific links: extraction from ores uses smelting and high heat whereas recycling requires lower temperatures; corrosion issues mean recycled metals may need treatment; recycled metal supply reduces pressure on rock mining and quarrying.
- Conclusion: a supported judgement weighing local environmental controls and benefits of energy saving and reduced mining; e.g. support if strict pollution controls, noise limits and community benefits are in place, otherwise recommend further mitigation.

Question 4

B cao	B1

Answer: **B) A lit splint gives a squeaky pop**

Question 5

correct order: potassium, iron, copper	M1
Potassium, iron, copper cao	A1

Answer: **Potassium, iron, copper**

Question 6

a correct observation: burns with a bright white flame or bright white light, or a white powder or white ash is left, oe	B1
names the product: magnesium oxide	B1

Answer: **The magnesium burns with a bright white flame and leaves a white powder, magnesium oxide.**

Question 7

sodium: reacts vigorously, moves on surface, may fizz and melt into a ball	M1
magnesium: reacts slowly or very little with cold water, maybe slight fizzing or no visible reaction	M1
comparison statement referencing faster/stronger reaction for sodium than magnesium cao	A1

Answer: **Sodium reacts vigorously with water, fizzes, may move and form a small ball; magnesium reacts slowly or hardly at all with cold water, showing little or no fizzing. Sodium reacts much faster than magnesium.**

Question 8

prediction that the blue colour fades or the solution becomes colourless/less blue	M1
zinc displaces copper ions to form colourless zinc sulfate and copper metal precipitates, causing blue to fade cao	A1

Answer: **The blue colour will fade as copper metal forms and the solution becomes less blue (zinc ions replace copper ions).**

Question 9

method named: heating in a blast furnace, smelting, or reduction of the iron oxide with carbon / carbon monoxide	M1
reactant named: coke (carbon) or limestone or hot air (oxygen as part of hot air) - one required	M1
brief link: coke is used to reduce the iron oxide to iron (or limestone removes impurities) cao	A1

Answer: **Method: heating in a blast furnace (smelting). Reactant: coke (carbon) used to reduce iron oxide to iron.**

Question 10

variable: concentration of salt (same) with brief reason: affects corrosion rate	M1
variable: temperature (same) with brief reason: affects reaction speed	M1
variable: surface area of metal samples (same) with brief reason: more area gives more corrosion	A1
variable: time exposed (same) with brief reason: ensures fair comparison	A1

Answer: **Keep salt concentration and temperature the same so corrosion conditions do not vary; also use the same surface area and exposure time so results are comparable.**

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