Materials

Aims

You have been asked to design a quiz about certain materials, their reactions, and their uses that you have met in this chapter.

Work through the tasks below to show your understanding of this topic.

Your teacher may ask you to produce the quiz for homework, based on your answers to the tasks below.

Task 1: Reactions of metals

1 The table below show some observations from metal reactions.

	Reaction with		
	acid	**oxygen**	**water**
copper	does not react	does burn (forms a layer of oxide on surface when heated)	does not react
potassium	too dangerous to react	tarnishes in contact with oxygen	reacts vigorously with cold water (lilac flame produced)
magnesium	reacts vigorously	burns vigorously	reacts quickly with steam

Compare the reactivity of these three metals by completing the sentences below.

____________________ is the most reactive in water. ____________________ is the least reactive.

____________________ is less reactive than ____________________ but more reactive than ____________________ in oxygen.

____________________ is so reactive that it cannot be tested with dilute acid.

In terms of reactivity:

____________________ > ____________________ > ____________________

2 ____________________ gas is produced when a metal reacts in dilute acid. The presence of this gas can be tested by holding a lit splint next to the mouth of reaction vessel.

Write the word equation for this reaction below, then balance the formula equation and add state symbols.

__________________ + __________________ → __________________

______ H_2 (______) + ______ O_2 (______) → ______ H_2O (______)

Task 2: The reactivity series

1 The reactivity series of metals is shown below. Complete the series by filling in the corresponding element names and deleting the appropriate word on each arrow.

K	
Na	
Li	
Ca	
Mg	
Al	
C	
Zn	
Fe	
Pb	
Cu	
Ag	
Au	

↑ increasing/decreasing reactivity

↓ increasing/decreasing reactivity

2 Name the element that is the odd one out in the reactivity series above. Explain your answer.

____

____

3 a Carbon can be used to extract metals from their ores by replacing the metal in the compound with carbon. Name this type of reaction.

b List the metals from the reactivity series that can be extracted using carbon. Describe and explain why this can be done.

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4 Use the reactivity series to predict if the following pairs of substances will undergo displacement. For reactions that occur, write a word equation.

a iron + copper sulfate

____

b zinc + magnesium oxide

____

c sodium + iron chloride

____

d lead + aluminium nitrate

____

5 The iron ore haematite contains 70% iron by mass. We can calculate the amount of iron obtained in 1 tonne (1000 kg) of haematite by:

$$\text{mass of iron (kg)} = \frac{70}{100} \times 1000 = 700 \text{ kg}$$

Calculate the amount of calcium and magnesium obtained from 500 kg of dolomite, which is 22% calcium and 13% magnesium by mass. Show your working.

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Activate

Task 3: Ceramics, polymers, and composite materials

1 Complete the diagram below by joining ceramics, polymers, and composite materials to their descriptions and uses.

Type of material	Description	Possible uses
ceramics	There are two types of this material – natural and synthetic. Properties depend on the identical groups of atoms that make them. Properties include flexibility, strength, and durability.	Bricks for buildings, electrical power-line insulators, jet-engine turbine blades, and common kitchen crockery (plates, bowls, mugs, and jugs).
polymers	Made from a mixture of materials. Properties shown are combinations of the properties of the materials that make it. Examples of these materials do not rust, are extremely light, and can withstand stretching and squashing forces.	Reinforced concrete, carbon-fibre bicycles, glass-fibre-reinforced aluminium for making planes.
composites	These materials are made from compounds such as metal silicates, metal oxides, metal carbides, and metal nitrides. They are often hard, brittle, and solids at room temperatures. They are also electrical insulators.	Wool and cotton for clothes, rubber for tyres, LDPE for carrier bags, and PVC for insulating electric cables.

2 For one example of the uses of ceramics, polymers, and composites, explain how their properties make them suitable for their uses.

Ceramic: ____

____

Polymer: ____

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Composite: ____

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