Quiz (Reaction of Metal with Oxygen, Water and Dilute Acids)

1. For each of the following experiments, state an expected observation and write a balanced chemical equation for the reaction involved.
   (a) Heating sodium in air

   (b) Heating zinc in oxygen strongly

   (c) Heating copper in oxygen strongly

2. Rubidium (Rb) reacts with water to form a compound and hydrogen.
   (a) Compared with potassium, is the reaction of rubidium with water more vigorous? Explain your answer.

   (b) Does rubidium float on the water surface or sink to the bottom of water during the reaction?

   (c) Write a balanced chemical equation for the reaction of rubidium with water.

   (d) Is the resultant solution acidic or alkaline? Explain.

3. For each of the following experiments, predict whether a reaction would occur. Write a balanced chemical equation for any reaction involved.
   (a) Adding calcium granules to dilute hydrochloric acid

   (b) Adding zinc granules to dilute sulphuric acid

   (c) Adding silver to dilute hydrochloric acid

4. *A*, *B*, *C* and *D* are four different metals. The table below shows the results of three experiments carried out using the metals.

Experiment	**Metal**			
	A	***B***	***C***	***D***
Strong heating in air	burns with a brick red flame; a white powder forms	does not burn; its surface slowly turns black	burns with a lilac flame; a white powder forms	burns with a very bright white flame; a white powder forms
Reaction with cold water	moderate reaction; a colourless gas evolves	no observable change	vigorous reaction; burns with a lilac flame; a colourless gas evolves	no observable change
Reaction with dilute sulphuric acid	reacts quickly but the reaction stops soon; a colourless gas evolves	no observable change	(experiment not performed as the reaction is explosive)	reacts quickly; a colourless gas evolves

(a) What is the colourless gas formed when *A* is added to cold water? Suggest a test for the gas.

(b) Write a word equation for the reaction between *C* and cold water.

(c) Explain why the reaction of *A* with dilute sulphuric acid stops soon.

(d) Arrange the four metals in descending order of reactivity. Explain your answer.

(e) Suggest a possible name for each of the four metals.

5.

Experiment	Metal		
	A	***B***	**C**
Strong heating in air	burns with yellow sparks; a black solid forms	burns with a golden yellow flame; a white powder forms	burns, a yellow powder forms; but it turns white when cold
Reaction with cold water	no observable change	vigorous reaction; moves about on the water surface; burns by itself	no observable change
Reaction with dilute hydrochloric acid	colourless gas bubbles are given out slowly	(experiment not performed as the reaction is explosive)	colourless gas bubbles are given out rapidly

(a) Arrange the three metals in ascending order of reactivity. Explain your answer by referring to their reactions with dilute hydrochloric acid.

(b) Give a possible name for each of the three metals.

Suggested Answer

1. (a) Sodium burns vigorously with a golden yellow flame to produce a white powder.
$4Na(s) + O_2(g) \longrightarrow 2Na_2O(s)$

   (b) Zinc burns to give out some heat; a powder (yellow when hot, white when cold) forms.
$2Zn(s) + O_2(g) \longrightarrow 2ZnO(s)$

   (c) The surface of copper turns black.
$2Cu(s) + O_2(g) \longrightarrow 2CuO(s)$

2. (a) Yes. This is because the reactivity of Group I elements increases down the group.

   (b) Rubidium floats on the water surface during the reaction.

   (c) $2Rb(s) + 2H_2O(l) \longrightarrow 2RbOH(aq) + H_2(g)$

   (d) The resultant solution is alkaline because the rubidium hydroxide formed is alkaline.

3. (a) Yes
$Ca(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2(g)$

   (b) Yes
$Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2(g)$

   (c) No

4. (a) The gas is hydrogen. We can test the gas with a burning splint. It burns with a 'pop' sound.

   (b) *C* + water ⟶ hydroxide of *C* + hydrogen

   (c) An insoluble metal sulphate forms when *A* reacts with dilute sulphuric acid. It covers the metal surface and stops further reaction.

   (d) *C*, *A*, *D*, *B*.

   C and *A* are more reactive than *B* and *D* because they can react with cold water. *C* reacts more vigorously with water than *A*.

   Hence, *C* is more reactive than *A*. *D* is more reactive than *B* because it can react with dilute sulphuric acid while *B* cannot.

   (e) *A*: calcium; *B*: copper; *C*: potassium; *D*: magnesium

5. (a) *A*, *C*, *B*

B is the most reactive metal because it reacts explosively with dilute hydrochloric acid.

C is more reactive than *A* because *C* reacts more rapidly with dilute hydrochloric acid than *A*.

(b) *A*: iron; *B*: sodium; *C*: zinc