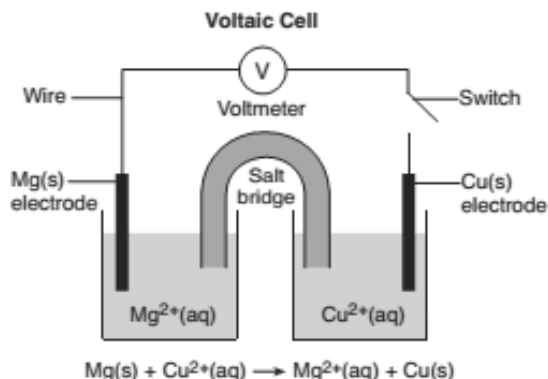


CONSTRUCTED RESPONSE REVIEW: Redox & Electrochemistry

June 2009

Base your answers to questions 60 through 62 on the information below.

A voltaic cell with magnesium and copper electrodes is shown in the diagram below. The copper electrode has a mass of 15.0 grams.



When the switch is closed, the reaction in the cell begins. The balanced ionic equation for the reaction in the cell is shown below the cell diagram. After several hours, the copper electrode is removed, rinsed with water, and dried. At this time, the mass of the copper electrode is greater than 15.0 grams.

- 60 State the direction of electron flow through the wire between the electrodes when the switch is closed. [1]
- 61 State the purpose of the salt bridge in this cell. [1]
- 62 Explain, in terms of copper ions and copper atoms, why the mass of the copper electrode increases as the cell operates. Your response must include information about *both* copper ions and copper atoms. [1]

Answers:

60. _____

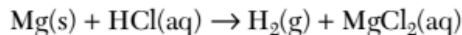
61. _____

62. _____

January 2010

Base your answers to questions 69 through 71 on the information below.

In a laboratory investigation, magnesium reacts with hydrochloric acid to produce hydrogen gas and magnesium chloride. This reaction is represented by the unbalanced equation below.



- 69 State, in terms of the relative activity of elements, why this reaction is spontaneous. [1]
- 70 Balance the equation *in your answer booklet*, using the smallest whole-number coefficients. [1]
- 71 Write a balanced half-reaction equation for the oxidation that occurs. [1]

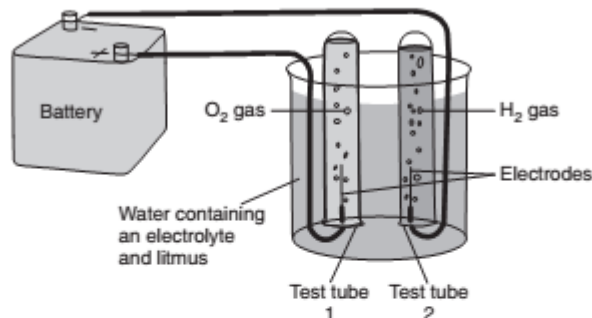
69 _____

70 _____ Mg(s) + _____ HCl(aq) → _____ H₂(g) + _____ MgCl₂(aq)

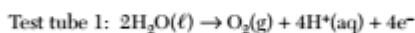
71 _____

Base your answers to questions 82 through 84 on the information below.

The diagram below shows a system in which water is being decomposed into oxygen gas and hydrogen gas. Litmus is used as an indicator in the water. The litmus turns red in test tube 1 and blue in test tube 2.



The oxidation and reduction occurring in the test tubes are represented by the balanced equations below.



- 82 Identify the information in the diagram that indicates this system is an electrolytic cell. [1]
- 83 Determine the change in oxidation number of oxygen during the reaction in test tube 1. [1]
- 84 Explain, in terms of the products formed in test tube 2, why litmus turns blue in test tube 2. [1]

Answers:

82. _____

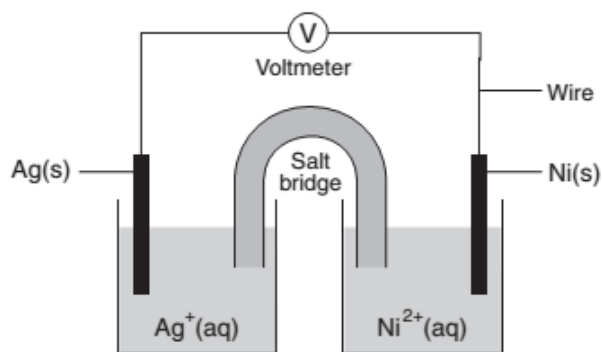
83. _____ to _____

84. _____

August 2010

Base your answers to questions 64 through 66 on the information below.

The diagram below represents an operating voltaic cell at 298 K and 1.0 atmosphere in a laboratory investigation. The reaction occurring in the cell is represented by the balanced ionic equation below.



- 64 Identify the anode in this cell. [1]
- 65 Determine the total number of moles of $\text{Ni}^{2+}(\text{aq})$ ions produced when 4.0 moles of $\text{Ag}^+(\text{aq})$ ions completely react in this cell. [1]
- 66 Write a balanced half-reaction equation for the reduction that occurs in this cell. [1]

Answers:

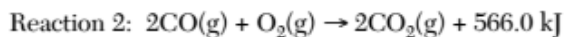
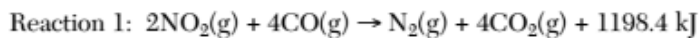
64. _____

65. _____ mol

66. _____

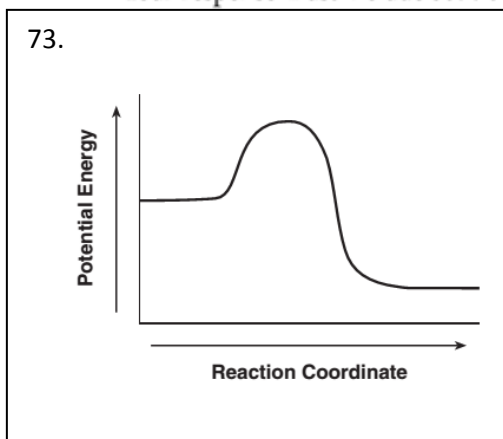
Base your answers to questions 73 and 74 on the information below.

The catalytic converter in an automobile changes harmful gases produced during fuel combustion to less harmful exhaust gases. In the catalytic converter, nitrogen dioxide reacts with carbon monoxide to produce nitrogen and carbon dioxide. In addition, some carbon monoxide reacts with oxygen, producing carbon dioxide in the converter. These reactions are represented by the balanced equations below.



73 The potential energy diagram in *your answer booklet* represents reaction 1 without a catalyst. On the same diagram, draw a dashed line to indicate how potential energy changes when the reaction is catalyzed in the converter. [1]

74 Determine the oxidation number of carbon in *each* carbon compound in reaction 2. Your response must include *both* the sign and value of *each* oxidation number. [1]



74 CO: _____

CO₂: _____

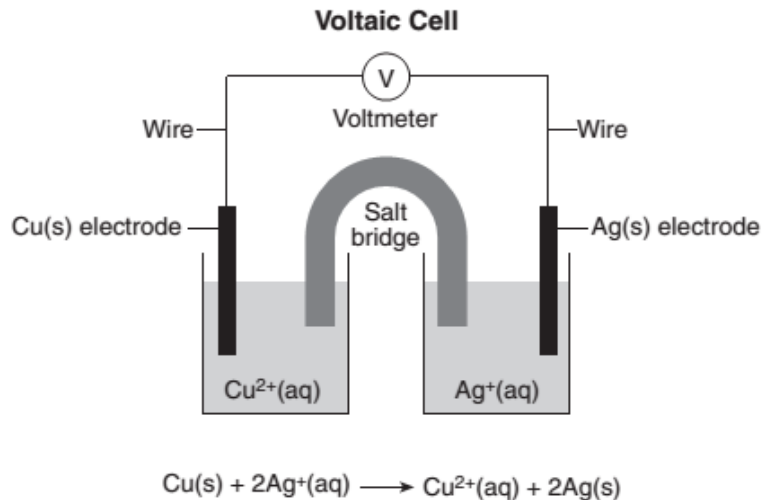
January 2011

52 Explain, in terms of activity, why HCl(aq) reacts with Zn(s), but HCl(aq) does *not* react with Cu(s). [1]

Answers to Question 52

Base your answers to questions 62 and 63 on the information below.

The diagram and balanced ionic equation below represent a voltaic cell with copper and silver electrodes and the reaction that occurs when the cell is operating.



Answers:

62. _____

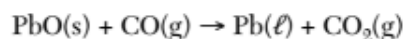
63.

62 Describe the direction of electron flow in the external circuit in this operating cell. [1]

63 State the purpose of the salt bridge in this voltaic cell. [1]

Base your answers to questions 75 through 77 on the information below.

Litharge, PbO, is an ore that can be roasted (heated) in the presence of carbon monoxide, CO, to produce elemental lead. The reaction that takes place during this roasting process is represented by the balanced equation below.



75 Write the balanced equation for the reduction half-reaction that occurs during this roasting process. [1]

76 Determine the oxidation number of carbon in carbon monoxide. [1]

77 Calculate the percent composition by mass of oxygen in litharge (gram-formula mass = 223.2 grams per mole). Your response must include *both* a numerical setup and the calculated result. [2]

Answers:

75 _____

76 _____

77

_____ %