**Redox topic test solutions**

**SECTION A: Multiple-choice questions (1 mark each)**

**Question 1**

*Answer:* C

*Explanation:*

Assume oxygen is -2 to work out the oxidation number of bromine.

**Question 2**

*Answer:* B

*Explanation:*

Sulfur in sulfuric acid is +6 and in SO2 it is +4.

**Question 3**

*Answer:* D

*Explanation:*

The reaction at the cathode will be reduction. Option D shows the reduction of sulfur.

**Question 4**

*Answer:* D

*Explanation:*

The efficiency of a modern fuel cell should be higher than that of a gas-fired power station.

**Question 5**

*Answer:* B

*Explanation:*

The oxidation state of nitrogen in NO3- is +5, while in NO it is +2.

**Question 6**

*Answer:* D

*Explanation:*

Aluminium metal is oxidised and chlorine gas is reduced. The electrons flow from the aluminium to the chlorine electrode.

**Question 7**

*Answer:* A

*Explanation:*

Experiment 1 shows gallium is more reactive than cadmium and experiment 2 shows rubidium is more reactive than gallium. A discussion of oxidants will be a comparison of the ions of eac metal.

**Question 8**

*Answer:* A

*Explanation:*

Zinc metal is oxidised in tis reaction and silver ions are reduced.

**Question 9**

*Answer:* A

*Explanation:*

Alternative A shows a balanced equation for the reaction of zinc with silver oxide.

**Question 10**

*Answer:* D

*Explanation:*

 The anode reaction needs to be oxidation so it will be the reaction of ethane not oxygen. Alternative B is correctly balanced.

**SECTION B: Short-answer questions**

**Question 1** (7 marks)

**a**. **i**. C2O42- +3 **ii**. **N**H4+ -3 **iii**. **N**O2- +3 3 marks

**b**. **i**. O2 + 4e- 🡪 2O2- 2 marks

 **ii**. Sn2+ 🡪 Sn4+ + 2e-

**c**. **i**. SO32-(aq) + H2O(l) 🡪 SO42-(aq) + 2H+(aq) + 2e- 2 marks

 **ii**. IO3-(aq) + 6H+(aq) + 5e- 🡪 I2(aq) + 3H2O(l)

**Question 2** (6 marks)

**a**. Fe2+(aq) 🡪 Fe3+(aq) + e-  reducing agent 3 marks

 Cl2(g) + 2e- 🡪 2Cl-(aq) oxidizing agent

**b**. K(s) 🡪 K+(aq) + e- reducing agent 3 marks

 Al3+(aq) + 3e- 🡪 Al(s) oxidizing agent

**Question 3** (8 marks)

 + e -

 *Platinum electrode with Cl2 in NaCl Magnesium electrode in Mg(NO3)2*



Voltage 3.63 V

 ½ equations Cl2(g) + 2e- 🡪 2Cl-(aq) Mg(s) 🡪 Mg2+(aq) + 2e-

 Mg(s) + Cl2(g) 🡪 Mg2+(aq) + 2Cl-(aq)

**Question 4** (6 marks)

**a**. FeCl3(aq) + Ni(s) 1 mark

**b**. Fe3+(aq) + e- 🡪 Fe2+(aq)

 Ni(s) 🡪 Ni2+(aq) + 2e-

 2FeCl3(aq) + Ni(s) 🡪 2FeCl2(aq) + NiCl2(aq) 3 marks

**c**. Fe3+(aq) 1 mark

**Question 5** (6 marks)

**a**. **i**. A secondary cell is a cell that can be recharged. The products of the reaction stay in contact with the

 electrodes to facilitate this. 2 marks

 **ii**. A secondary cell has a set amount of reactant while a fuel cell has a continuous supply of reactants.

**b**. Anode: Cd(s) + 2OH-(aq) 🡪 Cd(OH)2(s) + 2e-  2 marks

 Cathode: 2NiO(OH)(s) + 2H2O(l) + 2e- 🡪 2Ni(OH)2(s) + 2OH-(aq)

**c**.  **i**. 2Ni(OH)2(s) + Cd(OH)2(s) 🡪 Cd(s) + 2NiO(OH)(s) + 2H2O(l) 2 marks

 **ii**. Nickel electrode

**Question 6** (7 marks)

**a**. anode: CH4(g) + 2H2O(l) 🡪 CO2(g) + 8H+(aq) + 8e-

 cathode: O2(g) + 4H+(aq) + 4e- 🡪 2H2O(l)

 overall equation: CH4(g) + 2O2(g) 🡪 CO2(g) + 2H2O(l) 3 marks

**b**. **i**. CH4  will react at the negative anode. 1 mark

 **ii**. -4 to +4 1 mark

**c**. Renewability will depend upon the source of methane. If it is obtained as a fossil fuel the process is non-

 renewable. If it is sourced as biogas it could be renewable. 2 marks