EEC Assignment 1 ANSWERS

- 1. (a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
- (b) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2$
- (c) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$
- (d) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$
- (e) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$
- 2. (a) s
- (b) d
- (c) f
- (d) p
- 3. (a) Sodium has a metallic nature and a low electronegativity

Aluminium has a metalloid nature and an intermediate electronegativity

Phosphorus has a non-metal nature and a high electronegativity

(b) Sodium oxide is basic, so it reacts with hydrogen ions:

$$Na_2O_{(aq)} + 2H^+_{(aq)} \rightarrow 2Na^+_{(aq)} + H_2O_{(1)}$$

$$Na_2O_{(aq)} + H_2O_{(1)} \rightarrow 2Na^+_{(aq)} + 2OH^-_{(aq)}$$

Aluminium oxide is amphoteric, so it reacts with both hydrogen ions and hydroxide ions:

$$Al_2O_{3(s)} + 6H^+_{(aq)} \rightarrow 2Al^{3+}_{(aq)} + 3H_2O_{(l)}$$

$$Al_2O_{3(s)} + 2OH_{(aq)}^- \rightarrow 2AlO_{2(aq)}^- + H_2O_{(1)}$$

Phosphorus oxide is acidic, so it reacts with hydroxide ions:

$$P_4O_{10(aq)} + 12OH_{(aq)}^- \rightarrow 4PO_4^{3-} + 6H_2O_{(1)}$$

$$P_4O_{10(aq)} + 6H_2O_{(l)} \rightarrow 4H_3PO_{4(aq)}$$

4. carbon/sulfur/nitrogen (not silicon as it does not dissolve in water)

$$CO_{2(aq)} + H_2O_{(l)} \to H_2CO_{3(aq)} \qquad SO_{2(aq)} + H_2O_{(l)} \to H_2SO_{3(aq)} \qquad 2NO_{2(aq)} + H_2O_{(l)} \to HNO_{3(aq)} + HNO_{2(aq)} + HOO_{2(aq)} + H$$

(a) Iron (or chromium)

$$\text{(b)} \hspace{0.5cm} Fe_2O_{3(s)} + 6H^+_{\ (aq)} \to 2Fe^{3+}_{\ (aq)} + 3H_2O_{(l)}$$

$$Fe_2^{}O_{_{3(s)}} + 3H_2^{}O \ \rightarrow 6OH^{^-}{_{(aq)}} + 2Fe^{^{3+}}{_{(aq)}}$$

6. Copper (basic)

$$CuO_{(s)} + 2H^{+}_{(aq)} \rightarrow Cu^{2+}_{(aq)} + H_{2}O_{(1)}$$

$$CuO_{_{(s)}} + H_{_2}O_{_{(l)}} \to Cu^{^{2+}}_{\phantom{^{(aq)}}} + OH^{^-}_{\phantom{^{(aq)}}}$$

Zinc (amphoteric)

$$ZnO_{(s)} + 2H^{+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + H_{2}O_{(1)}$$

$$ZnO_{(s)} + 2OH^{-}_{(aq)} \rightarrow ZnO_{2}^{2-}_{(aq)} + H_{2}O_{(l)}$$

7.

5.

- (a) GO_3 would be acidic, Q_2O would be basic, and J_2O_3 would be amphoteric.
- (b) (1) G, since it forms an acidic oxide and therefore is likely to be found to the right of the periodic table.
 - (2) Q, since it forms a basic oxide and therefore is likely to be found to the left of the periodic table.
- (c) G: group VI, Q: group I, J: group III