

Describe the periodic trends exhibited by atomic radii. Justify these trends in terms of principal quantum number,  $n$ , and effective nuclear charge,  $Z_{\text{eff}}$ .

**Marks**  
**2**

Giving reasons, order either the set of oxyacids or the binary acids in terms of increasing acidity.

$\text{HClO}$ ,  $\text{HClO}_2$ ,  $\text{HClO}_3$ ,  $\text{HClO}_4$       or       $\text{H}_2\text{O}$ ,  $\text{H}_2\text{S}$ ,  $\text{H}_2\text{Se}$ ,  $\text{H}_2\text{Te}$

**Marks**  
**2**

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- Explain why  $\text{HClO}_4$  is a stronger Brønsted acid than  $\text{HBrO}_4$ , but  $\text{HCl}$  is a weaker acid than  $\text{HBr}$ .

**Marks**  
**2**

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- Describe the periodic trends of **either** atomic radius **or** of ionisation energy.  
Explain the trend in the property selected.

**1**

**THE REMAINDER OF THIS PAGE IS FOR ROUGH WORKING ONLY.**

**Marks**  
**2**

- Order **either one** of the two following sets of oxides in terms of increasing acidity. Explain the reasons for your order.

1.  $\text{HBrO}_4$ ,  $\text{H}_3\text{AsO}_4$ ,  $\text{H}_2\text{SeO}_4$ 2.  $\text{HClO}_2$ ,  $\text{HClO}$ ,  $\text{HClO}_4$ ,  $\text{HClO}_3$ .

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- Explain in terms of their electronic configurations **and** ionisation energies why the halogens (Group 17) are powerful *oxidising* agents.

**Marks**  
**2**

- Explain why  $\text{H}_2\text{SO}_4$  is a stronger acid than  $\text{H}_2\text{SO}_3$ .

**Marks**  
**2**

- Explain in terms of their electronic configurations **and** ionisation energies why the alkali metals (Group 1) are powerful *reducing* agents.

**Marks**  
**2**

- Briefly explain how the concept of electronegativity can rationalise the existence of acidic, basic and amphoteric oxides.

**Marks**  
**3**

- Briefly explain why  $\text{H}_2\text{Se}$  is a stronger Brønsted-Lowry acid than  $\text{H}_2\text{O}$  and a weaker acid than  $\text{H}_2\text{Te}$ .

**Marks**  
**2**

- Rank  $\text{H}_2\text{O}(\text{l})$ ,  $\text{H}_2\text{S}(\text{aq})$  and  $\text{HF}(\text{aq})$  in order of their Brønsted acid strengths. Explain your reasoning.

**Marks**  
**2**

- Buffer systems are frequently used in chemistry. Briefly describe a buffer system and how it functions? Use equations where appropriate.

**4**

What ratio of concentrations of acetic acid to sodium acetate would you require to prepare a buffer with  $\text{pH} = 4.00$ ? The  $K_a$  of acetic acid is  $1.8 \times 10^{-5}$  M.

Answer:

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- Briefly explain why HF is a weaker Brønsted acid than HI and a stronger acid than H<sub>2</sub>O.

**Marks**  
**2**

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