

Name \_\_\_\_\_ Date \_\_\_\_\_

## Worksheet 10.1: The trends in the properties of elements down a group and across a period

1 Complete the following sentences with the word *increases* or *decreases*:

- a Going down Group 1, the atomic radius \_\_\_\_\_
- b Going across Period 2, the atomic radius \_\_\_\_\_
- c Going down Group 1, the electronegativity \_\_\_\_\_
- d Going across Period 2, the electronegativity \_\_\_\_\_

2 Complete the following sentences with the word *exothermic* or *endothermic*:

- a Going down Group 1, the first ionisation energy becomes less  
\_\_\_\_\_
- b Going across Period 2, the first ionisation energy generally becomes more  
\_\_\_\_\_
- c For the same element, the successive ionisation energy becomes more  
\_\_\_\_\_
- d Going down Group 17, the first electron affinity generally becomes less  
\_\_\_\_\_
- e Going across Period 3 from Al to Cl, the first electron affinity generally becomes more  
\_\_\_\_\_

3 Explain your answer to the following questions:

- a Which of the atoms Na, K and Rb would have the smallest radius?  
\_\_\_\_\_  
\_\_\_\_\_
- b Which of the ions  $F^-$ ,  $Cl^-$  and  $Br^-$  would have the smallest radius?  
\_\_\_\_\_  
\_\_\_\_\_

- c Which of  $F^-$ , Ne and  $Na^+$  would have the smallest radius?

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- d Which of  $P^{3-}$ ,  $S^{2-}$  and  $Cl^-$  would have the smallest radius?

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- e Which of Sc, Ti and V would have the smallest radius?

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- 4 Deduce the oxidation state of vanadium in  $VO_3^-$ ,  $V^{3+}$ ,  $VO_2^+$ , and  $VO^{2+}$ .

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- 5 This question is about the ionisation energies of sodium.

- a Write down the full electron configuration of a sodium atom.

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- b Define the term first ionisation energy and write an equation to show the second ionisation energy of sodium.

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- c Explain why the second ionisation energy of sodium is much higher than its first ionisation energy.

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- d Explain why the third ionisation energy of sodium is higher than its second ionisation energy.

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- e Explain why magnesium has a higher first ionisation energy than sodium.

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**6** This question is about the electron affinities of Group 17 elements.

**a** Define the term first electron affinity and write an equation to show the second electron affinity of chlorine.

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**b** Explain the signs for the first and second electron affinities of chlorine.

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**c** Explain the trend of first electron affinities for chlorine, bromine and iodine.

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**d** Explain why fluorine has a less exothermic first electron affinity than chlorine.

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