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90780

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 3 Chemistry, 2006

90780 Describe properties of particles and thermochemical principles

Credits: Five
9.30 am Monday 27 November 2006

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

A Periodic Table is provided on the RESOURCE SHEET in your Level 3 Chemistry package.

You should answer ALL the questions in this booklet.

Show all working for all calculations.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

For Assessor's use only	**Achievement Criteria**		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe properties of particles and thermochemical principles.	Explain and apply properties of particles and thermochemical principles.	Discuss properties of particles and thermochemical principles.
Overall Level of Performance		

You are advised to spend 45 minutes answering the questions in this booklet.

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QUESTION ONE: PROPERTIES OF ATOMS AND IONS

(a) Compare the relative sizes of the Ca^{2+} and Cl^{-} ions, and explain the difference in their radii.

(b) (i) Describe what is meant by "the first ionisation energy of chlorine".

(ii) Place magnesium, calcium and chlorine atoms in order of increasing first ionisation energies (IE). Justify your answer in terms of the factors that affect ionisation energy.

Order of increasing IE is _____

QUESTION TWO: SHAPES AND POLARITIES

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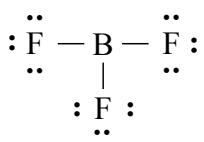
(a) Complete the table below by:

(i) drawing Lewis diagrams for phosphorus trifluoride, PF_3, and tetrachloroiodide ion ICl_4^-,

(ii) identifying the shape of BF_3, PF_3 and ICl_4^-.

		BF_3	**PF_3**	**ICl_4^-**
(i)	**Lewis diagram**			
(ii)	**Shape**			

(b) Discuss reasons for the difference in the polarities of BF_3 and PF_3 molecules.

QUESTION THREE: TRANSITION METALS

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(a) Write the electron configuration for:

Cr _____

Mn _____

Mn^{2+} _____

(b) Explain why manganese and chromium form a variety of different compounds and ions with oxygen.

_____

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(c) Explain why most manganese and chromium compounds are coloured.

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QUESTION FOUR: ENTHALPY OF VAPORISATION

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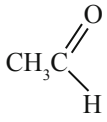
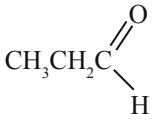
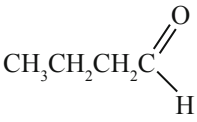
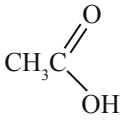
Use the following information to answer the question below.

	ethanal	propanal	butanal	ethanoic acid
				
$\Delta_{vap}H$ / kJ mol^{-1}	26	30	34	52

Discuss the trend in $\Delta_{vap}H$ of the compounds in the table above in terms of the **attractive forces** between the particles and the **factors** affecting those forces.

QUESTION FIVE: ENTHALPY OF FORMATION AND COMBUSTION

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(a) Write the equation for the reaction that has an enthalpy change equal to $\Delta_c H°(H_2, g)$

(b) Explain why $\Delta_f H°(H_2O, \ell)$ is equal to $\Delta_c H°(H_2, g)$.

(c) (i) Calculate the enthalpy of formation of water in the **gas** state, $\Delta_f H°(H_2O, g)$, using the following bond enthalpies.

Bond	Bond enthalpy / kJ mol^{-1}
H–H	436
O–H	463
O=O	498

(ii) The experimental value for $\Delta_f H°(H_2O, \ell)$ is –286 kJ mol^{-1}.

Using the information above, calculate the $\Delta_{vap} H°(H_2O)$, and also the heat required to vaporise 100 g of water.

(d) Calculate $\Delta_f H°(C_2H_5OH, \ell)$ using the following data.

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$\Delta_c H°(C_2H_5OH, \ell) = -1367 \text{ kJ mol}^{-1}$
$\Delta_f H°(CO_2, g) = -394 \text{ kJ mol}^{-1}$
$\Delta_f H°(H_2O, \ell) = -286 \text{ kJ mol}^{-1}$

Extra paper for continuation of answers if required.
Clearly number the question.

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Question number