91390M

913905

NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

3

SUPERVISOR'S USE ONLY

Te Mātauranga Matū, Kaupae 3, 2018

91390M Te whakaatu māramatanga ki ngā tikanga matūrewarau me ngā āhuatanga o ngā korakora me ngā matū

2.00 i te ahiahi Rāpare 15 Whiringa-ā-rangi 2018
Whiwhinga: Rima

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā tikanga matūrewarau me ngā āhuatanga o ngā korakora me ngā matū.	Te whakaatu māramatanga hōhonu ki ngā tikanga matūrewarau me ngā āhuatanga o ngā korakora me ngā matū.	Te whakaatu māramatanga matawhānui ki ngā tikanga matūrewarau me ngā āhuatanga o ngā korakora me ngā matū.

Tirohia mēnā e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

Me whakamātau koe i ngā tūmahi KATOA kei roto i tēnei pukapuka.

He taka pūmotu me ētahi atu rauemi tautoko kei te Pukapuka Rauemi L3–CHEMMR.

Mēnā ka hiahia whārangi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–19 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI

MĀ TE KAIMĀKA ANAKE

(a) Whakaotihia te tūtohi e whai ake nei.

Tohu	Whakanaha irahiko (whakamahia te tuhinga *s, p, d*)
V	
Cu^{+}	
Br^{-}	

(b) Whakamāramahia mai ngā āhuatanga e whakaawe ana i ngā ia i roto i te pūngao katotetanga tuatahi me te pūtoro ngota puta i te kapa tuarua o te taka pūmotu.

I tō tuhinga, me:

- whakaahua ngā ia kei te pūngao katotetanga tuatahi me te pūtoro ngota puta i te kapa tuarua.
- whakamārama ngā āhuatanga e whakaawe ana i ngā ia kei te pūngao katotetanga tuatahi me te pūtoro ngota puta i te kapa tuarua.
- whakahāngai te ia kei te pūngao katotetanga tuatahi ki te ia kei te pūtoro ngota.

MĀ TE KAIMĀKA ANAKE

(c) (i) Whakaotihia te tūtohi e whai ake nei.

	AsF_5	BrF_5
Hoahoa Lewis		
Te ingoa o te hanga		

QUESTION ONE

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(a) Complete the following table.

Symbol	Electron configuration (use *s, p, d* notation)
V	
Cu^+	
Br^-	

(b) Explain the factors influencing the trends in first ionisation energy and atomic radius across the second period of the periodic table.

In your answer, you should:

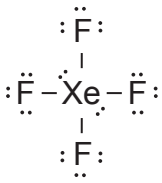
- describe the trends in both first ionisation energy and atomic radius across the second period
- explain the factors influencing the trends in first ionistion energy and atomic radius across the second period
- relate the trend in first ionisation energy to the trend in atomic radius.

ASSESSOR'S USE ONLY

(c) (i) Complete the table below.

	AsF_5	BrF_5
Lewis diagram		
Name of shape		

(ii) E whakaaturia ana i raro ko te hoahoa Lewis me te hanga mō XeF_4.



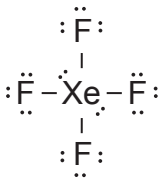
papatahi tapawhā rite

Whakamārama whānuitia te hanga me te tōranga o XeF_4.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(ii) The Lewis diagram and shape for XeF_4 are given below.



square planar

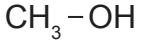
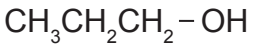
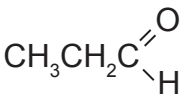
Elaborate on the shape and polarity of XeF_4.

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

Ko te hāwera (enthalpy) noa o te rehuwaitanga, $\Delta_{vap}H°$, o te waihā mewaro, o te waihā-1-pōwaro me te hāparo-tahi pōwaro ka tukuna ki te tūtohi i raro.

(a) (i) Whakarārangihia mai ngā tōpana kume katoa i waenga i ngā rāpoi ngota i te āhua wē.

Rāpoi ngota	$\Delta_{vap}H°$ **/kJ mol^{-1}**	M **/g mol^{-1}**	**Ngā tōpana kume**
Waihā mewaro 	38	32	
Waihā-1-pōwaro 	47	60	
Hāporo-tahi pōwaro 	30	58	

(ii) Whakatauritea te hāwera o te rehuwaitanga o te waihā mewaro, o te waihā-1-pōwaro me te hāparo-tahi pōwaro.

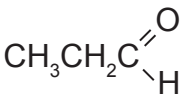
I tō whakautu tuhia he whakamāramatanga o te torokaha hāngai o ngā tōpana kume i waenga i ngā rāpoi ngota.

QUESTION TWO

ASSESSOR'S USE ONLY

The standard enthalpy of vaporisation, $\Delta_{vap}H°$, of methanol, propan-1-ol, and propanal, are given in the table below.

(a) (i) List all the forces of attraction between the molecules in their liquid state.

Molecule	$\Delta_{vap}H°$ /kJ mol^{-1}	M /g mol^{-1}	Attractive forces
Methanol CH_3-OH	38	32	
Propan-1-ol $CH_3CH_2CH_2-OH$	47	60	
Propanal 	30	58	

(ii) Compare and contrast the enthalpy of vaporisation of methanol, propan-1-ol, and propanal.

Your answer should include an explanation of the relative strength of the attractive forces between the molecules.

(b) (i) Ko te whārite mō te ngingiha o te waihā-1-pōwaro ko:

$$C_3H_7OH(\ell) + 4.5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(\ell)$$

Tātaitia te hāwera noa o te ngingiha, $\Delta_c H°$, o te waihā-1-pōwaro, e ai ki ngā raraunga i raro nei:

$\Delta_f H°(C_3H_7OH(\ell)) = -255$ kJ mol^{-1}
$\Delta_f H°(CO_2(g)) = -394$ kJ mol^{-1}
$\Delta_f H°(H_2O(\ell)) = -286$ kJ mol^{-1}

MĀ TE KAIMĀKA ANAKE

(ii) Me whakamārama mai he aha te take ka rerekē te $\Delta_c H°$(waihā-1-pōwaro) mēnā i puta te wai hei haurehu kē, kaua hei wē.

ASSESSOR'S USE ONLY

(b) (i) The equation for the combustion of propan-1-ol is:

$$C_3H_7OH(\ell) + 4.5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(\ell)$$

Calculate the standard enthalpy of combustion, $\Delta_c H°$, of propan-1-ol, given the following data:

$\Delta_f H°(C_3H_7OH(\ell)) = -255$ kJ mol^{-1}

$\Delta_f H°(CO_2(g)) = -394$ kJ mol^{-1}

$\Delta_f H°(H_2O(\ell)) = -286$ kJ mol^{-1}

(ii) Explain how $\Delta_c H°$(propan-1-ol) would differ if water was produced as a gas rather than a liquid.

(c) Ko te whārite mō te hanganga o te $Al_2Cl_6(s)$ he:

$$2Al(s) + 3Cl_2(g) \rightarrow Al_2Cl_6(s)$$

Tātaihia te panoni hāwera, $\Delta_r H°$, mō tēnei tauhohenga, mā te whakamahi i ngā raraunga e whai ake ana:

$$2Al(s) + 6HCl(aq) \rightarrow Al_2Cl_6(aq) + 3H_2(g) \qquad \Delta_r H° = -1003 \text{ kJ mol}^{-1}$$

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g) \qquad \Delta_r H° = -184 \text{ kJ mol}^{-1}$$

$$HCl(g) \rightarrow HCl(aq) \qquad \Delta_r H° = -72.4 \text{ kJ mol}^{-1}$$

$$Al_2Cl_6(s) \rightarrow Al_2Cl_6(aq) \qquad \Delta_r H° = -643 \text{ kJ mol}^{-1}$$

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(c) The equation for the formation of $Al_2Cl_6(s)$ is:

$$2Al(s) + 3Cl_2(g) \rightarrow Al_2Cl_6(s)$$

Calculate the enthalpy change, $\Delta_r H°$, for this reaction using the following data:

$$2Al(s) + 6HCl(aq) \rightarrow Al_2Cl_6(aq) + 3H_2(g) \qquad \Delta_r H° = -1003 \text{ kJ mol}^{-1}$$

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g) \qquad \Delta_r H° = -184 \text{ kJ mol}^{-1}$$

$$HCl(g) \rightarrow HCl(aq) \qquad \Delta_r H° = -72.4 \text{ kJ mol}^{-1}$$

$$Al_2Cl_6(s) \rightarrow Al_2Cl_6(aq) \qquad \Delta_r H° = -643 \text{ kJ mol}^{-1}$$

TŪMAHI TUATORU

MĀ TE KAIMĀKA ANAKE

(a) (i) Tuhia he whārite hei whakaatu i te hāwera o te honokarihi (rewa), $\Delta_{fus}H°$, o te wai.

(ii) He aha i nui ake ai te hāwera o te whakahaurehu wai i te hāwera o te honokarihi?

(b) Ina rewa ana te 10.6 g o te haukini pūhaumāota, NH_4Cl, ki te 65.0 mL o te wai, ka huri te paemahana o te wai mai i te 20.9°C ki te 11.5°C.

Ko te papatipu o te mehanga whakamutunga he 75.6 g

Me kī, ko te kītanga wera motuhake o te haukini pūhaumāota waiwai he 4.18 J g^{-1} $°C^{-1}$

$M(NH_4Cl) = 53.5$ g mol^{-1}

Tātaihia te panoni hāwera, $\Delta_r H°$, mō te whakarewa i te haukini pūhaumāota ki roto i te wai.

QUESTION THREE

ASSESSOR'S USE ONLY

(a) (i) Write an equation to represent the enthalpy of fusion (melting), $\Delta_{fus}H°$, of water.

(ii) Why is the enthalpy of vaporisation of water larger than its enthalpy of fusion?

(b) When 10.6 g of ammonium chloride, NH_4Cl, is dissolved in 65.0 mL of water, the temperature of the water changes from 20.9°C to 11.5°C.

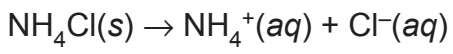
The mass of the final solution is 75.6 g

Assume specific heat capacity of aqueous ammonium chloride = 4.18 J g^{-1} $°C^{-1}$

$M(NH_4Cl)$ = 53.5 g mol^{-1}

Calculate the enthalpy change, $\Delta_r H°$, for dissolving ammonium chloride in water.

(c) He tukanga pauwera te whakarewa i te haukini pūhaumāota i te wai, engari ka rewa noa te haukini pūhaumāota i rō wai.



$$NH_4Cl(s) \rightarrow NH_4^+(aq) + Cl^-(aq)$$

Me parahau, e ai ki ngā panoni pūngao ngoikore o te pūnaha me ngā mea o waho, he aha i rewa noa ai te haukini pūhaumāota i rō wai.

MĀ TE KAIMĀKA ANAKE

(c) The dissolving of ammonium chloride in water is an endothermic process, but ammonium chloride readily dissolves in water.

$$NH_4Cl(s) \rightarrow NH_4^+(aq) + Cl^-(aq)$$

Justify, in terms of the entropy changes of the system and the surroundings, why ammonium chloride readily dissolves in water.

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He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

TAU TŪMAHI

MĀ TE KAIMĀKA ANAKE

Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

ASSESSOR'S USE ONLY

English translation of the wording on the front cover

Level 3 Chemistry, 2018

91390 Demonstrate understanding of thermochemical principles and the properties of particles and substances

2.00 p.m. Thursday 15 November 2018
Credits: Five

91390M

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of thermochemical principles and the properties of particles and substances.	Demonstrate in-depth understanding of thermochemical principles and the properties of particles and substances.	Demonstrate comprehensive understanding of thermochemical principles and the properties of particles and substances.

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

You should attempt ALL the questions in this booklet.

A periodic table and relevant formulae are provided in the Resource Booklet L3–CHEMR.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–19 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.