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, 2017

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

2.00 i te ahiahi Rāapa 15 Whiringa-ā-rangi 2017
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 kua whakaritea ki te Puka Rauemi L3-CHEMMR.

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

HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI 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 korakora	Whakanaha irahiko (whakamahia te tuhinga *s, p, d*)	Whana hiko	Tau Iraoho
Cl		0	
		+2	20
Mn^{2+}			

(b) (i) Tautuhia te kupu tōrarotanga hiko.

(ii) Whakamāramahia mai he aha i nui ake ai te tōrarotanga hiko o te haumāota i tō te pūtūtaewhetū[1].

[1] poporahi

QUESTION ONE

ASSESSOR'S USE ONLY

(a) Complete the following table.

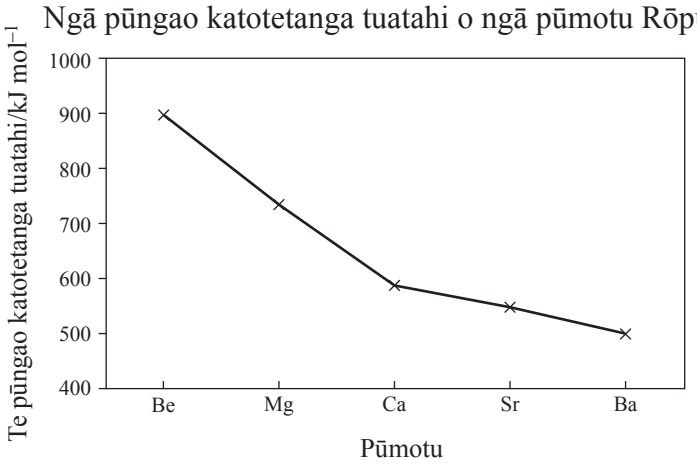
Symbol of particle	Electron configuration (use *s, p, d* notation)	Charge	Atomic number
Cl		0	
		+2	20
Mn^{2+}			

(b) (i) Define the term electronegativity.

(ii) Explain why the electronegativity of chlorine is greater than that of phosphorus.

(c) E whakaatu ana te kauwhata i raro i ngā pūngao katotetanga tuatahi o ngā pūmotu Rōpū 2 mai i Be ki Ba.

MĀ TE KAIMĀKA ANAKE

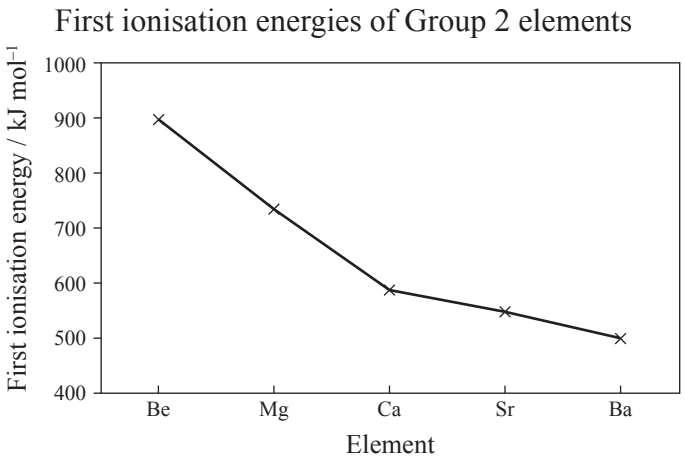


(i) Tuhia he whārite hei whakaatu i te pūngao katotetanga tuatahi o te pūmotu konupūmā.

(ii) Whakamāramahia te ia kua whakaaturia o ngā pūngao katotetanga tuatahi o ngā pūmotu Rōpū 2.

ASSESSOR'S USE ONLY

(c) The following graph shows the first ionisation energies of the Group 2 elements from Be to Ba.



(i) Write an equation to show the first ionisation energy for the element calcium.

(ii) Explain the trend shown of first ionisation energies of the Group 2 elements.

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

Rāpoi ngota	**Pae koropupū / °C**	***M* / g mol^{-1}**
Haitarahine, N_2H_4	114	32
Hautawa mewaro, CH_3I	42.4	142
Ngawaro, $C_{10}H_{22}$	174	142

Whakamahia ngā mōhiohio kei te tūtohi i runga nei ka whakataurite i ngā pae koropupū o ngā matū i raro.

I ō tuhinga, me:

- whakarārangi i ngā momo tōpana kume i waenga rāpoi ngota mō ia matū
- whakamārama i te kaha hāngai i waenga i ngā korakora kei roto.

(a) (i) Haitarahine me te hautawa mewaro.

(ii) Hautawa mewaro me te ngawaro.

QUESTION TWO

ASSESSOR'S USE ONLY

Molecule	Boiling Point / °C	M / g mol^{-1}
Hydrazine, N_2H_4	114	32
Iodomethane, CH_3I	42.4	142
Decane, $C_{10}H_{22}$	174	142

Use the information in the table above to compare and contrast the boiling points of the substances below.

In your answers, you should:

- list the types of intermolecular forces present for each substance
- explain the relative strength between the particles involved.

(a) (i) Hydrazine and iodomethane.

(ii) Iodomethane and decane.

(b) Whakamāramahia he aha i nui ake ai te mehamehanga o te haitarahine i rō wai i tō te ngawaro i rō wai.

MĀ TE KAIMĀKA ANAKE

(c) Ka puta te hauhā me te wai ina tino ngingiha ana te ngawaro i rō hāora. E whakaaturia ana te tauhohenga ki te whārite i raro.

$$C_{10}H_{22}(\ell) + 15\tfrac{1}{2}O_2(g) \rightarrow 10CO_2(g) + 11H_2O(\ell)$$

Tātaitia te hāwera o te ngingiha mō te ngawaro, e ai ki ngā raraunga i raro nei:

$\Delta_f H°\ (C_{10}H_{22}(\ell)) = -301$ kJ mol^{-1}

$\Delta_c H°\ (C) = -393$ kJ mol^{-1}

$\Delta_c H°\ (H_2) = -286$ kJ mol^{-1}

ASSESSOR'S USE ONLY

(b) Explain why the solubility of hydrazine in water is greater than that of decane in water.

(c) Carbon dioxide and water are formed when decane burns completely in oxygen. The reaction is shown in the equation below.

$$C_{10}H_{22}(\ell) + 15\tfrac{1}{2}O_2(g) \rightarrow 10CO_2(g) + 11H_2O(\ell)$$

Calculate the enthalpy of combustion for decane, given the following data:

$\Delta_f H°\ (C_{10}H_{22}(\ell)) = -301$ kJ mol^{-1}

$\Delta_c H°\ (C) = -393$ kJ mol^{-1}

$\Delta_c H°\ (H_2) = -286$ kJ mol^{-1}

(d) E whakaaturia ana te tauhohenga mō te tino ngingiha o te haitarahine ki te whārite i raro.

$$N_2H_4(\ell) + O_2(g) \rightarrow N_2(g) + 2H_2O(g)$$

He tauhohenga putawera tēnei.

Whakamāramahia ngā huringa pūngao ngoikore (entropy) i roto i tēnei tauhohenga.

MĀ TE KAIMĀKA ANAKE

(d) The reaction for the complete combustion of hydrazine is shown in the equation below.

$$N_2H_4(\ell) + O_2(g) \rightarrow N_2(g) + 2H_2O(g)$$

This is an exothermic reaction.

Explain the entropy changes associated with this reaction.

ASSESSOR'S USE ONLY

TŪMAHI TUATORU

MĀ TE KAIMĀKA ANAKE

Ko te haumāota, Cl_2, te pūkane, Br_2, me te hautawa, I_2, he kōnakonako katoa.
He wē te pūkane i te paemahana rūma.

(a) (i) I te pouaka i raro, tohua ngā momo tōpana kume i waenga rāpoi ngota kei roto i te pūkane **wē**.

Tōpana kume i waenga rāpoi ngota	**Tohu (✔)**
Ngā tōpana kume wehewhana-wehewhana rangitahi	
Ngā tōpana kume wehewhana-wehewhana pūmau	
Hononga hauwai	

(ii) Whakamāramahia mai he aha i wē ai te pūkane i te paemahana rūma, engari he haurehu te haumāota.

(b) (i) Tuhia he whārite mō te whāhaurehu o te hautawa i roto i te pouaka i raro.

(ii) Tautuhia te hāwera (enthalpy) o te whāhaurehu mō te hautawa.

Ka haere tonu te Tūmahi Tuatoru i te whārangi 14.

QUESTION THREE

ASSESSOR'S USE ONLY

Chlorine, Cl_2, bromine, Br_2, and iodine, I_2, are all halogens.
Bromine is a liquid at room temperature.

(a) (i) In the box below, tick the type(s) of intermolecular attractions in **liquid** bromine.

Intermolecular attraction	**Tick (✔)**
Temporary dipole-dipole attractions	
Permanent dipole-dipole attractions	
Hydrogen bonding	

(ii) Explain why bromine is a liquid at room temperature, whereas chlorine is a gas.

(b) (i) Write an equation for the sublimation of iodine in the box below.

(ii) Define the enthalpy of sublimation for iodine.

Question Three continues on page 15.

(iii) Whakamāramahia te take he ohorere noa te whāhaurehu o te hautawa, ahakoa he uara tōrunga te hāwera o te whāhaurehu.

MĀ TE KAIMĀKA ANAKE

(c) Ka puta i te hautawa he katote I_3^- rārangi.

(i) Tātuhia te hoahoa Lewis mō te katote I_3^- ki te pouaka i raro.

(ii) Whakamāramahia he aha te take he rārangi te āhua o te katote I_3^- .

ASSESSOR'S USE ONLY

(iii) Explain why the sublimation of iodine is spontaneous, even though the enthalpy of sublimation is a positive value.

(c) Iodine forms a linear I_3^- ion.

(i) Draw the Lewis structure for the I_3^- ion in the box below.

(ii) Explain why the I_3^- ion has a linear shape.

(iii) He koeke-tapawhā hāngai te āhua o te IF_5.

Me tohu mēnā he pitorua, pitokore rānei te rāpoi ngota IF_5.

Porowhitatia tō kōwhiringa. **pitorua** **pitokore**

Parahautia tō kōwhiringa.

MĀ TE KAIMĀKA ANAKE

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(iii) IF_5 has a square pyramidal shape.

Indicate whether the molecule IF_5 is polar or non-polar.

Circle your choice. **polar** **non-polar**

Justify your choice.

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

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English translation of the wording on the front cover

Level 3 Chemistry, 2017

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

2.00 p.m. Wednesday 15 November 2017
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 is provided on the Resource Sheet 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.