See back cover for an English translation of this cover

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91164M

911645

NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

SUPERVISOR'S USE ONLY

Te Mātauranga Matū, Kaupae 2, 2014

91164M Te whakaatu māramatanga ki te honohono, te hanga, ngā āhuatanga me ngā huringa pūngao

2.00 i te ahiahi Rātū 11 Whiringa-ā-rangi 2014
Whiwhinga: Rima

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki te honohono, te hanga, ngā āhuatanga me ngā huringa pūngao.	Te whakaatu māramatanga hōhonu ki te honohono, te hanga, ngā āhuatanga me ngā huringa pūngao.	Te whakaatu māramatanga matawhānui ki te honohono, te hanga, ngā āhuatanga me ngā huringa pūngao.

Tirohia mehemea e ōrite ana te Tau Ākonga ā-Motu (NSN) kei tō pepa whakauru ki te tau kei runga ake nei.

Whakautua e koe ngā pātai KATOA kei roto i te pukapuka nei.

He taka pūmotu kua whakaritea ki te Pukaiti Rauemi L2-CHEMMR.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te (ngā) whārangi kei muri i te pukapuka nei, ka āta tohu ai i ngā tau pātai.

Tirohia mehemea kei roto nei ngā whārangi 2–17 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

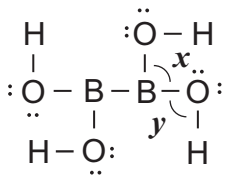
PĀTAI TUATAHI

MĀ TE KAIMĀKA ANAKE

(a) Tāngia te hanganga a Lewis (hoahoa tongi irahiko) mō ia rāpoi ngota e whai ake nei.

Te rāpoi ngota	HCN	CH_2Br_2	AsH_3
Hanganga a Lewis			

(b) Ko te hanganga a Lewis mō tētahi rāpoi ngota e mau ana i ngā ngota pūtiwha, hāora me te hauwai kei te whakaaturia i raro.



(i) E whakaahua ana te tūtohi e whai ake i ngā āhua e tākai ana i ngā ngota e rua i roto i te rāpoi ngota i runga ake.

Whakaotihia te tūtohi me ngā koki hononga āwhiwhi ***x*** me ***y***.

Ngota pū	**Te āhua ka puta i ngā hononga e tākai ana i te ngota pū**	**Koki hononga āwhiwhi**
B	tapatoru papatahi[1]	***x*** =
O	piko	***y*** =

(ii) He rerekē ngā koki hononga ***x*** me ***y*** i roto i te rāpoi ngota i runga ake.

Āta whakamāramahia he aha ngā koki hononga i rerekē ai.

I roto i tō whakautu me whakauru e koe:

- ngā āhuatanga e whakatau ai i te āhua e tākai ana i te
  - ngota **B** mō te koki hononga ***x***
  - ngota **O** mō te koki hononga ***y***
- he kōrero whakamārama o ngā irahiko e karapoti ana i ngā ngota **B** me **O**.

He wāhi anō mō tō whakautu ki tēnei pātai kei te whārangi 4.

[1] trigonal planar

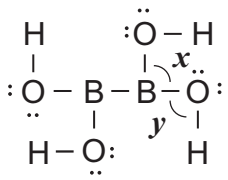
QUESTION ONE

ASSESSOR'S USE ONLY

(a) Draw the Lewis structure (electron dot diagram) for each of the following molecules.

Molecule	HCN	CH_2Br_2	AsH_3
Lewis structure			

(b) The Lewis structure for a molecule containing atoms of boron, oxygen, and hydrogen, is shown below.



(i) The following table describes the shapes around two of the atoms in the molecule above.

Complete the table with the approximate bond angles ***x*** and ***y***.

Central atom	**Shape formed by bonds around the central atom**	**Approximate bond angle**
B	trigonal planar	***x*** =
O	bent	***y*** =

(ii) The bond angles ***x*** and ***y*** in the molecule above are different.

Elaborate on why the bond angles are different.

In your answer you should include:

- factors which determine the shape around the:
  - **B** atom for bond angle ***x***
  - **O** atom for bond angle ***y***
- reference to the arrangement of electrons around the **B** and **O** atoms.

There is more space for your answer to this question on page 5.

MĀ TE KAIMĀKA ANAKE

(c) Ka taea te whakaahua mai ngā rāpoi ngota hei pitorua, pitokore rānei.

E whakaatu ana ngā hoahoa e whai ake i ngā hanganga a Lewis mō ngā rāpoi ngota e rua, **SO_2** me **CO_2**.

Porohitatia te kupu e whakaahua ana i te **pitoruatanga** o ia rāpoi ngota.

SO_2	**Pitorua**	**Pitokore**
CO_2	**Pitorua**	**Pitokore**

Whakataunakihia tō kōwhiringa mō ia rāpoi ngota.

He wāhi anō mō tō whakautu ki tēnei pātai kei te whārangi 6.

ASSESSOR'S USE ONLY

(c) Molecules can be described as being polar or non-polar.

The following diagrams show the Lewis structures for two molecules, **SO_2** and **CO_2**.

Circle the term that describes the **polarity** of each of the molecules.

SO_2	**Polar**	**Non-polar**
CO_2	**Polar**	**Non-polar**

For each molecule, justify your choice.

There is more space for your answer to this question on page 7.

(d) Ka tauhohe te haurehu hauwai, $H_2(g)$, ki te haurehu hāora, $O_2(g)$, e ai ki te whārite e whai ake

$$H_2(g) + \tfrac{1}{2}O_2(g) \rightarrow H_2O(g) \qquad \Delta_r H^o = -242 \text{ kJ mol}^{-1}$$

Nā ngā hāwera hononga toharite i roto i te tūtohi i raro, tātaihia te hāwera hononga toharite o te hononga **O – H** i roto i te H_2O.

Hononga	**Hāwera hononga toharite / kJ mol^{-1}**
H – H	436
O = O	498

ASSESSOR'S USE ONLY

(d) Hydrogen gas, $H_2(g)$, reacts with oxygen gas, $O_2(g)$, as shown by the following equation

$$H_2(g) + \tfrac{1}{2}O_2(g) \rightarrow H_2O(g) \qquad \Delta_r H^o = -242 \text{ kJ mol}^{-1}$$

Given the average bond enthalpies in the table below, calculate the average bond enthalpy of the **O – H** bond in H_2O.

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

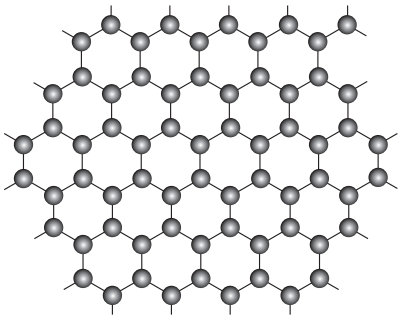
PĀTAI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) Whakaotia te tūtohi i raro mā te tuhi i te momo matū, te momo korakora, me te momo honohono (tōpana kume) i waenga i ngā korakora mō ia matū e rua.

Utoka	Tūmomo matū	Tūmomo korakora	Tōpana kume i waenga i ngā korakora
Mg(*s*) (konupora)			
$I_2(s)$ (konutawa)			

(b) He matū ahu-2 hou te karawhīni[2] i takea mai i ngā ngota waro. Ko te whakaahuatanga mō te karawhīni he papatūranga ‘ngota kotahi te mātotoru’ o te matāpango[3]. E whakaaturia ana i raro tētahi hoahoa o te karawhīni me ana āhuatanga e rua.



Ngā āhuatanga o te karawhīni:

Pūwāhi rewa: tino teitei

Te kawenga hiko: tino pai rawa atu

Mā tō mōhio ki te hanganga me te honohono, whakamāramahia ngā āhuatanga e rua o te karawhīni i hōmai i runga ake.

[2] graphene
[3] waro reti

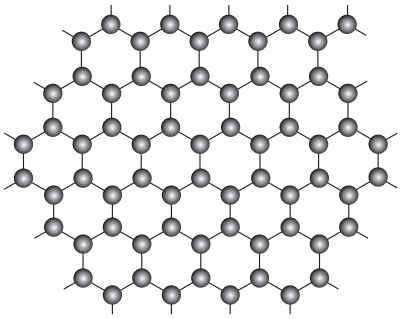
QUESTION TWO

ASSESSOR'S USE ONLY

(a) Complete the table below by stating the type of substance, the type of particle, and the type of bonding (attractive forces) between the particles for each of the two substances.

Solid	Type of substance	Type of particle	Attractive forces between particles
Mg(*s*) (magnesium)			
$I_2(s)$ (iodine)			

(b) Graphene is a new 2-dimensional material made of carbon atoms. Graphene can be described as a 'one-atom-thick' layer of graphite. A diagram of graphene and two of its properties is shown below.



Properties of graphene:

Melting point: very high

Electrical conductivity: excellent

Use your knowledge of structure and bonding to explain the two properties of graphene given above.

(c) I whakamātauhia te Mg me te I_2 utoka mō ngā āhuatanga ōkiko e toru. E whakaatu ana te tūtohi i raro i ngā hua o ngā whakamātau.

MĀ TE KAIMĀKA ANAKE

	Āhuatanga ōkiko		
Te matū i whakamātauhia	Kōngohe	Ka memeha i roto i te huriowaro (tāmeha[4] pitokore)	Ka kawe hiko
Mg	āe	kāo	āe
I_2	kāo	āe	kāo

Mā tō mōhio ki te hanganga me te honohono, whakamāramahia ngā hua o ngā whakamātau.

[4] whakarewa

ASSESSOR'S USE ONLY

(c) Solid Mg and I_2 were tested for three physical properties. The table below shows the results of the tests.

	Physical property		
Substance tested	Ductile	Soluble in cyclohexane (non-polar solvent)	Conducts electricity
Mg	yes	no	yes
I_2	no	yes	no

Use your knowledge of structure and bonding to explain the results of the tests.

PĀTAI TUATORU

MĀ TE KAIMĀKA ANAKE

(a) (i) Ina tāpirihia he konutai waihā utoka ki te wai, ka piki te pāmahana.

Porohitatia te kupu e whakaahua pai ana i tēnei tauhohenga.

Putawera **Pauwera**

He aha tau i whakaaro pēnei ai.

(ii) Ka taea te whakaatu te whakatio wai kia huri hei tio mā te whārite e whai ake:

$$H_2O(\ell) \rightarrow H_2O(s)$$

Porohitatia te kupu e whakaahua pai ana i tēnei tauhohenga.

Putawera **Pauwera**

Whakamāramahia tāu i kōwhiri ai.

(b) Mā tō mōhio ki te hanganga me te honohono, whakamāramahia mai te tukanga mehameha o te konutai pūhaumāota i roto i te wai.

Tautokohia tō whakautu mā tētahi hoahoa taipitopito (whai tapanga).

QUESTION THREE

ASSESSOR'S USE ONLY

(a) (i) When solid sodium hydroxide is added to water, the temperature increases.

Circle the term that best describes this reaction.

Exothermic **Endothermic**

Give a reason for your choice.

(ii) The freezing of water to form ice can be represented by the following equation.

$$H_2O(\ell) \rightarrow H_2O(s)$$

Circle the term that best describes this reaction.

Exothermic **Endothermic**

Explain your choice.

(b) Use your knowledge of structure and bonding to explain the dissolving process of sodium chloride in water.

Support your answer with an annotated (labelled) diagram.

(c) Ka taea te waihā mewaro me te waihā ewaro te whakamahi hei kora. Ka taea te whakaatu ngā tauhohenga ngingiha mā ngā whārite e whai ake nei:

MĀ TE KAIMĀKA ANAKE

Ngingiha waihā mewaro: $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$ $\Delta_r H^o = -1450$ kJ mol^{-1}

Ngingiha waihā ewaro: $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ $\Delta_r H^o = -1370$ kJ mol^{-1}

Taunakihia ko tēhea te kora ko te waihā mewaro, te waihā ewaro rānei, ka whakaputa i te pūngao wera nui ake, ina ngingihatia te 345 g o ia kora ki te hāora inati.

$M(CH_3OH) = 32.0$ g mol^{-1}

$M(C_2H_5OH) = 46.0$ g mol^{-1}

ASSESSOR'S USE ONLY

(c) Methanol and ethanol can both be used as fuels. Their combustion reactions can be represented by the following equations:

Methanol combustion: $2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$ $\Delta_r H^o = -1450$ kJ mol^{-1}

Ethanol combustion: $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ $\Delta_r H^o = -1370$ kJ mol^{-1}

Justify which fuel, methanol or ethanol, will produce more heat energy when 345 g of each fuel is combusted in excess oxygen.

$M(CH_3OH) = 32.0$ g mol^{-1}

$M(C_2H_5OH) = 46.0$ g mol^{-1}

He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tāu pātai mēnā e hāngai ana.

TAU PĀTAI

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 2 Chemistry, 2014

91164 Demonstrate understanding of bonding, structure, properties and energy changes

2.00 pm Tuesday 11 November 2014
Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of bonding, structure, properties and energy changes.	Demonstrate in-depth understanding of bonding, structure, properties and energy changes.	Demonstrate comprehensive understanding of bonding, structure, properties and energy changes.

91164M

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 L2–CHEMMR.

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 2–17 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.