91164M

911645

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

2

SUPERVISOR'S USE ONLY

Te Mātauranga Matū, Kaupae 2, 2016

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

9.30 i te ata Rāhina 21 Whiringa-ā-rangi 2016
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 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 Rau Rauemi L2-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) He whaitake ngā mōkī whakamakariri wawe mō te whakamaimoa wharanga hākinakina i runga i te papa tākaro. Kei roto ko ngā tote[1] pēnei i te haukini pākawa ota, NH_4NO_3. Ina whakahohea ngā mōkī, ka rewa te tote i roto i te wai, hei whakaheke i te paemahana.

Porohitatia te kupu e whakaahua pai ana i tēnei tukanga whakarewa.

pauwera **putawera**

Homai tētahi pūtake mō tō kōwhiringa.

(b) Anei te whārite hei waiwai i te konukura pākawa pungatara waikore ki te wai:

$CuSO_4(s) + 5H_2O(\ell) \rightarrow CuSO_4.5H_2O(s)$ $\Delta_r H^\circ = -78.2$ kJ mol^{-1}

Porohitatia te kupu e whakaahua pai ana i tēnei tauhohenga.

pauwera **putawera**

Homai tētahi pūtake mō tō kōwhiringa.

(c) He wē te pēwaro, C_5H_{12}, i te paemahana rūma. Ka whakaeto i te 36.1°C i roto i tētahi tukanga pauwera.

(i) Whakamāramahia mai te take he tukanga pauwera te whakaetonga o te pēwaro.

[1] pāhare

QUESTION ONE

ASSESSOR'S USE ONLY

(a) Instant cold packs are useful for treating sports injuries on the field. They contain salts such as ammonium nitrate, NH_4NO_3. When the packs are activated, the salt dissolves in water, causing the temperature to decrease.

Circle the term that best describes the dissolving process.

endothermic **exothermic**

Give a reason for your choice.

(b) The equation for hydrating anhydrous copper sulfate is as follows:

$$CuSO_4(s) + 5H_2O(\ell) \rightarrow CuSO_4.5H_2O(s) \qquad \Delta_r H^\circ = -78.2 \text{ kJ mol}^{-1}$$

Circle the term that best describes this reaction.

endothermic **exothermic**

Give a reason for your choice.

(c) Pentane, C_5H_{12}, is a liquid at room temperature. It evaporates at 36.1°C in an endothermic process.

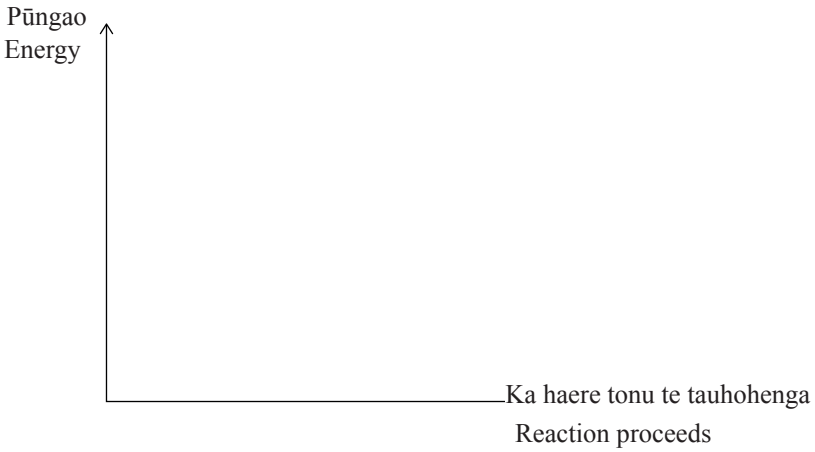
(i) Explain why the evaporation of pentane is an endothermic process.

(ii) Tātuhia, me ngā tapanga anō, te hoahoa pūngao mō te ngingiha o te pēwaro, $C_5H_{12}(\ell)$.

Ngingiha pēwaro:

$$C_5H_{12}(\ell) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(\ell) \qquad \Delta_r H^\circ = -3509 \text{ kJ mol}^{-1}$$

Me whakauru ki tō hoahoa ngā matū hohe, ngā hua, me te panoni o te hāwera (enthalpy).



(iii) Ka ngingiha (tahu) te owaro, C_6H_{14}, pērā i te pēwaro, ki te rawaka te hāora hei whakanao haurehu hauhā me te wai.

Ngingiha owaro:

$$2C_6H_{14}(\ell) + 19O_2(g) \rightarrow 12CO_2(g) + 14H_2O(\ell) \qquad \Delta_r H^\circ = -8316 \text{ kJ mol}^{-1}$$

Parahautia ko tēhea te waiwaro tahi - ko te pēwaro, ko te owaro rānei - ka whakaputa i te pūngao wera rawa atu ina ngingihatia te 125 g o ia kora ki te hāora rawaka.

$M(C_5H_{12}) = 72.0 \text{ g mol}^{-1}$ $M(C_6H_{14}) = 86.0 \text{ g mol}^{-1}$

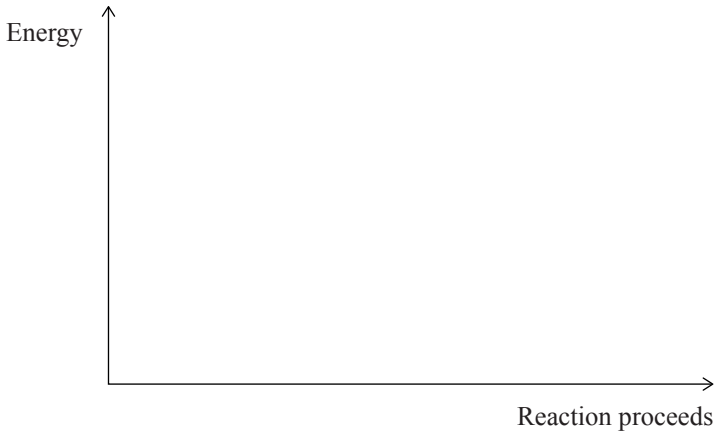
ASSESSOR'S USE ONLY

(ii) Draw, including labels, the energy diagram for the combustion of pentane, $C_5H_{12}(\ell)$.

Pentane combustion:

$$C_5H_{12}(\ell) + 8O_2(g) \rightarrow 5CO_2(g) + 6H_2O(\ell) \qquad \Delta_r H^\circ = -3509 \text{ kJ mol}^{-1}$$

Include in your diagram the reactants, products, and change in enthalpy.



(iii) Hexane, C_6H_{14}, like pentane, will combust (burn) in sufficient oxygen to produce carbon dioxide gas and water.

Hexane combustion:

$$2C_6H_{14}(\ell) + 19O_2(g) \rightarrow 12CO_2(g) + 14H_2O(\ell) \qquad \Delta_r H^\circ = -8316 \text{ kJ mol}^{-1}$$

Justify which alkane – pentane or hexane – will produce more heat energy when 125 g of each fuel is combusted in sufficient oxygen.

$M(C_5H_{12}) = 72.0 \text{ g mol}^{-1}$ $M(C_6H_{14}) = 86.0 \text{ g mol}^{-1}$

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) Whakaotihia te ripanga i raro mā te kī mai i te momo matū, te momo korakora kei roto, me ngā tōpana kume i waenga i ngā korakora i te totoka mō ia matū.

Matū	Tūmomo matū	Tūmomo korakora	Ngā tōpana kume i waenga korakora
$ZnCl_2(s)$ (konutea pūhaumāota)			
$C(s)$ (matāpango)			
$CO_2(s)$ (hauhā / hauhā totoka)			

(b) Ka kawe hiko te waro (matāpango) ina totoka, engari kāore te konutea pūhaumāota, $ZnCl_2$, e kawe hiko ina totoka, ēngari ka kawe i te wā kei te rewa.

Parahautia tēnei kīanga e ai ki ngā korakora, te hanganga, me te honohono mō ngā matū e rua.

QUESTION TWO

ASSESSOR'S USE ONLY

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

Substance	Type of substance	Type of particle	Attractive forces between particles
$ZnCl_2(s)$ (zinc chloride)			
$C(s)$ (graphite)			
$CO_2(s)$ (carbon dioxide / dry ice)			

(b) Carbon (graphite) conducts electricity when it is solid, whereas zinc chloride, $ZnCl_2$, will not conduct electricity when solid, but will conduct when molten.

Justify this statement in terms of the particles, structure, and bonding for both substances.

(c) Ka rewa te konutea pūhaumāota totoka, $ZnCl_2(s)$, i roto i te wai. Kaore te hauhā totoka, $CO_2(s)$, e tino rewa i roto i te wai.

Parahautia ēnei kīanga e ai ki ngā korakora, te hanganga, me te honohono o ēnei matū.

Ka whakaaetia te whakamahi hoahoa ki tō tuhinga.

MĀ TE KAIMĀKA ANAKE

Mokowā mō ngā hoahoa

(c) Solid zinc chloride, $ZnCl_2(s)$, is soluble in water. Dry ice, $CO_2(s)$, is not readily soluble in water.

ASSESSOR'S USE ONLY

Justify these statements in terms of the particles, structure, and bonding of these substances.

You may include a diagram or diagrams in your answer.

Space for diagrams

TŪMAHI TUATORU

MĀ TE KAIMĀKA ANAKE

(a) (i) Tātuhia te hanganga a Lewis (hoahoa tongi irahiko) mō ia rāpoi ngota e whai ake nei, ā, ka whakaingoa i ngā āhua.

Te rāpoi ngota	H_2O	CS_2	PH_3
Hanganga a Lewis			
Te ingoa o te āhua			
Koki hononga āwhiwhi i te ngota pū	109.5°	180°	109.5°

(ii) Whakatauritehia ngā āhua me ngā koki hononga o H_2O, CS_2 me PH_3.

QUESTION THREE

ASSESSOR'S USE ONLY

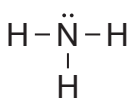
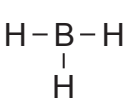
(a) (i) Draw the Lewis structure (electron dot diagram) for each of the following molecules, and name their shapes.

Molecule	H_2O	CS_2	PH_3
Lewis structure			
Name of shape			
Approximate bond angle around the central atom	109.5°	180°	109.5°

(ii) Compare and contrast the shapes and bond angles of H_2O, CS_2 and PH_3.

(b) Kei te whakaaturia ngā hanganga a Lewis mō ngā rāpoi ngota e rua.

MĀ TE KAIMĀKA ANAKE

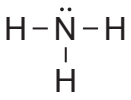
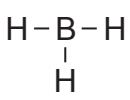
Te rāpoi ngota	 Haukini	 Poreina (Borane)
Pitoruatanga (tōranga) o te rāpoi ngota	pitorua	pitokore

He pitorua te haukini, NH_3, ā, he pitokore te poreina, BH_3.

Parahautia tēnei tauākī.

(b) The Lewis structures for two molecules are shown.

ASSESSOR'S USE ONLY

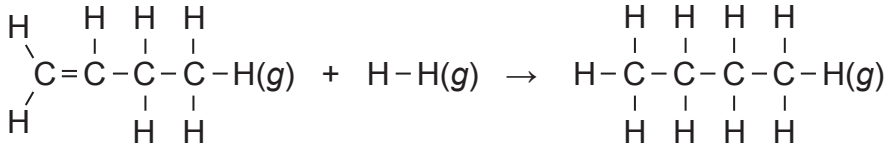
Molecule	 Ammonia	 Borane
Polarity of molecule	polar	non-polar

Ammonia, NH_3, is polar, and borane, BH_3, is non-polar.

Justify this statement.

(c) Tātaihia te panoni hāwera, $\Delta_r H°$, mō te tauhohenga o te haurehu waiwaro rua-1-pūwaro, $C_4H_8(g)$, ki te haurehu hauwai, $H_2(g)$, hei hanga haurehu pūwaro, $C_4H_{10}(g)$.

Whakamahia ngā hāwera hononga toharite kei roto i te tūtohi i raro.



Hononga	Hāwera hononga toharite / kJ mol^{-1}
C=C	614
C−C	346
C−H	414
H−H	436

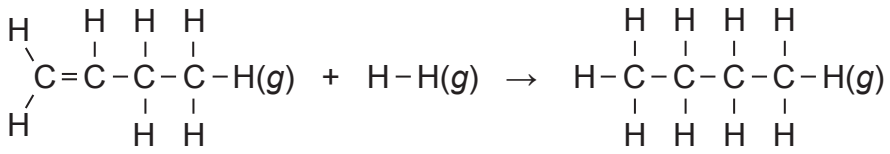
Whakaaturia katoatia ō mahinga me te whakauru i ngā waeine hāngai ki tō tuhinga.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(c) Calculate the enthalpy change, $\Delta_r H°$, for the reaction of but-1-ene gas, $C_4H_8(g)$, with hydrogen gas, $H_2(g)$, to form butane gas, $C_4H_{10}(g)$.

Use the average bond enthalpies given in the table below.



Bond	Average bond enthalpy / kJ mol^{-1}
C=C	614
C−C	346
C−H	414
H−H	436

Show your working and include appropriate units in your answer.

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

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 2 Chemistry, 2016

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

9.30 a.m. Monday 21 November 2016
Credits: Five

91164M

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.

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–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.