See back cover for an English translation of this cover

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91166M

911665

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

SUPERVISOR'S USE ONLY

Te Mātauranga Matū, Kaupae 2, 2013

91166M Te whakaatu māramatanga ki te tauhohenga matū

9.30 i te ata Rātū 19 Whiringa-ā-rangi 2013
Whiwhinga: Whā

Paetae	Paetae Kaiaka	Paetae Kairangi
Te whakaatu māramatanga ki te tauhohenga matū.	Te whakaatu māramatanga hōhonu ki te tauhohenga matū.	Te whakaatu māramatanga matawhānui ki te tauhohenga matū.

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

Me whakautu 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 mēnā kei roto nei ngā whārangi 2–21 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

Kia 60 meneti hei whakautu i ngā pātai o tēnei pukapuka.

MĀ TE KAIMĀKA ANAKE

PĀTAI TUATAHI

(a) I whakahohea te waikawa pūhaumāota ki te konupūmā pākawa waro i roto i ngā maramara māpere (kurukuru) me te paura (maramara māpere nakunaku) i tētahi whakamātaraunga hei tūhura i ngā āhuatanga whai pānga ki te tere o tētahi tauhohe matū.

Maramara māpere (kurukuru)

He tapu tēnei rauemi. E kore taea te tuku atu. Aata tirohia ki ngā kupu kei raro iho i te pouaka nei.

https://encrypted-tbn1.gstatic.com/images?q=tbn:ANd9GcTZD8kay1SBm9N6sSYimAnkGYxFM7nPts1o9WEAyR5giwILW38O

Maramara māpere nakunaku (paura)

He tapu tēnei rauemi. E kore taea te tuku atu. Aata tirohia ki ngā kupu kei raro iho i te pouaka nei.

http://hoangnhat.en.ecplaza.net/ground-calcium-carbonate-powder--333617-2615449.html

(i) Tautuhia te āhuatanga e tūhuratia ana.

(ii) Whakamāramahia te take ka tere ake te tauhohe o te waikawa pūhaumāota ki te paura.

You are advised to spend 60 minutes answering the questions in this booklet.

ASSESSOR'S USE ONLY

QUESTION ONE

(a) Hydrochloric acid was reacted with calcium carbonate in the form of marble chips (lumps) and powder (crushed marble chips) in an experiment to investigate factors affecting the rate of a chemical reaction.

Marble chips (lumps)

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https://encrypted-tbn1.gstatic.com/images?q=tbn:ANd9GcTZD8kay1SBm9N6sSYimAnkGYxFM7nPts1o9WEAyR5giwILW38O

Crushed marble chips (powder)

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http://hoangnhat.en.ecplaza.net/ground-calcium-carbonate-powder--333617-2615449.html

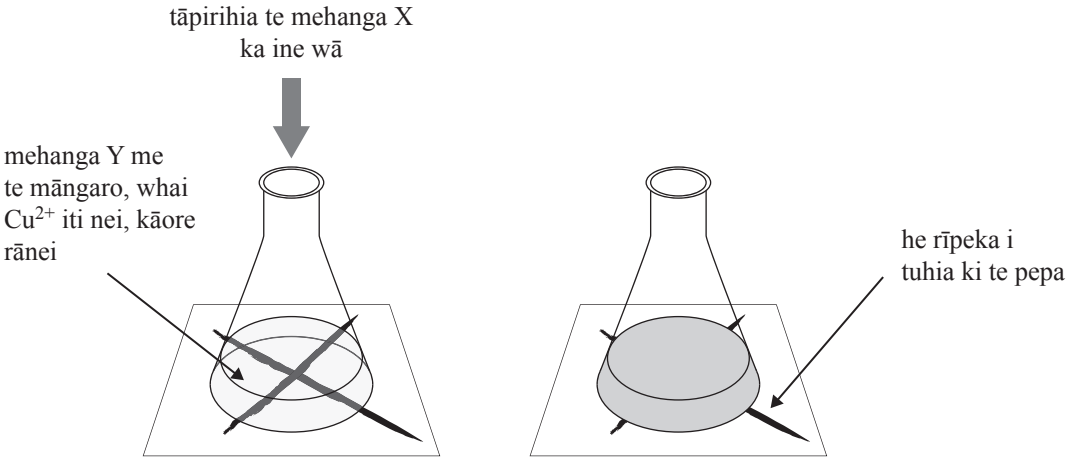
(i) Identify the factor being investigated.

(ii) Explain why the hydrochloric acid would react faster with the powder.

MĀ TE KAIMĀKA ANAKE

(b) Kei roto i tētahi *tauhohenga karaka* te whakaranu i te mehanga[1] X me te mehanga Y ki te māngaro. Oti ana te tauhohenga ka huri te tae o te mehanga ki te kikorangi-pango.

I whakahaerehia e tētahi ākonga tēnei tauhohenga i waenga i te mehanga X me te mehanga Y i roto i tētahi puoto koeko. I te haere o te wā, kua kore kē te rīpeka i te pepa i raro i te puoto ina tirohia mai i runga.



I whakahaerehia ngā whakamātauranga e whai ake, ā, i tuhia ngā wā mō te kore haere o te rīpeka.

Whakamātauranga		**Pāmahana / °C**	**Te wā e kore haere ai te rīpeka / hēkona**
1	Kāore he Cu^{2+}	25	42
2	Kāore he Cu^{2+}	50	23
3	He Cu^{2+} kei roto	25	5

Whakamāramahia te take e tere ake ngā tauhohe i **Whakamātauranga 2** me **Whakamātauranga 3** i te tauhohe i **Whakamātauranga 1**.

I tō whakautu me whakauru ngā kupu e whai ake:

tukinga **pūngao hohenga** **pāmahana** **whaitake** **whākōkī**

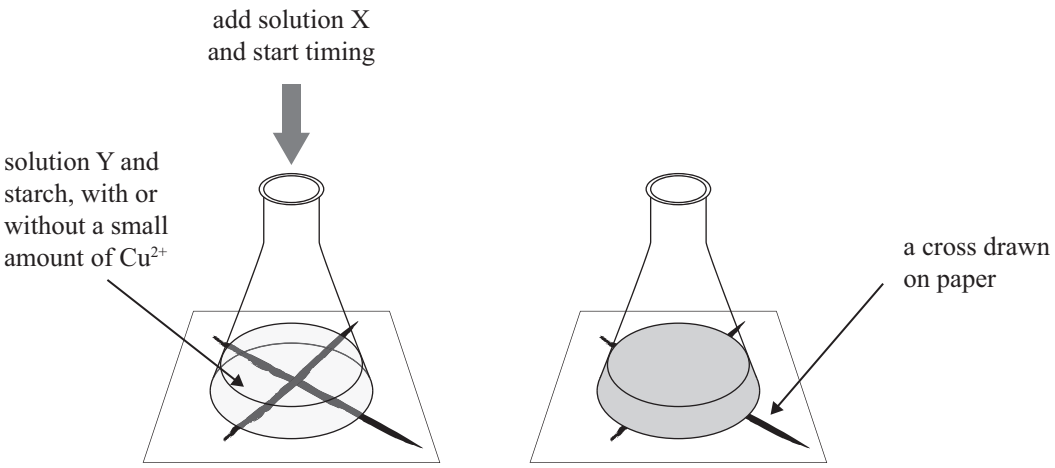
[1] wairewa

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(b) A *clock reaction* involves mixing solution X and solution Y with starch present. When the reaction is complete the solution turns blue-black in colour.

A student carried out this reaction between solution X and solution Y in a conical flask. Over time, the cross on the piece of paper under the flask disappeared when viewed from above.



The following experiments were carried out, and the times taken for the cross to disappear recorded.

Experiment		Temperature / °C	Time for cross to disappear / s
1	No Cu^{2+} present	25	42
2	No Cu^{2+} present	50	23
3	Cu^{2+} present	25	5

Elaborate on why the reactions in **Experiment 2** and **Experiment 3** occur faster than the reaction in **Experiment 1**.

In your answer, include the following words or terms.

collisions **activation energy** **temperature** **effective** **catalyst**

ASSESSOR'S USE ONLY

PĀTAI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) Ka hangaia te haurehu haukini, $NH_3(g)$, i te haurehu hauwai me te haurehu hauota, e ai ki te whārite e whai ake.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

(a) Whakaotihia te kīanga aumou taurite mō tēnei tauhohe.

$K_c =$

(b) Ko te K_c mō tētahi tauhohenga rerekē he

$$K_c = \frac{[SO_3(g)]^2}{[SO_2(g)]^2[O_2(g)]}$$

Tuhia te whārite matū e hāngai ana ki tēnei kīanga ki roto i te pouaka i raro.

$\rightleftharpoons$

(c) Ko ngā tauhohe e rua e whakaaturia ana i te pouaka e whai ake ana kei te taurite.

Tauhohenga	Whārite	E pāngia ana e te pikinga o te pēhenga
Tahi	$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$	kāo
Rua	$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$	āe

Whakatauritea te pānga o te pikinga o te pēhanga ki ngā tauhohe e rua, me te kōrero mō ngā tūnga tauritenga.

MĀ TE KAIMĀKA ANAKE

(d) Mō te **Tauhohe Tuarua** i te wāhanga (c), ko ngā uara o K_c i ngā pāmahana rerekē ka whakaaturia i raro.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Pāmahana	227°C	327°C	427°C	527°C
K_c	90	3	0.3	0.04

Whakamahia ēnei mōhiohio ki te whakatau mēnā he pauwera, he putawera rānei te hanganga $NH_3(g)$.

Parahautia ō whakaaro mā ngā mātāpono taurite.

QUESTION TWO

ASSESSOR'S USE ONLY

(a) Ammonia gas, $NH_3(g)$, is formed from hydrogen gas and nitrogen gas, as shown in the following equation.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Complete the equilibrium constant expression for this reaction.

$K_c =$

(b) The K_c for a different reaction is

$$K_c = \frac{[SO_3(g)]^2}{[SO_2(g)]^2 [O_2(g)]}$$

Write the chemical equation that corresponds to this expression in the box below.

$\rightleftharpoons$

(c) The two reactions shown in the following table are both at equilibrium.

Reaction	Equation	Affected by increased pressure
One	$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$	no
Two	$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$	yes

Compare and contrast the effect of increasing the pressure on both reactions, with reference to the equilibrium positions.

ASSESSOR'S USE ONLY

(d) For **Reaction Two** in part (c), the values of K_c at different temperatures are shown below.

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

Temperature	227°C	327°C	427°C	527°C
K_c	90	3	0.3	0.04

Use this information to determine whether the formation of $NH_3(g)$ is endothermic or exothermic.

Justify your reasoning using equilibrium principles.

(e) Mō te **Tauhohe Tuatahi** i te wāhanga (c), ko te uara K_c he 46.8 i 491°C

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

Tātaihia te kukūtanga o HI(*g*), i te tauritenga, i 491°C, mēnā ko te kukūtanga o $H_2(g)$ he 0.0190 mol L^{-1} me te kukūtanga o $I_2(g)$ he 0.210 mol L^{-1}.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(e) For **Reaction One** in part (c), the K_c value is 46.8 at 491°C

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

Calculate the concentration of HI(g), at equilibrium, at 491°C, if the concentration of $H_2(g)$ is 0.0190 mol L^{-1} and the concentration of $I_2(g)$ is 0.210 mol L^{-1}.

PĀTAI TUATORU

MĀ TE KAIMĀKA ANAKE

(a) E whakaatu ana te tūtohi i raro i ngā waikawa e rua me tō rāua kawakore[2] haumi.

Waikawa	Kawakore haumi
HCl	Cl^-
HSO_4^-	SO_4^{2-}

Whakamāramahia te hononga i waenga i tētahi waikawa me tōna kawakore haumi mā te whakamahi i tētahi tauira kotahi mai i te tūtohi i runga.

(b) I roto i tētahi mehanga waikawa hauota, HNO_3, ko te kukūtanga o ngā katote H_3O^+ he 0.0125 mol L^{-1}.

Whakatauhia te kukūtanga o ngā katote waihā, OH^-, me te pH o tēnei mehanga.

$[OH^-]$ =

pH =

(c) Kua kitea he waikawakawa te mehanga waikawa ewaro, CH_3COOH.

(i) Whakaotihia te whārite mō te tauhohe o te waikawa ewaro ki te wai.

$$CH_3COOH + H_2O \rightleftharpoons$$

(ii) Whakamāramahia te take he waikawakawa te mehanga.

[2] pāpāhua

QUESTION THREE

ASSESSOR'S USE ONLY

(a) The table below shows two acids with their conjugate base.

Acid	Conjugate base
HCl	Cl^-
HSO_4^-	SO_4^{2-}

Explain the relationship between an acid and its conjugate base using one example from the table above.

(b) In a solution of nitric acid, HNO_3, the concentration of H_3O^+ ions is 0.0125 mol L^{-1}.

Determine the concentration of hydroxide ions, OH^-, and the pH of this solution.

$[OH^-]$ =

pH =

(c) A solution of ethanoic acid, CH_3COOH, is found to be acidic.

(i) Complete the equation for the reaction of ethanoic acid with water.

$$CH_3COOH + H_2O \rightleftharpoons$$

(ii) Explain why the solution is acidic.

(d) E whakaatu ana te tūtohi e whai ake ana i te kukūtanga me te pH o ngā waikawa e toru, me te tere o te tauhohenga mō ia waikawa ki te konganuku konupora (Mg).

MĀ TE KAIMĀKA ANAKE

Waikawa	Kukūtanga / mol L^{-1}	pH	Ngā tere o te tauhohenga ki te Mg
HA	0.100	3.4	pōturi
HB	0.0100	2	tere
HC	1.00×10^{-5}	5	tino pōturi

(i) Tuhia he whārite mō te tauhohe o **HA** ki te konupora ki roto i te pouaka i raro.

(ii) Whakamāramahia te rerekētanga i waenga i te waikawa kaha me te waikawa ngoikore.

(iii) Whakatauritehia te kaha o te tauhohe o ngā waikawa e toru ki te konupora.

I tō whakautu:

- whakatauhia te kukūtanga o ngā katote hauwai honowai (hydronium), H_3O^+, i roto i ia waikawa
- whakatauritehia te kukūtanga o ngā katote hauwai honowai ki te kukūtanga o te waikawa
- whakamāramahia te tere o te tauhohenga mō ia waikawa ki te konupora mā te kōrero mō ngā mōhiohio kei te tūtohi i runga ake.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(d) The following table shows the concentration and pH of three acids, and the relative rate of reaction with magnesium (Mg) metal.

Acid	Concentration / mol L^{-1}	pH	Relative rate of reaction with Mg
HA	0.100	3.4	slow
HB	0.0100	2	fast
HC	1.00×10^{-5}	5	very slow

(i) Write an equation for the reaction of **HA** with magnesium in the box below.

(ii) Explain the difference between a strong acid and a weak acid.

(iii) Compare and contrast the reactivity of the three acids with magnesium.

In your answer:

- determine the concentration of hydronium ions, H_3O^+, in each acid
- compare the concentration of hydronium ions to the concentration of the acid
- explain the relative rate of reaction for each acid with magnesium by referring to the information in the table above.

ASSESSOR'S USE ONLY

He puka anō mēnā ka hiahiatia.
Tuhia te (ngā) tau 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

Level 2 Chemistry, 2013

91166 Demonstrate understanding of chemical reactivity

9.30 am Tuesday 19 November 2013
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of chemical reactivity.	Demonstrate in-depth understanding of chemical reactivity.	Demonstrate comprehensive understanding of chemical reactivity.

91166M

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 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 2–21 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.