



2019
Higher School Certificate
Year 11 Yearly Examination

Chemistry

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Board approved calculators may be used
- Write using black pen
- A data sheet, formulae sheets and periodic table are provided
- Draw diagrams using pencil
- A ruler is required

Write your NESA number in the spaces provided in the written section of the paper

Total marks – 75

Section I – Pages 3-9

20 marks

Attempt Questions 1–20

Allow 35 minutes for this section

Write your answers on the multiple choice grid on page 11 of writing booklet

Section II – Pages 13– 22

55 marks

Attempt Questions 21–32

Allow 1 hour and 25 minutes for this section

This paper MUST NOT be removed from the examination room

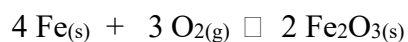
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1. Calcium reacts with water as shown:



What volume of hydrogen would be liberated at 25°C and 100kPa when 16 g of calcium reacts with excess water?

- (A) 16 L
(B) 22.79 L
(C) 10.5 L
(D) 9.90 L
2. By what percentage does the mass increase when Fe is oxidised to Fe₂O₃?



- (A) 86%
(B) 22%
(C) 43%
(D) 30%
3. A group of students conducted an experiment to determine the molar mass of magnesium by reacting a strip of magnesium ribbon with dilute hydrochloric acid. The students then recorded the volume of hydrogen gas produced from a recorded mass of magnesium. Using the results below calculate the molar mass of magnesium?

For this experiment the students assumed that the temperature and pressure are 25°C and 100 kPa.

Results

Mass of 4 cm Mg = 0.05 g

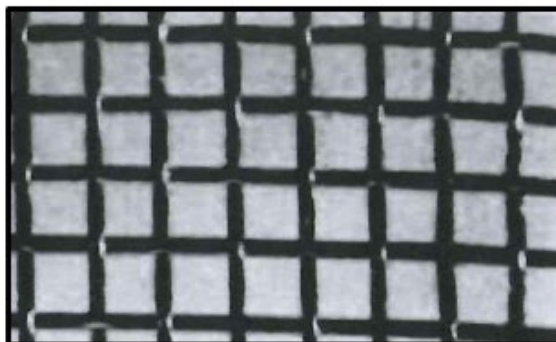
Volume of hydrogen = 47 mL

The molar mass of magnesium is:

- (A) 31.06 g
(B) 27.11 g
(C) 24.31g
(D) 26.37 g

4. Ethene gas (C_2H_4) reacts with hydrogen gas to produce ethane gas (C_2H_6) in a reaction known as a hydrogenation reaction.

To increase the rate of this reaction a piece of gauze made of platinum metal can be used as a catalyst (shown below).



How does the gauze increase the rate?

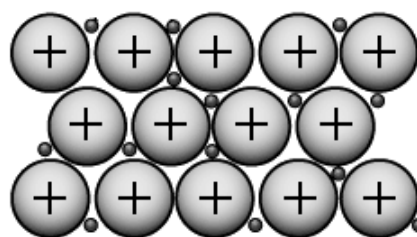
- (A) It increases the temperature of the gases.
(B) It increases the pressure of the gases.
(C) It provides a greater surface area for reactants to combine on.
(D) It ensures that reactants have the correct molecular orientation.
5. Solid “X” is a dull, brittle solid with a surface that scratches easily. It has a density of 2.27 g cm^{-3} and conducts electricity in the solid form.

Which model below is consistent with a substance with these physical properties?

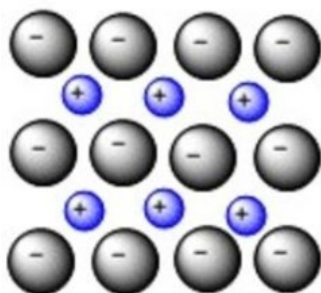
(A)



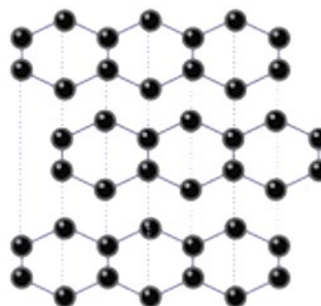
(B)



(C)



(D)



Questions 6 and 7 refer to the table below.

Solder contains a mixture of lead and tin. The table shows the melting range of two types of solder.

Sn63/Pb37	182-183
Sn 62/Pb38	178-180

6. Which of the following statements is correct, based on the information shown in the table?
- (A) Solder must be classed as a chemical mixture.
 - (B) Solder is a pure substance because it melts over a very narrow range.
 - (C) Solder is an example of heterogeneous matter.
 - (D) Solder should be classed as a compound because the lead and tin combine in close to fixed proportions.
7. A 3.00g sample of solder was dissolved in nitric acid (HNO_3). Sulfuric acid was added to this solution, which precipitated out 1.69 g of PbSO_4 .
- Assuming that all of the lead was precipitated out in the PbSO_4 , what is the percentage of tin in the sample?
- (A) 35.2 %
 - (B) 38.5 %
 - (C) 61.5 %
 - (D) 64.8 %
8. Two identical flasks, X and Y, contain, respectively, 1.70 g of nitrogen gas and 4.91 g of an unknown gas. The gases in both flasks are held at the same temperature and atmospheric pressure. From this data, which of the following gases could occupy flask Y?
- (A) helium
 - (B) oxygen
 - (C) sulfur dioxide
 - (D) hydrogen bromide

9. 10.79 g of powdered aluminium reacts with an accurately measured mass of oxygen gas, producing 20.39g of solid aluminium oxide.

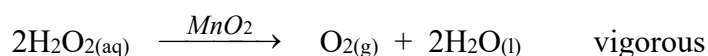
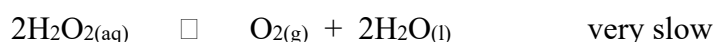
From these data, which of the conclusions below can be drawn?

- (A) Aluminium is the limiting reagent in this reaction.
 - (B) More oxygen added to the same mass of aluminium will result in a higher yield of product.
 - (C) The mole ratio of aluminium to oxygen gas used in the reaction was 4:3
 - (D) Equal moles of aluminium and oxygen were used in the reaction.
10. It is important for a volumetric flask to be filled, so that the bottom of the meniscus is level with the graduation line on the neck of the volumetric flask.

To properly read the meniscus, your line of sight must be level with the center of the curve of the meniscus. Failure to do so introduces what kind of error?

- (A) Instrumental error
 - (B) Parallax error
 - (C) Theoretical error
 - (D) Environmental error
11. The colour produced when an element or its salt is heated is due to:
- (A) energy being absorbed by the nucleus
 - (B) energy released by the atoms in the compound separately
 - (C) energy being absorbed to melt the salt
 - (D) energy being emitted by electrons changing energy levels
12. Which one of the following does NOT occur as we move from left to right across the third row of elements in the periodic table?
- (A) Ionisation energy of the elements across the row decreases.
 - (B) The size of the atomic radius increases.
 - (C) Melting and boiling points increase up to the Group IV elements, then decrease.
 - (D) The number of outer energy level electrons increases.

13. Gay-Lussac discovered that:
- (A) gases react
 - (B) gases combine in simple, whole number ratios by volumes
 - (C) gases contain Avagadro's number of atoms
 - (D) water has the formula H_2O_2 .
14. What is the change in temperature of 1.0 kg of water when it absorbs 100 kJ of heat energy?
- (A) $0.024^{\circ}C$
 - (B) $0.42^{\circ}C$
 - (C) $24^{\circ}C$
 - (D) $42^{\circ}C$
15. Moving across the periodic table from left to right the electronegativity of the element:
- (A) stays the same.
 - (B) increases.
 - (C) decreases.
 - (D) changes unpredictably.
16. The decomposition of hydrogen peroxide into oxygen and water proceeds very slowly at room temperature. However, the addition of a small amount of manganese dioxide (MnO_2), causes the hydrogen peroxide to bubble vigorously due to the rapid production of oxygen.



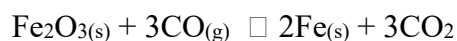
The best explanation for this is:

- (A) the manganese dioxide acts as a catalyst, providing an alternative reaction pathway that has a lower activation energy.
- (B) the manganese dioxide increases the temperature of the reaction thereby increasing the collision rate of the molecules.
- (C) the manganese dioxide increases the collision rate between reacting molecules simply by causing an increase in the total number of molecules in the solution.
- (D) the manganese dioxide increases the collision energy of the hydrogen peroxide molecules.

17. Chemical reactions occur as a result of collisions between the reacting particles.

Which of the following best outlines the reason for collisions between the reacting particles to be successful?

- (A) For collisions to be successful, reacting particles must have sufficient bond energy.
 - (B) For collisions to be successful, reacting particles must collide with each other with sufficient energy, and with correct orientation.
 - (C) For collisions to be successful, reacting particles must collide with the walls of the container with the correct orientation.
 - (D) For collisions to be successful, reacting particles must collide with the walls of the container with sufficient energy.
18. Which of the following statement provides the best description for activation energy?
- (A) The activation energy for a reaction is the maximum energy that colliding particles must have in order to undergo a chemical reaction.
 - (B) The activation energy for a reaction is the minimum energy that colliding particles must have in order to undergo a chemical reaction.
 - (C) The activation energy for a reaction is the maximum energy released by the colliding particles during a chemical reaction.
 - (D) The activation energy for a reaction is the maximum energy absorbed by the colliding particles during a chemical reaction
19. Use the oxidation numbers to determine which element has been oxidized and which has been reduced in the following chemical reaction.



- (A) Both Carbon and Iron (III) are reduced.
- (B) Both Carbon and Iron are (III) oxidised.
- (C) Carbon is reduced and Iron (III) is oxidised.
- (D) Carbon is oxidised and Iron (III) is reduced.

20. The periodic table is a tool for organising elements according to their chemical and physical properties.

Which of the following is correct for the periodic table?

- (A) The periodic table has five main blocks of elements. The elements in each block all have the same type of subshells (s, p, d, f, m) as their highest energy subshell.
- (B) The periodic table has three main blocks of elements. The elements in each block all have the same type of subshells (s, p, d) as their highest energy subshell.
- (C) The periodic table has four main blocks of elements. The elements in each block all have the same type of subshells (s, p, d, f) as their highest energy subshell.
- (D) The periodic table has four main blocks of elements. The elements in each block all have the different type of subshells (s, p, d, f) as their highest energy subshell.

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Section I

20 marks

Attempt Questions 1–20

Allow about 35 minutes for this section

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

	A	B	C	D
1				
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	A	B	C	D
11				
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Outcome	Questions	Mark
Knowledge and Understanding	MCQ 11-20(10), Q21(6), Q22(4), Q23(4), Q24(3), Q25(2), Q26(3), Q27(5)	/37
Working Scientifically	MCQ 1-10 (10), Q28(5), Q29(4), Q30(5), Q31(8), Q32(6)	/38

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Section II

55 marks

Attempt Questions 21–32

Allow about 1 hour and 25 minutes for this section

Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.

Show all relevant working in questions involving calculations.

Question 21 (6 marks)

Marks

List the formulae of the common chlorides of the first 5 elements in Period 3 and explain how differences in the structure and bonding of the chloride of sodium and the chloride of silicon affect their properties.

6

Include relevant diagrams with your answer.

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Question 22 (4 marks)**Marks**

The dichromate ion found in compounds such as potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$) is such a powerful oxidant that it can oxidise inert metals such as platinum to form its ion (Pt^{2+}).

The reduction potential of platinum has been measured at 1.2V.

- (a) Write an oxidation half-equation to represent the oxidation of Pt as described above.

1

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- (b) The half-equation for the reduction of $\text{Cr}_2\text{O}_7^{2-}$ is shown on the data sheet. Use this to determine the *change* in oxidation state that chromium undergoes in the reduction.

1

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- (c) Combine the equations in (a) and (b) to produce a balanced net ionic equation for the reaction that would occur when platinum metal was placed into a solution of acidified potassium dichromate. Show your working.

1

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- (d) A galvanic cell was produced from coupling a standard Pt/Pt^{2+} half cell with a standard half cell for $\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}$.

What was the maximum theoretical voltage produced?

1

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Question 23 (4 marks)

Marks

Ionic compounds are poor conductors of electricity in solid form but are able to conduct electricity under specific conditions.

- (a) Explain why ionic compounds are generally poor conductors of electricity at room temperature. **2**

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- (b) Identify the specific conditions when ionic compounds become conductors of electricity and give a reason. **2**

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Question 24 (3 marks)

Marks

- (a) What are radioisotopes? **1**

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- (b) Write a balanced equation to show the decay of naturally occurring uranium-238 when it emits an alpha particle and gamma radiation. **2**

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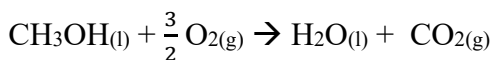
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Question 25 (2 marks)**Marks**

Methanol is used as a fuel for internal combustion engines. The following equation shows the reaction for combustion of methanol.



Predict the sign of ΔH for the above equation and explain your answer.

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Question 26 (3 marks)**Marks**

Infants and children require a daily allowance of 0.52mg of copper per kg of body weight.

- (a) Calculate for a 12kg infant the number of moles of copper required per day.

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- (b) Calculate the number of atoms of copper required per day.

1

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Question 27 (5 marks)

Marks

Aluminium oxide can be produced by igniting aluminium with oxygen.

- (a) Write a balanced equation for the formation of aluminium oxide from aluminium and oxygen. **1**

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- (b) How many moles of $\text{Al}_2\text{O}_{3(s)}$ can be produced when a mixture of 0.36 moles of aluminium and 0.36 moles of oxygen is ignited? **2**

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- (c) Using the information above in (b), which substance and how much of it is in excess of that required when producing the $\text{Al}_2\text{O}_{3(s)}$? **2**

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Question 28 (5 marks)**Marks**

Sulfur dioxide gas can react with oxygen gas to form sulfur trioxide gas. The temperature of the reaction vessel becomes hot as the reaction proceeds.

- (a) Write a balanced chemical equation for this reaction.

1

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- (b) Sketch a labelled energy profile diagram for this reaction.

2

- (c) Vanadium pentoxide is a catalyst for this reaction.

Explain its role and show how the energy profile diagram for the catalyzed reaction differs from the one shown above, without a catalyst.

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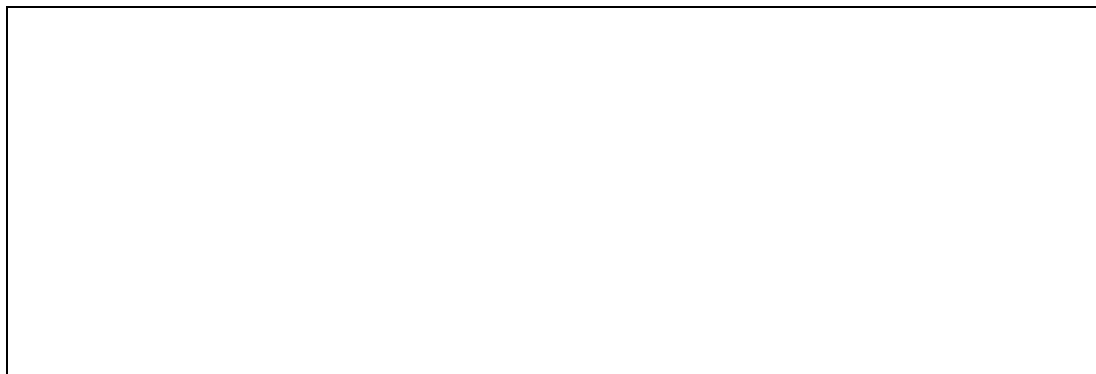
Question 29 (4 marks)

Marks

Hydrogen cyanide (HCN) is a flammable, highly toxic chemical which boils at temperatures just above 25°C and forms a miscible mixture with water.

- (a) Draw an electron-dot diagram to represent this molecule.

1



- (b) By referring to an appropriate theory, predict the shape of this molecule and explain why it is soluble in water.

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Question 30 (5 marks)**Marks**

The simplified solubility rules below may help you to answer this question.

General Rule	Exceptions
all Group I, nitrate and ammonium compounds are soluble	none
most chlorides are soluble	silver and lead (insoluble)
most sulfates are soluble	barium and lead (insoluble) calcium and silver (sparingly soluble)
most hydroxides are insoluble	group I, ammonium and barium compounds (soluble) calcium (slightly soluble)
most carbonates are insoluble	group I and ammonium compounds

A science teacher mixes solutions of magnesium nitrate and sodium hydroxide.

- (a) Write a balanced chemical equation (including states) for the reaction that occurs. 1

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- (b) Write the net ionic equation for the reaction. 1

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- (c) Using the solubility rules above, suggest a method that could be followed to determine which of the compounds below is present in an unlabelled bottle known to contain **one** of these dissolved compounds. 3

Explain how your observations would allow you to identify the unknown.
potassium nitrate, sodium sulfate, lithium hydroxide

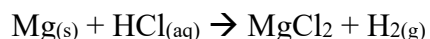
(Assume you have access to typical laboratory equipment, as well as dropper bottles, each containing 0.1M solutions of any chemical you require in your procedure.)

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Question 31 (8 marks)

Marks

Magnesium reacts with hydrochloric acid according to the following equation.

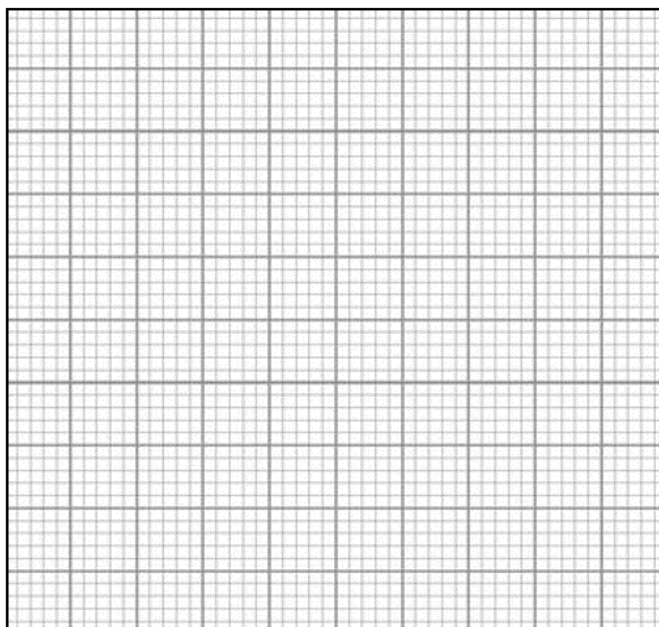


In an experiment the hydrogen gas was collected in a container and the volume of the gas produced over a period of time was recorded as shown below.

Time (s)	0	5	10	15	20	25	30	35	40	45
Volume of Hydrogen gas	0	12	22	30	36	41	45	48	50	50

- (a) Plot a graph showing volume of hydrogen gas produced versus time.
Label this as curve 1.

4



- (b) Explain why the volume of hydrogen gas collected in each 5 second interval becomes smaller and smaller.

2

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- (c) Draw another curve on the **same grid** showing the effect of raising the temperature by 5°C. Label this as curve 2.

1

- (d) Draw another curve on the **same grid** showing the effect of using more dilute hydrochloric acid. Label this as curve 3.

1

Please turn page over for last question...

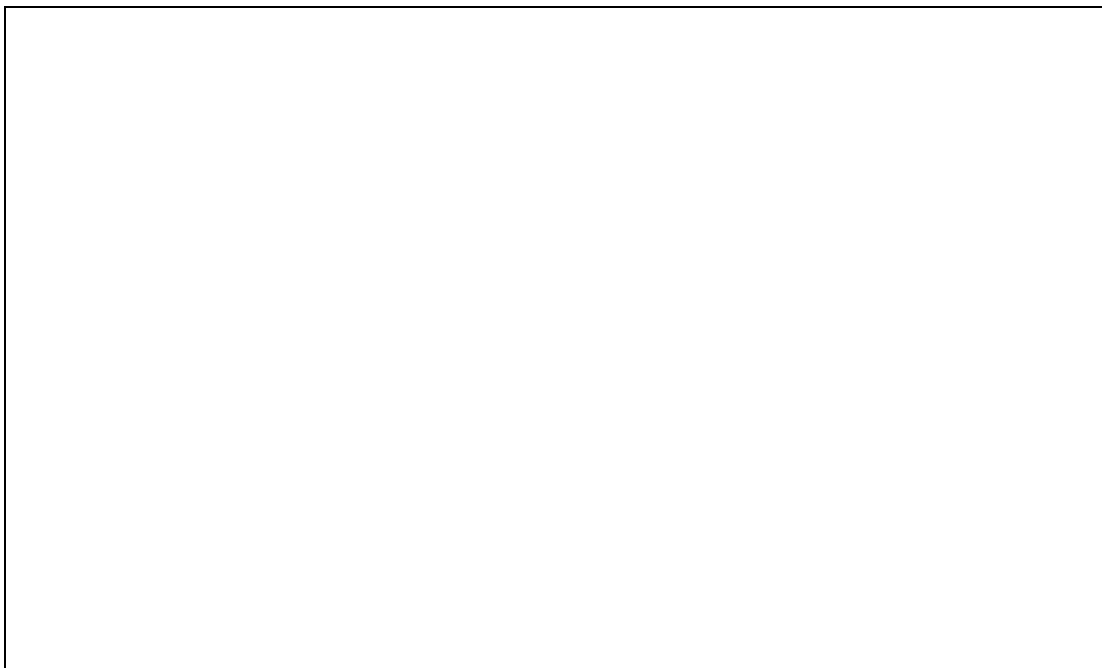
Question 32 (6 marks)

Marks

Students want to set up two half cells so that the resulting galvanic cell will generate an EMF. One half cell was constructed using magnesium metal in a solution of magnesium nitrate and the other half cell was constructed using zinc metal in zinc nitrate solution.

- (a) Sketch the galvanic cell

3



- (b) Write half equations for both half cells and using these construct a balanced overall equation to represent the reaction for the galvanic cell.

2

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- (c) Calculate the EMF generated by this galvanic cell.

1

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END OF EXAMINATION

NESA Number:

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Year 11 Chemistry Yearly Examination Marking Guidelines 2019

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
D	C	D	C	D	A	C	D	C	B	D	B	B		B	A	B	B	D	C

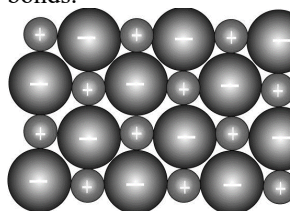
Question 21

Marking Criteria	Marks
Determines the formula for each chloride and explains how differences in the structure AND bonding in NaCl and SiCl₄ affect their physical properties, including relevant diagrams.	6
As above, with an error or omission.	5
Determines the formula for most of the chlorides and describes the structure AND bonding in NaCl and SiCl₄ and explains at least TWO difference in their properties, including a relevant diagram.	4
Determines the formula for most of the chlorides and describes the structure AND bonding in NaCl and SiCl₄ and explains at least TWO difference in their properties.	3
Determines the formula for at least three of the chlorides and describes the structure AND bonding in either NaCl and SiCl₄ OR Compares the structure and/or bonding in NaCl and SiCl₄ OR Compares the physical properties of NaCl and SiCl₄	2
Determines the formula of at least two chlorides OR describes the structure and/or bonding or physical properties in NaCl and SiCl₄ OR includes a relevant diagram.	1

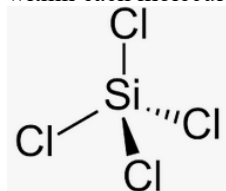
The chloride formulae are: NaCl, MgCl₂, AlCl₃, SiCl₄ and PCl₃ (or PCl₅)

The structure and bonding in NaCl and SiCl₄ differ significantly because NaCl is an ionic substance and SiCl₄ is covalent molecular.

Since NaCl is ionic, it is comprised of a lattice of alternating Na⁺ and Cl⁻ ions held together by strong ionic bonds.



These bonds give NaCl a relatively high melting and boiling point. Conversely, SiCl₄ has strong covalent bonds within each molecule but relatively weak dispersion forces between molecules, owing to the fact it is non-polar.



These weak IMF can be easily overcome, and so the solid would melt and then boil at much lower temperatures compared to NaCl.

The fact that NaCl is comprised of charged ions means it is able to conduct electricity as a liquid or in solution, as mobile charge carriers are available to conduct electricity. Since SiCl₄ is comprised on non-polar molecules, the absence of charge carriers prevents it from being an electrical conductor.

The fact that NaCl is made of charged ions is the reason it is highly soluble in water, which is polar, and hence ion-dipole forces can form between the ions and oppositely charged ends of water molecules, allowing the lattice to dissolve. SiCl₄ in a liquid or solid form would be much less soluble in water, as the SiCl₄ is non-polar, and cannot interact with polar water molecules, which are themselves held together by stronger hydrogen bonding.

Question 22

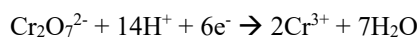
a.

Marking Criteria	Marks
Writes the correct half-equation.	1



b.

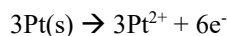
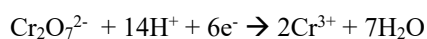
Marking Criteria	Marks
Determines oxidation state change.	1



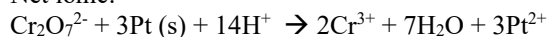
Change in oxidation state of +6 to +3.

c.

Marking Criteria	Marks
Write a correct net ionic equation for the redox reaction.	1



Net ionic:



d.

Marking Criteria	Marks
Calculates the EMF of the cell	1

$$\begin{aligned}\text{EMF}^{\circ}_{\text{cell}} &= \text{EMF}^{\circ}_{\text{ox}} + \text{EMF}^{\circ}_{\text{red}} \\ &= -1.2 + 1.36 = 0.16\text{V}\end{aligned}$$

Question 23

a.

Criteria	Marks
Identifies that generally ionic compounds exist as solids at room temperature. AND Identifies that ions need to move to conduct electricity which solid ionic compounds are unable to do.	2
One of the above	1

Sample answer:

Generally ionic compounds exist in solid form at room temperature and ions in a crystal lattice are not free to move and therefore cannot conduct electricity.

b.

Criteria	Marks
Identifies conditions for conductivity. AND Identifies the reason for conductivity.	2
One of the above	1

Sample answer:

When ionic compounds melt or dissolve in water, they can conduct electricity. The reason for this is that being in molten form and in solution allows the positive ions to move towards the negative end and negative ions to move towards the positive end, resulting in an electric current.

Question 24

a.

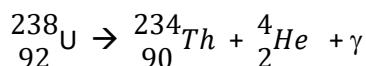
Criteria	Marks
Provides the correct definition.	1

Sample answer:

Radioisotopes are radioactive isotopes of an element. These atoms have unstable nucleus which decay by emitting radiation in the form of alpha particle, beta particle or gamma particle.

b.

Criteria	Marks
Provides correct equation with all correct detail.	2
Provides correct equation with one mistake.	1



Question 25

Criteria	Marks
Provides sign and reason.	2
Any one of the above.	1

Sample answer:

Combustion reaction so ΔH is negative.

Question 26

(a)

Criteria	Marks
• Converts mg into grams and converts into grams per day based on 12kg body weight AND calculates the moles of Cu required per day	2
• Converts mg into grams and converts into grams per day based on 12kg body weight OR calculates the moles of Cu required per day	1

Sample answer

Convert mg into grams $0.52\text{mg} = 0.52 \times 10^{-3}\text{ g}$.

Cu required for a 12 kg baby $= 0.52 \times 10^{-3} \times 12$

$= 6.2 \times 10^{-3}\text{ g per day}$.

Moles of Cu in $6 \times 10^{-3}\text{ g} = 6.2 \times 10^{-3}\text{ g} / 63.55 = 9.8 \times 10^{-5}\text{ moles}$ (2 sig figures)

(b)

Criteria	Mark
• Multiplies the moles in (a) by N_A number (6.023×10^{23})	1

Sample answer:

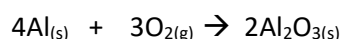
No. of Cu atoms in 9.8×10^{-5} moles = $9.8 \times 10^{-5} \times 6.023 \times 10^{23} = 5.9 \times 10^{19}$ Cu atoms required.

Question 27

(a)

Criteria	Mark
• Derives a symbol equation for the formation of $Al_2O_{3(s)}$ from $Al_{(s)}$ and $O_{2(g)}$ AND balances the equation	1

Sample answer



(b)

Criteria	Marks
• Uses the 0.36 moles of aluminium as the basis of establishing mole ratios AND converts the 0.36 moles of Al reacting to a mole ratio of $Al_2O_{3(s)}$ formed	2
• Uses the 0.36 moles of aluminium as the basis of establishing mole ratios OR converts the 0.36 moles of Al reacting to a mole ratio of $Al_2O_{3(s)}$ formed	1

Sample answer

Using the equation $4Al_{(s)} + 3O_{2(g)} \rightarrow 2Al_2O_{3(s)}$

The element in excess is O_2 as more moles of Al are required than of O_2 . E.g., If using 0.36 moles of O_2 then you need 0.48 moles of Al but you only have 0.36 moles of each reactant.

Therefore from the eqn 2 mole of Al react with 1.5 mole of O_2 forming 1 mole of $Al_2O_{3(s)}$

Therefore 0.36 " " 0.27 " " 0.18 " "

Moles of $Al_2O_{3(s)}$ formed is 0.18 moles.

(c)

Criteria	Marks
• Recognises that the moles of oxygen are in excess AND calculates the moles in excess of O_2 left over from the reaction	2
• Recognises that the moles of oxygen are in excess OR calculates the moles in excess of O_2 left over from the reaction	1

Sample answer

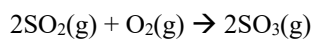
Using the information above O_2 is in excess.

The amount of O_2 left over from the reaction = 0.36 mole initially – 0.27 mole reacted
= 0.09 moles of O_2 left over from the reaction.

Question 28

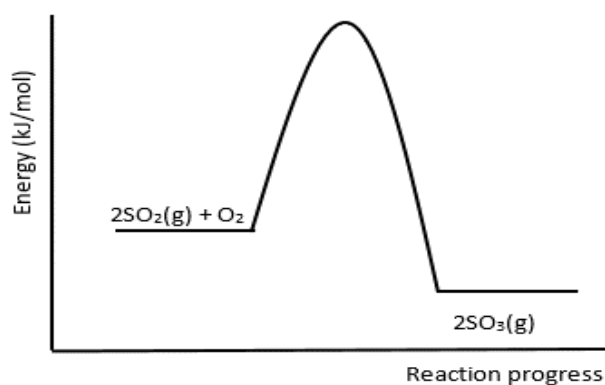
a.

Marking Criteria	Marks
Writes the correct equation.	1



b.

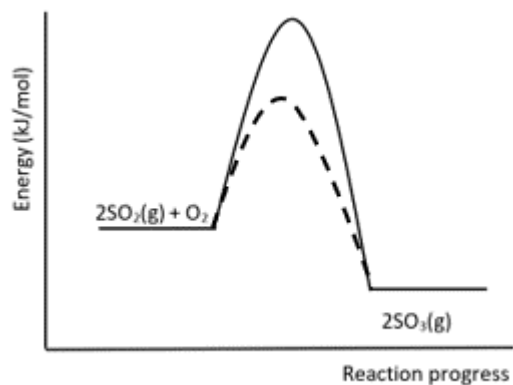
Marking Criteria	Marks
Draws a correct energy profile reaction for the reaction above.	2
The exothermic nature of the reaction is obvious in the profile diagram.	1



c.

Marking Criteria	Marks
Explains the role of a catalyst AND shows how the addition of a catalyst affects the activation energy.	2
Explains the role of a catalyst OR shows how the addition of a catalyst affects the activation energy.	1

Catalysts provide a pathway for the reaction with a lower activation energy, and hence increase the rate of a reaction, without changing the ΔH of the reaction.



Question 29

a.

Marking Criteria	Marks
Draws correct electron-dot diagram.	1



b.

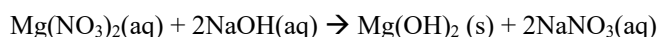
Marking Criteria	Marks
Applies the VSEPR theory to predict the linear shape of the molecule, identifies the molecule as being polar, and uses this to explain its solubility in water.	3
Predicts the linear shape of the molecule, identifies the molecule as being polar, and uses this to explain its solubility in water.	2
Predicts the linear shape of the molecule OR identifies it is a polar molecule.	1

The VSEPR theory states that the orbitals occupying electrons around the central atom will repel and arrange themselves as far away as possible to minimise repulsion. There are 2 areas of electron density around the central C (the 3 pairs forming a triple bond count as one area), and so the theory predicts the molecule would be linear. Since the H, C and N has difference electronegativities, the bonds are polar and there is a net dipole towards the more electronegative N. This explains why the molecule dissolves in water, which is a polar solvent.

Question 30

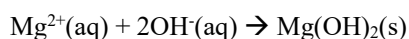
a.

Marking Criteria	Marks
Writes correctly balanced equation..	1



b.

Marking Criteria	Marks
Writes the correct net ionic equation based on the reaction from (a) above.	1



c.

Marking Criteria	Marks
Records a procedure that could be followed to identify which compound must be in the unlabelled bottle and explains how the results would lead to the identification of the compound, applying the solubility rules.	3
Records a procedure that could be followed to identify which compound must be in the unlabelled bottle with insufficient explanation of how the results would lead to the identification.	2
Shows some understanding of how the solubility rules could be used to identify the unknown.	1

- Pour 1mL of the unknown solution into a test tube.
- Add a few drops of $\text{Ba}(\text{NO}_3)_2$. If a precipitate forms, the solution can only be sodium sulfate, as BaSO_4 is insoluble but neither K_2SO_4 or $\text{Ba}(\text{OH})_2$ are insoluble.
- If no precipitate forms in Step 2, add a few drops of $\text{Pb}(\text{NO}_3)_2$. If a precipitate forms, the solution must be LiOH , as $\text{Pb}(\text{OH})_2$ is insoluble but $\text{Pb}(\text{NO}_3)_2$ is soluble.

Since potassium nitrate is soluble with any combination of ions, if no precipitate forms from steps 2 and 3, this must be the unknown.

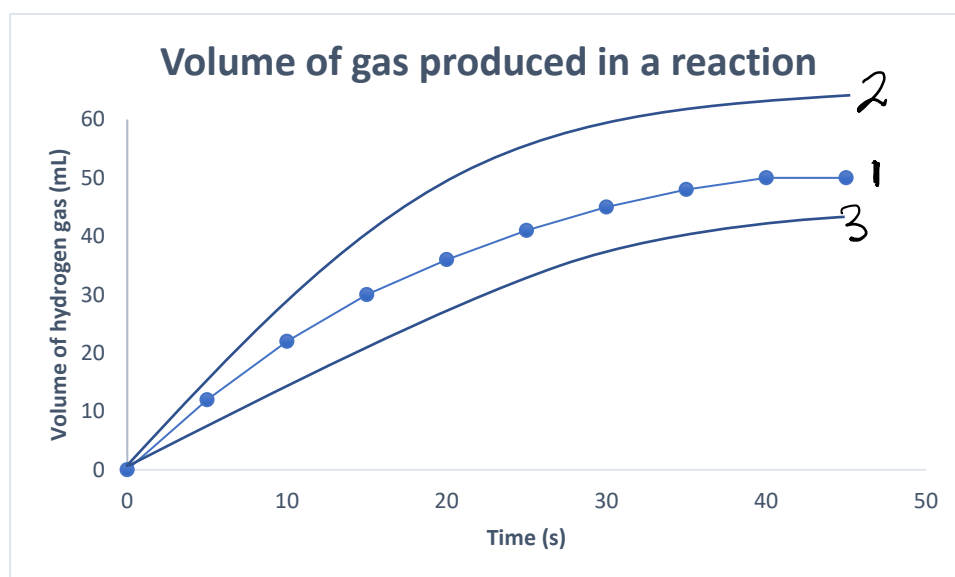
Question 31

a.

Criteria	Marks
The graph has correct axes labels, correct units on axes, correct plots and correct curve Of best fit.	4
Any three of the above.	3
Any two of the above.	2
Any one of the above.	1

Sample answer:

This answer has all three graphs required for this question.



b.

Criteria	Marks
Provides correct cause and effect.	2
Any one of the above	1

Sample answer:

As the reaction proceeds, the acid is used up and there is less acid left for the metal and hence the reaction slows down.

c.

Criteria	Marks
Provides the correct curve.	1

Sample answer: On the first graph

d.

Criteria	Marks
Provides the correct curve.	1

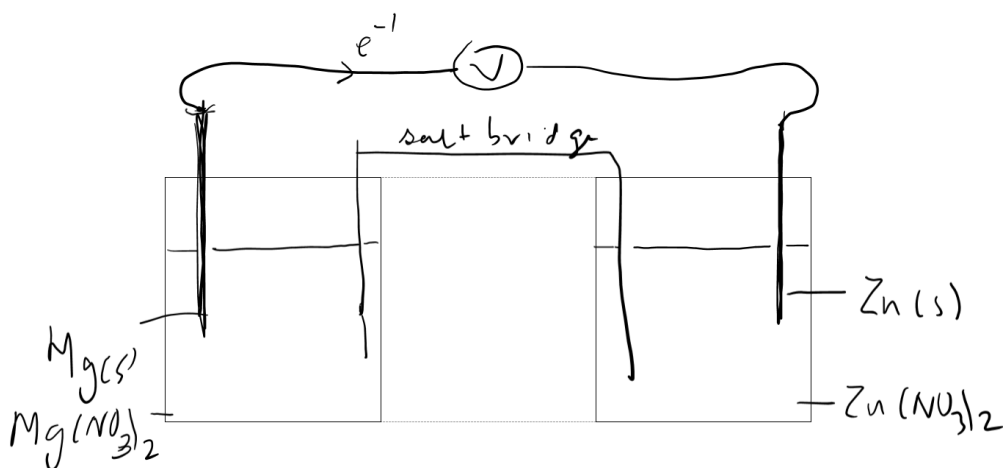
Sample answer: On the first graph

Question 32

a.

Criteria	Marks
Provides correct connections showing direction of electron flow, metals in their own solutions and salt bridge.	3
Any two of the above.	2
Any one of the above.	1

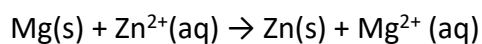
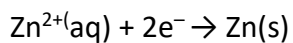
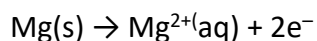
Sample answer:



b.

Criteria	Marks
Provides all three correct equations.	2
Provides at least two correct equations.	1

Sample answer:



c.

Criteria	Marks
Provides correct answer.	1

EMF generated = 1.60 V