Name: _____

Please highlight/circle your teacher's name

Mrs R. Campbell

Mrs S. Mathis

Mrs A. Paterson

Mrs A Thorne

Dr K Wood

PYMBLE LADIES' COLLEGE

SEMESTER 2, 2018

YEAR 11 CHEMISTRY

EXAMINATION

READING TIME: 5 minutes

TIME ALLOWED: 2 HOURS

TOTAL MARKS: 90

DIRECTIONS TO CANDIDATES

Write your name in the space at the top of the page where indicated.

PART A: **20 multiple choice questions, each worth one mark.**

Indicate your answers on the multiple choice answer sheet.

PART B: **Extended response questions (Total of 70 marks).**
Marks for each question are indicated.
Answer each question in the space provided.

A separate Periodic Table and Data Sheet are provided.

PART A

Total Marks – 20
Attempt ALL questions

Select the alternative that best answers the question.
Mark your answers on the Multiple Choice Answer Sheet provided.

[Allow about 25 minutes for this part]

Question 1.

Which of the following lists contains only non-metals?

A) Sodium, carbon, hydrogen, oxygen
B) Chlorine, aluminium, helium, nitrogen
C) Hydrogen, carbon, argon, iodine
D) Antimony, bromine, neon, phosphorus

Question 2.

What is the correct systematic (IUPAC) name for $Al_2(SO_4)_3$?

A) Dialuminium trisulfate
B) Aluminium sulfur oxide
C) Aluminium trisulfate
D) Aluminium sulfate

Question 3.

Which of the following correctly describes isotopes of an element?

A) They have the same number of protons, but different numbers of neutrons
B) They have the same number of protons, and the same number of neutrons
C) They have different number of protons, and the same number of neutrons
D) They have different numbers of protons, and different number of neutrons

Question 4.

Potassium has atomic number 19 and mass number 39. Which of the following statements is correct?

A) An atom of Potassium has 19 protons, 19 electrons and 19 neutrons
B) An atom of Potassium has 19 protons, 19 electrons and 20 neutrons
C) An atom of Potassium has 19 protons, 20 electrons and 19 neutrons
D) An atom of Potassium has 19 protons, 20 electrons and 20 neutrons

Question 5.

Laboratory tests established the following properties for sulfur, carbon and iron.

Test	Sulfur	Carbon	Iron
Solubility in water solvent	insoluble	insoluble	insoluble
Solubility in carbon disulfide solvent	soluble	insoluble	insoluble
Attraction to a magnet	unattracted	unattracted	attracted

A powdered mixture contains sulfur, carbon and iron. Which of the following describes a procedure which would separate all the compounds to give the pure solid components?

	Step 1	Step 2	Step 3	Step 4
A)	Magnetic separation	Add water	Filtration	Distillation
B)	Sieve	Add carbon disulfide	Decant	Evaporation
C)	Add water	Filtration	Crystallisation	Magnetic separation
D)	Magnetic separation	Add carbon disulfide	Filtration	Evaporation

Question 6.

Which of the following elements has the lowest ionisation energy?

A) Sodium
B) Magnesium
C) Potassium
D) Calcium

Question 7.

Thallium-208 has a half-life of 3.05 minutes. How long does it take for 120 g to decay to 7.50 g?

A) 9.15 minutes
B) 12.2 minutes
C) 15.3 minutes
D) 28.4 minutes

Question 8.

What is the electron configuration of the element with atomic number 35?

A) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
B) $1s^2 1p^6 2s^2 2p^6 3s^2 3p^6 4s^2 3d^9$
C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^6 4d^9$
D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^5 4d^{10}$

Question 9.

Avogadro's Number is 6.02×10^{23}. Which of the following statements is FALSE?

A) 6.02×10^{23} particles is a mole of particles
B) 6.02×10^{23} amu = 1 gram
C) 6.02×10^{23} particles of an element is its mass number
D) 6.02×10^{23} carbon atoms weigh 12.01 grams

Question 10.

What is the empirical formula for a compound that is 36.1% Ca and 63.9% Cl?

A) CaCl
B) $CaCl_2$
C) Ca_2Cl
D) Ca_2Cl_2

Question 11.

In which molecule is the percentage mass of oxygen 73%?

A) CO
B) NO
C) CO_2
D) NO_2

Question 12.

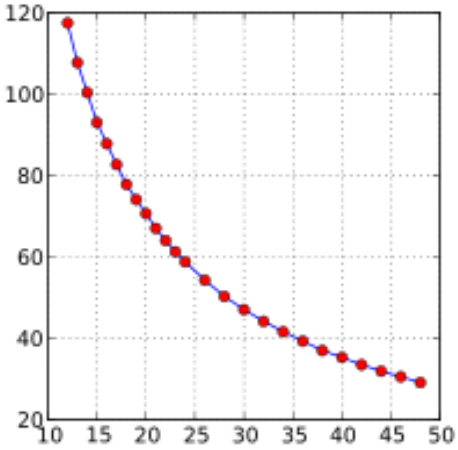
What numbers are required to correctly balance this equation?

__ MnO_2 + __K_2CO_3 + __O_2 → __$KMnO_4$ + __CO_2

A) 2, 1, 1, 2, 1
B) 1, 1, 2, 1, 3
C) 3, 1, 1, 2, 4
D) 4, 2, 3, 4, 2

Question 13.

Use this graph to answer the question.



A student carried out experiments with gases and got this graph when she plotted her results. She forgot to label her axes. What are the correct labels?

	x-axis	y- axis
A)	Pressure	Volume
B)	Pressure	Temperature
C)	Volume	Pressure
D)	Temperature	Pressure

Question 14.

A gas held in a container which is able to change size, originally has a pressure of 5.00 kPa, a temperature of 250 K and a volume of 5.00 L. If the temperature is increased to 300 K and the pressure becomes 5.50 kPa, what will the volume be?

A) 6.60 L
B) 5.45 L
C) 3.79 L
D) Unchanged

Question 15.

What are the features of an ideal gas?

A) The molecules do not attract each other and occupy a negligible volume.
B) There are forces between the molecules but they are weak so they occupy a large volume.
C) Their volume is lower than a real gas because they have no forces of attraction.
D) The features depend on the size of the particles. A general rule is not followed.

Question 16.

Use this table to answer this question.

<table>
<tr><th>Metal</th><th>Reaction when heated with oxygen</th><th>Reaction with water</th></tr>
<tr><td>K</td><td rowspan="3">Burn rapidly to form oxides</td><td rowspan="3">Reacts with cold water to form hydroxide ions and hydrogen gas</td></tr>
<tr><td>Na</td></tr>
<tr><td>Ca</td></tr>
<tr><td>Mg</td><td rowspan="4">Burn readily if powdered to form oxides</td><td>Reacts with hot water to form hydroxide ions and hydrogen gas</td></tr>
<tr><td>Al</td><td rowspan="3">Will react with steam to form oxide ions and hydrogen gas</td></tr>
<tr><td>Zn</td></tr>
<tr><td>Fe</td></tr>
<tr><td>Sn</td><td rowspan="3">Become coated with an oxide layer during heating</td><td rowspan="3">No reaction</td></tr>
<tr><td>Pb</td></tr>
<tr><td>Cu</td></tr>
</table>

Which of the following equations correctly represents the reaction of zinc with water?

A) $Zn\ (s) + 2\ H_2O\ (g) \rightarrow Zn(OH)_2\ (aq) + H_2\ (g)$
B) $Zn\ (s) + H_2O\ (g) \rightarrow ZnO\ (s) + H_2\ (g)$
C) $2\ Zn\ (s) + 2\ H_2O\ (l) \rightarrow ZnO_2\ (aq) + 2\ H_2\ (g)$
D) $Zn\ (s) + H_2O\ (l) \rightarrow ZnO\ (aq) + H_2\ (g)$

Question 17.

Identify the compound in which manganese has an oxidation state of +IV.

A) $MnSO_4$
B) $KMnO_4$
C) Mn_2O_3
D) MnO_2

Question 18.

For which pair of substances will a displacement reaction occur?

A) Magnesium in a solution of silver ions
B) Copper in a solution of aluminium ions
C) Iron in a solution of zinc ions
D) Lead in a solution of nickel ions

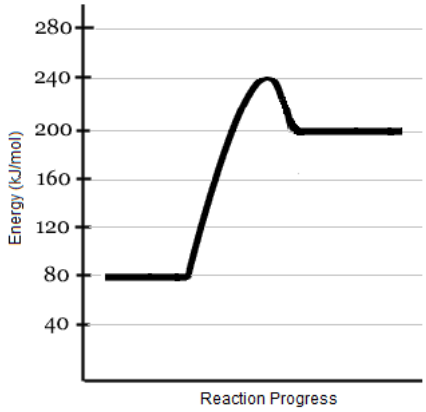
Question 19.

Which of the following statements is true for endothermic reactions?

A) ΔH is negative because energy is released, and the temperature of the surroundings increases
B) ΔH is negative because energy is absorbed, and the temperature of the surroundings decreases
C) ΔH is positive because energy is released, and the temperature of the surroundings increases
D) ΔH is positive because energy is absorbed, and the temperature of the surroundings decreases

Question 20.

The energy diagram for a reaction is shown.



What is the activation energy for this reaction?

A) 40 kJ/mol
B) 120 kJ/mol
C) 160 kJ/mol
D) 240 kJ/mol

PART B

Total marks – 70

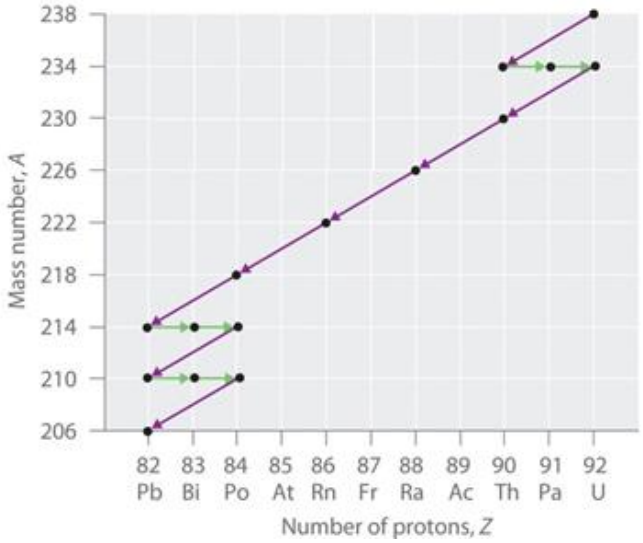
Attempt ALL questions

Show all relevant working in questions involving calculations.

[Allow about 1 hour and 40 minutes for this part]

Question 21. (5 marks)

A radioactive decay series is shown in the diagram below.



a) Rank the penetrating ability of alpha, beta and gamma radiation from lowest to highest **1**

……

b) Write an equation to show the α-decay of $^{238}_{92}U$ **1**

……

c) Write an equation to show the β-decay of $^{234}_{90}Th$ **1**

……

d) Explain why the radioactive decay stops when $^{206}_{82}Pb$ is formed. **2**

……

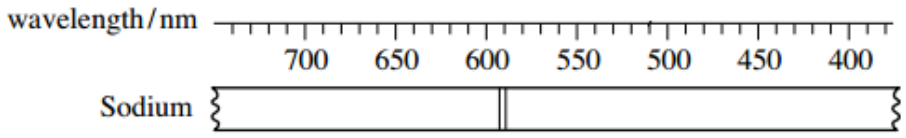
……

……

……

Question 22. (6 marks)

The emission line spectrum of sodium is shown.



The wavelengths of different colours of the visible spectrum are shown.

Colour	Wavelength (nm)
Violet	380 – 450
Blue	450 – 495
Green	495 – 570
Yellow	570 – 590
Orange	590 – 620
red	620 – 750

a) Use the emission line spectrum to identify the colour sodium would produce in a flame test. **1**

……

b) Explain how emission line spectra are produced. Include a diagram in your answer. **5**

……

……

……

……

……

……

……

……

……

……

Question 23. (9 marks)

The following table gives some information about two covalent molecular substances

Compound	Molecular formula	Boiling Point (°C)
Ammonia	NH_3	- 33
Hydrogen sulfide	H_2S	- 62

a) Draw Lewis dot diagrams for each molecule **2**

b) Identify the shape and polarity of each molecule **4**

Compound	Shape	Polarity
Ammonia		
Hydrogen sulfide		

c) Explain why there is a difference in the boiling points of these molecules **3**

……

……

……

……

……

……

Question 24. (11 marks)

A student was performing an experiment and placed some sodium chloride (NaCl), silicon dioxide (SiO_2) and sugar ($C_{12}H_{22}O_{11}$) into separate beakers.

Unfortunately, she did not label her beakers and couldn't remember which beaker contained which substance since they are all white solids.

She decided to do some tests to work out which substance was in each beaker. Her results are shown in the table.

Test	Beaker A	Beaker B	Beaker C
Solubility in water	soluble	soluble	insoluble
Conductivity in water	no	yes	n/a
Heat over Bunsen burner	melted	remains solid	remains solid

a) Identify which of the 3 substances is covalent molecular **1**

……..……..……..…….

b) Identify which substance is in each beaker **2**

Beaker A: ……..

Beaker B: ……..

Beaker C: ……..

c) Explain why the substance in beaker B conducts electricity when dissolved in water **2**

……..……..……..…….

……..……..……..…….

……..……..……..…….

……..……..……..…….

d) Explain, in detail, what binds particles together to form solid sodium chloride, silicon dioxide and sugar. **6**

……

……

……

……

……

……

……

……

……

……

……

Question 25. (6 marks)

Magnesium nitride is a solid compound formed when magnesium is heated strongly in air according to the equation:

$$3\ Mg\ (s) + N_2\ (g) \rightarrow Mg_3N_2\ (s)$$

In an experiment 1.44 g of magnesium ribbon is heated strongly.

a) How many moles of magnesium are present in 1.44 g of magnesium? **1**

……

……

b) Calculate the mass of nitrogen which combined with the 1.44 g of magnesium in this experiment. **2**

……

……

……

……

……

……

c) Calculate the mass of magnesium nitride which is formed. Show all working. **2**

……

……

……

……

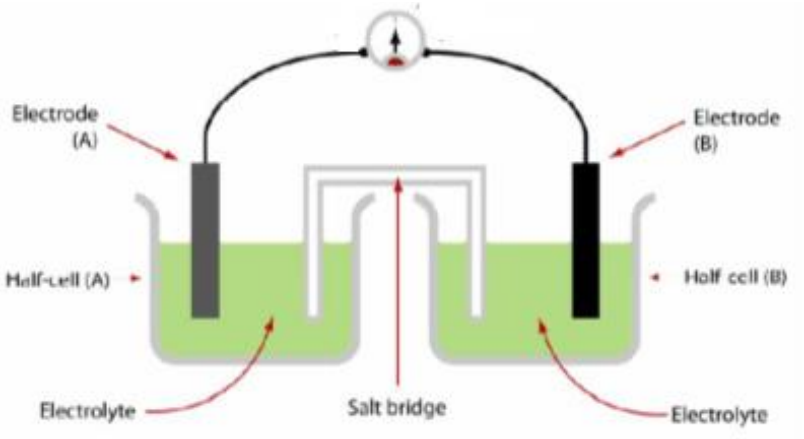
d) You should find that the mass of the magnesium added to the mass of nitrogen is equal to the mass of magnesium nitride. What Law does this illustrate? **1**

……

……

Question 26. (6 marks)

A student performed a first-hand investigation to determine the voltage produced using different combinations of metals in an electrolyte solution.



a) Complete the table by calculating the cell potentials **2**

Experiment	Half-Cell A	Half-Cell B	Theoretical Cell Potential (V)
1	$Ni_{(s)}/Ni^{2+}$	$Cu_{(s)}/Cu^{2+}$	
2	$Ag_{(s)}/Ag^{+}$	$Cu_{(s)}/Cu^{2+}$	

b) Is the nickel half-cell the anode or the cathode? Explain how you determined your answer. **2**

……

……

……

……

c) Write the net ionic equation for the reaction between the silver half-cell and the copper half-cell. **2**

……

……

Question 27. (5 marks)

A gas at a temperature of 1195 K in a container with a volume of 25 litres has a pressure of 560 kPa.

a) How many moles of gas are in the container? **3**

……..……..……..……..…

……..……..……..……...

……..……..……..……..…

……..……..……..……...

……..……..……..……..…

……..……..……..……...

b) If the empty container weighs 530.2 g and the container and gas weigh 575.3 g, what is the gaseous element in the container? **2**

……..……..……..……..…

……..……..……..……...

……..……..……..……..…

……..……..……..……...

Question 28. (6 marks)

Copper (II) chloride reacts with silver nitrate according to the equation:

$$CuCl_2\ (aq) + 2\ AgNO_3\ (aq) \rightarrow Cu(NO_3)_2\ (aq) + 2\ AgCl\ (s)$$

a) What mass of silver nitrate will react with 4.03 g of copper (II) chloride? **3**

……

……

……

……

b) i) If 3.40 g of silver nitrate is reacted with 4.03 g of copper (II) chloride. Which is the limiting reagent, copper (II) chloride or the silver nitrate? **1**

……

……

ii) What mass of silver chloride will be produced? **2**

……

……

……

……

Question 29. (4 marks)

a) 6.23 g of sodium chloride is dissolved in 500.0 mL of water. What is the concentration of this solution? **2**

……..……..……..……..…

……..……..……..……...

……..……..……..……..…

……..……..……..……...

b) How many grams of sodium carbonate will be needed to make 2.00 L of a 0.500 M solution? **2**

……..……..……..……..…

……..……..……..……...

……..……..……..……..…

……..……..……..……...

Question 30. (5 marks)

Iron (III) carbonate reacts with hydrochloric acid to produce iron (III) chloride, carbon dioxide and water.

What volume of carbon dioxide will be produced if 12.45 g of iron carbonate is reacted and the gas collected at 25 °C and 100 kPa? **5**

……

……

……

……

……

……

……

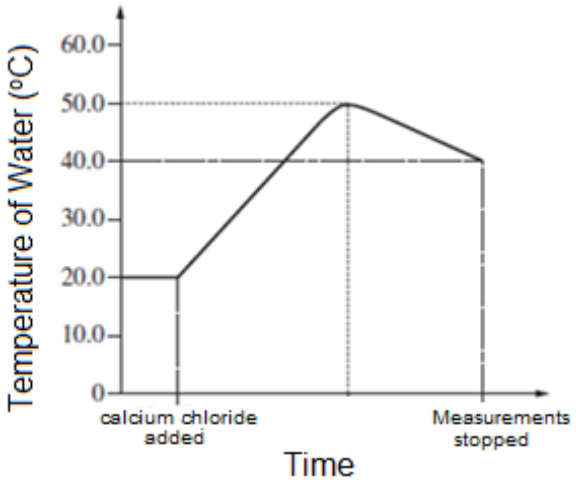
……

……

……

Question 31. (7 marks)

A 18.45 g sample of calcium chloride was dissolved in 100.0 ml of water and the temperature change was measured as shown in the graph.



a) Calculate the quantity of heat (q) absorbed by the water **2**

……

……

……

……

a) Calculate the number of moles of calcium chloride dissolved **2**

……

……

……

……

b) Calculate the enthalpy change (ΔH) per mole for the dissolution **2**

……

……

c) The standard enthalpy change (ΔH°) for the dissolution of calcium chloride is −82.9 kJ/mol. Give one reason why the calculated value in c) may differ from the standard value **1**

……

……

End of Examination

Extra Writing Space

Student Name: ……

Multiple Choice Answer Sheet

Select the alternative A, B, C or D that best answers the question.

Fill in the response space completely. If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word ***correct*** and drawing an arrow.

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

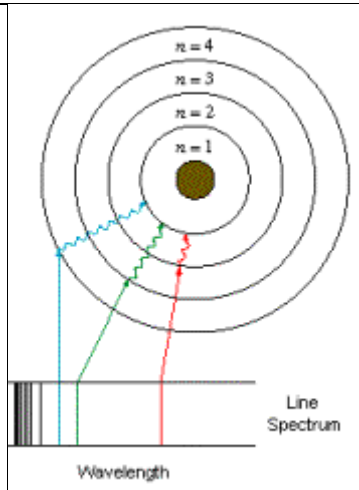
2018 YEAR 11 - CHEMISTRY - EXAMINATION ANSWERS

PART A

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

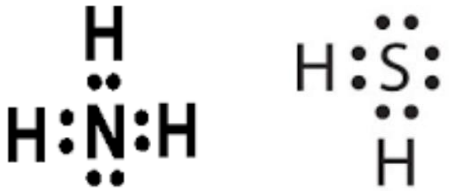
PART B

Question	Marking Guidelines	Suggested Answer	Markers Comments
21 a)	1 – correct order	Alpha < beta < gamma	Not well done.
21 b)	1 – correct balanced equation	$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}\alpha$ (or with He)	Please make sure that you have the alpha particle on the products side of the arrow
21 c)	1 – correct balanced equation	$^{234}_{90}Th \rightarrow {}^{234}_{91}Pa + {}^{0}_{-1}\beta$ (or with e)	Again please make sure that you have the beta particle on the products side of the arrow
21 d)	1 mark - identifies that $^{206}{}_{82}Pb$ has a stable nucleus 1 mark - explains conditions under which isotopes undergo radioactive decay	Only unstable isotopes with atomic numbers greater than 83 and a ratio of neutrons to protons outside the zone of stability emit radiation. The radioactive decay stops with $^{206}{}_{82}Pb$ because it is the first species produced in the decay series which has a stable nucleus and therefore does not emit radiation.	Most students recognised that Pb was stable but did not explain why this no longer undergoes decay
22 a)	1 – correct colour	orange	I didn't accept yellow but did accept yellowy-orange. One of the lines was on the border between yellow and orange but the other line was definitely in the orange section

<table>
<tr>
<td>22 b)</td>
<td>1 mark – identifies an atom has electron energy levels / shells
1 mark – identifies emission occurs when electron falls from an excited to ground state
1 mark – identifies energy is quantised between levels
1 mark – relates quantised energy to wavelengths in line spectrum
1 mark – relevant and correct diagram</td>
<td> 

The electrons of an atom occupy discrete energy levels (1). When an electron that has been excited to a higher energy falls back to the ground state, a photon of energy is emitted (1). The emission of photons is quantised (1), so each transition corresponds to a specific wavelength of light and appears as a line on the emission spectrum (1).</td>
<td>General points – a photon is released when an electron drops back to its ground state. Many students said a photon was released when the electron gets excited.

Please watch your diagrams. A circle with some dots on it doesn’t mean anything. Please make sure that you include LABELS

Atoms don’t get excited to produce light, electrons do</td>
</tr>
<tr>
<td>23 a)</td>
<td>1 mark for each correct diagram</td>
<td>  </td>
<td>Some students are putting the dots beside each other, we prefer you do not.</td>
</tr>
<tr>
<td>23 b)</td>
<td>1 mark for each correct answer</td>
<td>
<table>
<tr><th>Compound</th><th>Shape</th><th>Polarity</th></tr>
<tr><td>Ammonia</td><td>trigonal pyramidal</td><td>polar</td></tr>
<tr><td>Hydrogen sulfide</td><td>bent</td><td>polar</td></tr>
</table>
</td>
<td>Some overcomplication of whether polar or not!

Many said H_2S was linear</td>
</tr>
</table>

<table>
<tr>
<td>23 c)</td>
<td>
<table>
<tr><th>Criteria</th><th>Mark</th></tr>
<tr><td>• Identifies that NH_3 can form hydrogen bonding and H_2S forms dipole-dipole interactions
• Identifies that hydrogen bonds are much stronger than dipole-dipole forces therefore more energy is required to loosen forces so the bp of NH_3 is higher than that of H_2S.</td><td>3</td></tr>
<tr><td>Any 2 of:
• Identifies the intermolecular forces for NH_3
• Identifies the intermolecular forces for H_2S
• Identifies that the IMFs affects BP.</td><td>2</td></tr>
<tr><td>• One correct statement</td><td>1</td></tr>
</table>
</td>
<td>Even though both molecules are polar, H_2S has a lower boiling than NH_3 because H_2S has weaker dipole-dipole interactions between molecules. NH_3 has a highly electronegative nitrogen bonded to hydrogen and so can form stronger hydrogen bonding interactions between molecules. Since more energy is required to overcome the stronger intermolecular forces, NH_3 has the higher boiling point.

Could include a diagram to demonstrate hydrogen bonding</td>
<td>A lot of irrelevan information in the answer to this question. Please try to produce concise answers which are to the point.
You essentially just needed to identify the 2 types of intermolecular forces then explain why one needs more energy than the other to be overcome.

Avoid using the work “break” when talking about intermolecular forces.

These forces are between “adjacent molecules”. They are not bonds. Be careful when you say the force is btween a N and an H. Do you mean the covalent intramolecular BOND or the hydrogen bond intermolecular FORCE?</td>
</tr>
<tr>
<td>24 a)</td>
<td>1 – correct answer</td>
<td>Sugar $C_{12}H_{22}O_{11}$</td>
<td>Generally answered well. Many simply identified it as beaker A and in part B identified A as sugar. This was accepted as marked correct.</td>
</tr>
<tr>
<td>24 b)</td>
<td>1 – correct answer</td>
<td>Beaker A – sugar
Beaker B – sodium chloride
Beaker C – silicon dioxide</td>
<td>Generally answered well</td>
</tr>
<tr>
<td>24 c)</td>
<td>
<table>
<tr><th>Criteria</th><th>Mark</th></tr>
<tr><td>• Identifies and/or infers the substance (NaCl) is ionic
• Identifies that when dissolved ions move freely
• Identifies that free moving ions can carry charge</td><td>2</td></tr>
<tr><td>• One correct statement</td><td>1</td></tr>
</table>
</td>
<td>When the ionic substance, sodium chloride, is dissolved in water the charged ions are free to move so can carry charge.</td>
<td>Some identified incorrect substance
Many missed key point that free ions can carry charge.
Common mistake was to say that when an ionic lattice is dissolved electrons are free, it is actually ions that are free.</td>
</tr>
<tr>
<td>24 d)</td>
<td>
<table>
<tr><th>Criteria</th><th>Mark</th></tr>
<tr><td>• Demonstrates a thorough knowledge of the both the intramolecular and intermolecular forces which bind particles together to form different classes of solid chemical structures</td><td>6</td></tr>
</table>
</td>
<td>Sodium chloride is an ionic compound made of sodium ions and chloride ions. These ions are held together by electrostatic attraction in order to form the solid ionic lattice.

Silicon dioxide is a covalent network solid. The atoms are held together by the sharing of electrons to form covalent bonds. This covalent bonding extends in 3 dimensions to form the solid structure.</td>
<td>Needed to identify type of bond that binds the particles ie either ions or atoms.
When referring to covalent structures many lacked thorough detail to explain the covalent bond, and generally lacked detail.
Many just referred to the intermolecular force between sugar molecules and did not address what held the atoms together within the molecule.</td>
</tr>
</table>

	• Correct use of scientific terminology for each class • Demonstrates a sound understanding of the forces which bind partciles together in different classes of chemical structures (4-5) • Demonstrates a basic understanding of the forces which bind particules together (2-3) • One relevant statement (1)	Sugar is a covalent molecular solid. The atoms are held together by the sharing of electrons to form the covalent bonds within the molecule. The molecules are then held together by intermolecular forces (hydrogen bonding) to form the solid structure.	Also much confusion between the terms intramolecular and intermolecular. Many refering to dispersion, dipole-dipole and hydrogen bonding in the ionic and covalent network. These intermolecular forces exist between covalent molecules. Many went into irrelevant explanations on properties such as hardness and conductivity. The question was asking what binds particles to form the solid. Some incorrectly identified the bonding type for the substances listed. There was however a significant number who did show thorough understanding.
25 a)	1 mark – moles of Mg	n = m / MM = 1.44 / 24.31 = 0.0592 moles	Well answered. Most common error was using 3 x 24.31 for the MM. Do NOT include the balancing number in the MM. Soemstudents are still confused about significant figures
25 b)	1 mark – molar ratio 1 mark – mass of nitrogen	Since $n(N_2) : n(Mg)$ is 1 : 3 **1** $n(N_2) = 0.0592 / 3$ = 0.0197… mol $m(N_2) = n \times MM$ = 0.0197 x (14.01 x 2) = 0.0197 x 28.02 = 0.553 g (3 sig fig) **1**	Calculator error was not penalised in this question. If the working was correct the mark was given. Common error was x3 instead of dividing
25 c)	1 mark – molar ratio 1 mark – mass of magnesium nitride	Since $n(Mg_3N_2) : n(Mg)$ is 1 : 3 **1** $n(Mg_3N_2) = 0.0592 / 3$ = 0.0197… mol $m(Mg_3N_2) = n \times MM$ = 0.0197 x (24.31 x 3 + 14.01 x 2) = 0.0197 x 100.95 = 1.99 g (3 sig fig) **1**	Similar to part b) Students who made errors in part b then used it to calculate the difference were not awarded marks, ie, they could not use the Law of conservation of mass and get ecf
25 d)	1 mark – correct Law	Law of conservation of mass	
26 a)	1 mark for each correct answer	$Ni \rightarrow Ni^{2+} + 2e^-$ +0.24 $Cu^{2+} + 2e^- \rightarrow Cu$ 0.34 V +0.58 V **1** $Cu \rightarrow Cu^{2+} + 2e^-$ -0.34 $Ag^+ + e \rightarrow Ag$ 0.80 +0.46 V **1**	Reasonably well done Common mistakes • Used Cu^+ voltage instead of Cu^{2+} - if did this twice to get 0.76 V and 0.28 V then received ECF • Did not flip sign of oxidation half equation – if did this twice to get 0.10 V and 1.14V then received ECF Reversed the wrong sign

26 b)	1 mark – identifies Ni as anode 1 mark – reasonable explanation	Ni is more reactive than Cu so Ni will undergo oxidation. Since oxidation occurs at the anode, Ni will be the anode. Could also refer to standard potentials	Pretty well done Some confusion about what the voltage sign and anode/cathode signs mean. If the voltage in a) was negative then this means the reaction is not spontaneous in the direction written, it does <u>not</u> identify which is the anode.
26 c)	2 marks – correct balanced net ionic equation 1 mark – partially correct equation	$Cu\ (s) + 2Ag^{+}\ (aq) \rightarrow Cu^{2+}\ (aq) + 2\ Ag\ (s)$	Many students did not balance the positive charges Some confusion with the ion charges of both Cu and Ag – check the information provided and the data sheets to help avoid these errors
27 a)	1 mark – identifies correct gas equation 1 mark – moles of gas 1 mark – correct sig figs and units	PV = nRT 560 x 25 = n x 8.314 x 1195 14,000 = n x 9935.23 n = 1.4 mol (2 sig fig)	Generally well done Many students rounded to 3 sig figs, not paying attention to the volume being only 2 sig figs
27 b)	1 mark – molar mass of gas 1 mark – correctly identifies gas	m(gas) = 575.3 – 530.2 = 45.1 g MM = m / n = 45.1 / 1.409 = 32.00 **1** O_2 has a MM of 32.00 (2 x 16.00) **1**	Poorly done. Many students did not know what to do after subtracting the masses. Very limited number of students considered that lots of gases are diatomic and therefore realised 32.00 equates to 2 x 16 for O_2 Most students determined gas to be sulfur. This was accepted since at the temperature stated sulfur would happen be a gas (it is solid at room temperature) and with the part a) answer being only 2 sig fig, sulfur is reasonable answer with MM of 32.07. For future reference, it is unlikely that this type of question would have much error from actual MM. Lots of students used the rounded off value from a) in this calculation which made determining the gas more difficult because the determined MM was less accurate. This is a subpart of a single question so should <u>not</u> be using a rounded off number. No ECF was given if identified gas was a metal because it is not possible for it to be a gas since the bp of gases are too high
28 a)	1 mark – moles of $CuCl_2$ 1 mark – molar ratio	$n(CuCl_2)$ = 4.03/63.55 + 2 x 35.45 = 4.03/134.45	Generally well done

	1 mark – mass of $AgNO_3$	= 0.029997 mol **1** Since $AgNO_3$: $CuCl_2$ is 2:1 **1** ($AgNO_3$) = 0.029997 x 2 = 0.0599…. mol m($AgNO_3$) = n x MM = 0.0599… x (107.9 + 14.01 + 16 x 3) = 0.0599…. x 169.91 = 10.2 g (3 sig fig) **1**	Some students missed the mole ratio and some students had issues determining correct MM's
28 b) i)	1 mark – correct answer	3.40g $AgNO_3$ is less than the required 10.2g needed from part a) so $AgNO_3$ is the limiting reagent OR Moles of $AgNO_3$ = 3.40/169.91 = 0.0200 mol Since $CuCl_2$: $AgNO_3$ is 1:2, 0.0300 mol of $CuCl_2$ needs 2 x 0.0300 = 0.0600 moles of $AgNO_3$ so $AgNO_3$ is limiting reagent	Generally well done. Many students used calculation working. Some confusion about how this related to the previous question.
28 b) ii)	1 mark – molar ratio 1 mark – mass of AgCl	n($AgNO_3$) = 3.40/169.91 = 0.0200 mol Since $AgNO_3$: AgCl is 1 : 1 **1** n(AgCl) = 0.200 mol M(AgCl) = n x MM = 0.0200 x (107.9 + 35.45) = 0.0200 x 143.35 = 2.87 g (3 sig fig) **1**	Many students did not consider their answer from part b) i) and used the original moles from part a) instead of the limiting moles from 3.40 g of $AgNO_3$ ECF was given if $CuCl_2$ was determined to be the limiting reagent, to give mass of 8.59 g.

29 a)	1 mark – moles of NaCl 1 mark – concentration of NaCl	n(NaCl) = 6.23 / (22.99 + 35.45) = 0.1066… mol **1** C = n / V = 0.10666 / 0.500 = 0.213 mol/L (3 sig fig) **1**	Generally well done, but it was surprising how many girls calculated a % rather than a Molarity.(1 mark awarded if the correct units with the %)
29 b)	1 mark – moles of Na_2CO_3 1 mark – mass of Na_2CO_3	n (Na_2CO_3) = C x V = 0.500 x 2.00 = 1.00 mol **1** m(Na_2CO_3) = n x MM = 1.00 x (22.99 x 2 + 40.08 + 16 x 3) = 1.00 x 106.06 = 106 g (3 sig fig) **1**	Generally well done. A surprising number of gilrs did not know the formula for sodium carbonate.
30	2 marks – correct balanced equation 1 mark - partially correct equation 1 mark – moles of iron carbonate 1 mark – molar ratio 1 mark – volume of CO_2	$Fe_2(CO_3)_3 + 6\ HCl \rightarrow 2\ FeCl_3 + 3\ CO_2 + 3\ H_2O$ **2** n($Fe_2(CO_3)_3$) = m/MM = 6.23 / 2 x 55.85 + 3 x (12.01 + 3 x 16.00) = 12.45 / 291.73 = 0.0427 mol **1** $Fe_2(CO_3)_3$: CO_2 1 : 3 **1** 0.0427 : 3 x 0.427 n (CO_2) = 0.1281 V = n x MV = 0.1281 X 24.79 = 3.17 L **1** Alternate last step: PV = nRT 100 x V = 0.1281 x 8.314 x (25 +273.15) 100 x V = 317.36 V = 3.17 L	Lots of confusion about a correctly balanced equation. ECF was used. Many girls neglected to realise it was Fe(III). Others confused Fe(II) and Fe(III). Ratios fine as was final calculation,. Most girls used PV + nRt rather than molar volume.

31 a)	1 mark – correct ΔT 1 mark – correct J or kJ	q = mc ΔT = 100.0 x 4.18 x 30.0 = 12,540 J = 12.54 kJ	Lots of confusion here about m. Many girls took this as the mass of solid, not water. Also lots of confusion about temperature change. 0 marks if BOTH these were incorrect because they can't get correct kJ or J.
31 b)	1 mark – MM of $CaCl_2$ 1 mark – moles $CaCl_2$	n = 18.45 / 110.98 = 0.166 mol	Well done.
31 c)	1 mark – correct sign 1 mark – correct value	ΔH = q/n = 12.54 / 0.166 = - 75.4 kJ/mol (3 sig fig)	Lots forgot the sign, otherwise well done.
31 d)	1 mark – correct reason	Heat loss to surroundings	Fine.