education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 10

GR 10 PHYSICS P2

PHYSICAL SCIENCES: CHEMISTRY (P2)

COMMON TEST

JUNE 2019

MARKS: 100

TIME: 2 hours

This question paper consists of 11 pages and a Periodic Table.

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INSTRUCTIONS AND INFORMATION

1. This question paper consists of EIGHT questions. Answer ALL the questions in the ANSWER BOOK.
2. Number the answers correctly according to the numbering system used in this question paper.
3. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
4. You may use a non-programmable calculator.
5. You may use appropriate mathematical instruments.
6. YOU ARE ADVISED TO USE THE ATTACHED DATA SHEET.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your FINAL numerical answers to a minimum to TWO decimal places.
9. Give brief motivations, discussions, et cetera where required.
10. Write neatly and legibly.

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QUESTION 1: MULTIPLE- CHOICE

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.7) in the answer book, for example 1.8. D.

1.1 The property of material to shape on hammering is called... (2)

A Hard
B Brittle
C Ductile
D Malleable

1.2 The process whereby solid CO_2 changes to gas without forming a liquid is... (2)

A Boiling
B Evaporation
C Sublimation
D Condensation

1.3. The energy released when an electron is attached to an atom or molecule to form a negative ion is... (2)

A Electron affinity
B Electronegativity
C Ionisation energy
D 1st ionisation energy

1.4. Which one of the following reactions can be classified as redox reaction? (2)

A $Cu^{2+}(aq) + O^{2-}(aq) \rightarrow CuO(s)$
B $Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$
C $KCl(aq) + AgNO_3(aq) \rightarrow KNO_3(aq) + AgCl(s)$
D $ZnCl_2(aq) + CaSO_4(aq) \rightarrow ZnSO_4(aq) + CaCl_2(aq)$

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1.5. The bond whereby there is a complete transfer of electron(s) from one atom to another is called... (2)

A Ionic Bond
B Dative bond
C Metallic bond
D Covalent bond

1.6. The chemical name for SO_4^{2-} is ... (2)

A Sulphite ion
B Sulphide ion
C Sulphate ion
D Sulphur trioxide

1.7. A Specific name given to an atom that has lost electron(s) (2)

A Ion
B Atom
C Cation
D Anion

[14]

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QUESTION 2

Si, water-ethanol, $CuSO_4$, Fe_2O_3, cooking oil- iron filings, Fe, Cl_2

2.1. From above list identify the:

2.1.1. Heterogeneous mixture (1)

2.1.2. Semi-metal. (1)

2.1.3. Compound. (1)

2.1.4. Rust. (1)

2.1.5. The substance that exists as a gas at room temperature. (1)

2.2. Now, consider thoroughly stirred water-ethanol at room temperature.

2.2.1. Is this a homogeneous or heterogeneous mixture? (2)
Explain the answer.

2.2.2. Name a suitable separation technique that can be used to separate water-ethanol mixture (1)

2.2.3. Name the physical property used in this technique mentioned in 2.2.2 (1)

2.2.4. Which component of the mixture will be left behind? (1)

2.2.5. Why is this mixture considered ***miscible***? (2)

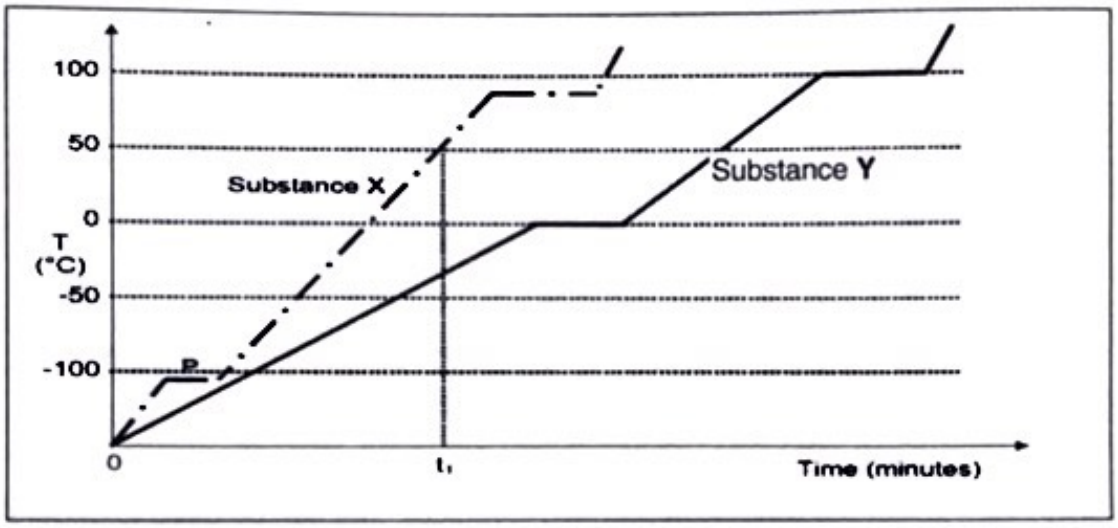
[12]

GR 10 PHYSICS P2

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QUESTION 3

The two graphs (not drawn to scale) below represent the change in temperature of two substances, **X** and **Y**, when heated for a certain time. Both substances were in the solid phase at t = 0 minutes.



3.1. Define ***temperature.*** (2)

3.2 At t_1, write down the particle arrangement of:

3.2.1. **X** (1)

3.2.2. **Y** (1)

3.3. Now, consider point **P** of substance **X**:

3.3.1 Name the process taking place at **P**. (1)

3.3.2. There is no change in temperature. Explain why that is the case. (2)

3.4. At -50°C, write down the phase(s) of:

3.4.1. **X** (1)

3.4.2. **Y** (1)

3.5. Is the boiling point of substance **X** HIGHER THAN, LOWER THAN or THE SAME AS the boiling point of substance **Y**? (1)

3.6. One of the substances from the above graphs is water. Which substance (**X** or **Y**) represents water? Explain the reason for the answer. (2)

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QUESTION 4

An element has the following electron configuration: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$

4.1 For the element write down the:

4.1.1 Group number on the periodic table. (2)
Give a reason for the answer by referring to the above electron configuration.

4.1.2 Period number in the periodic table. (2)
Give a reason for the answer by referring to the above electron configuration.

4.2. Use Lewis structures to show the bond formation between aluminium (Aℓ) and oxygen (O). (3)

4.3. A certain element, **Q**, is in-group VII of the periodic table.
For this element, write down the:

4.3.1. Name of the group. (1)

4.3.2. Normal valency. (1)

4.3.3. Number of valence electrons. (1)

4.3.4. Chemical equation that shows the formation of element **Q** ion. (2)

4.4 The symbol notation for a certain element is:

$$^{31}_{15}X$$

4.4.1. Draw the energy level (Aufbau) diagram. (2)

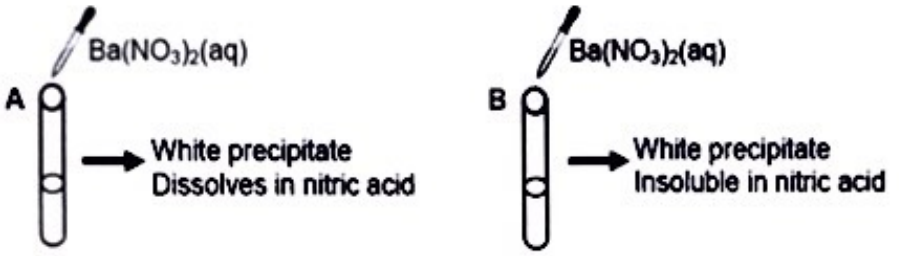
4.4.2. Write down the name of an element. (1)

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QUESTION 5

Two unlabelled SODIUM compounds are found in the laboratory, but laboratory technician stated that only sulphate and carbonate were on the inventory. Simplified experiment used to determine the sodium salts is shown in the diagram below:



5.1. Name the type of reaction done by adding $Ba(NO_3)_2$ (1)

5.2. Write down the formula of Sodium salt in:

5.2.1. Test tube A (2)

5.2.2. Test tube B (2)

5.3. Write down the name of precipitate formed in:

5.3.1. Test tube A. (2)

5.3.2. Test tube B. (2)

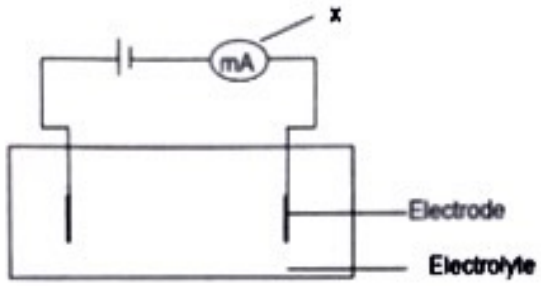
5.4. White precipitate in test tube A dissolved after the addition of nitric acid. (4)
Write down a balanced chemical equation to show this reaction.

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QUESTION 6

Sodium chloride crystals are added to water and dissociate to form an electrolyte. The experimental set up below was used to determine the electrical conductivity of sodium chloride solution.



6.1	Define an ***electrolyte***.	(2)
6.2.	What physical quantity is measured by component X?	(1)
6.3.	What is meant by the term ***dissociation***?	(2)
6.4	Use the chemical equation to explain the answer in 6.3.	(2)
6.5.	How would the increase in concentration of the solution affect the reading on X? (Choose from: INCREASES; DECREASES or REMAINS THE SAME) Explain the answer.	(3)
		[10]

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QUESTION 7

Study the following diagrams and then answer the questions set.

Oxygen Nitrogen Hydrogen



	Initially	Finally
A		

	Initially	Finally
B		

7.1. Identify the letter that represents:

7.1.1. Physical change. (1)

7.1.2. Chemical change. (1)

7.2. Now, consider **A**:

7.2.1. State the law of conservation of mass. (2)

7.2.2. With the use of calculations, determine whether the law in 7.2.1. is obeyed or not obeyed. (3)

7.2.3. Name the type of bond between nitrogen and hydrogen at the final stage. (1)

7.3. Use the Lewis structure to write down an equation for the formation of the molecule in **B**. (3)

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QUESTION 8

8.1. Given the data on the table below answer the questions that follows

Element	Ionization energies (kJ•mol^{-1})		
	1st	2nd	3rd
Potassium	419	3051	4419

8.1.1. Define the ***first ionization energy***. (2)

8.1.2. State the trend of ionization energy of potassium as it moves from first to third. (1)

8.1.3. Give a reason for the trend identified in 8.1.2. (2)

8.1.4. The first ionization energy of potassium is 419 kJ•mol^{-1}, whereas the first ionization energy of sodium is 496 kJ•mol^{-1}. (2)
Describe the difference between these two GROUP 1 elements.

8.2. Magnesium naturally exists as isotopes, ^{24}Mg, ^{25}Mg and ^{26}Mg.

Isotope	% abundance	Atomic Mass number
^{24}Mg	78,99	23,985
^{25}Mg	10,00	24,959
^{26}Mg	11,01	25,983

8.2.1 Explain the term "isotopes". (2)

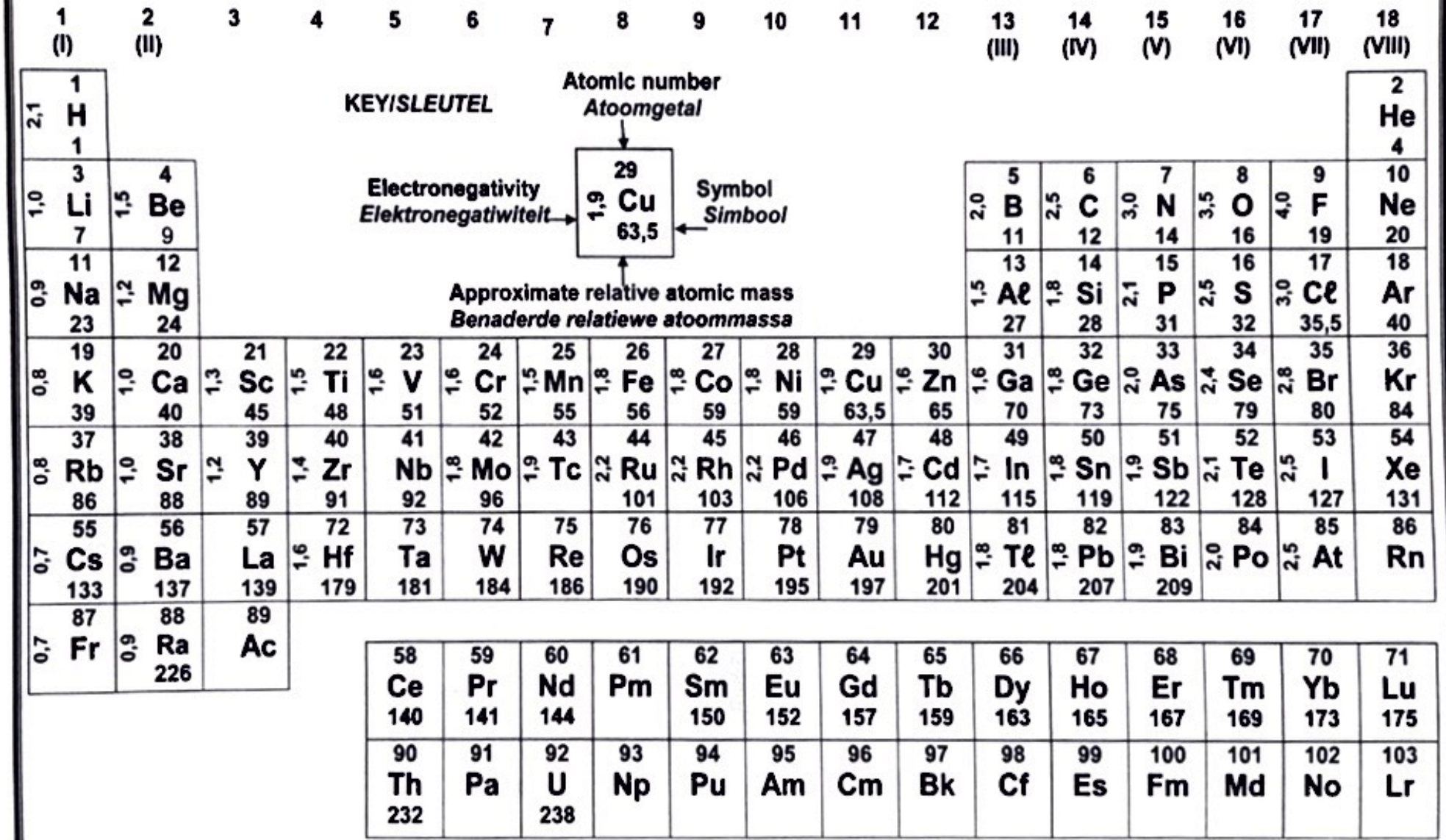
8.2.2. Calculate the relative atomic mass of magnesium. (4)

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TOTAL MARKS: 100

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TABLE 3: THE PERIODIC TABLE OF ELEMENTS



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MARKING GUIDELINE

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GRADE 10

MARKS: 100

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N.B: This marking guideline consists of 6 pages.

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SECTION A

QUESTION 1

1.1 D ✓✓ (2)

1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

1.4 B ✓✓ (2)

1.5 A ✓✓ (2)

1.6 C ✓✓ (2)

1.7 C ✓✓ (2)

[14]

QUESTION 2

2.1

2.1.1 Cooking oil – iron fillings ✓ (1)

2.1.2. Si ✓ (1)

2.1.3. $CuSO_4$, Fe_2O_3 ✓ (Any one of the two) (1)

2.1.4. Fe_2O_3 ✓ (1)

2.1.5. Cl_2 ✓ (1)

2.2.

2.2.1. Homogeneous ✓, water-ethanol form a mixture of uniform composition and all components are in the same phase at room temperature ✓ (2)

2.2.2. Fractional distillation ✓ (1)

2.2.3. Boiling point ✓ (1)

2.2.4. Water ✓ (1)

2.2.5. It mixes completely in all proportions. ✓✓ (2)

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QUESTION 3

3.1. Temperature is the average measure of kinetic energy of molecules. ✓✓ (2)

3.2.1.
- Closely packed. ✓ (Any one property mentioned)
- Irregular shape
- Take shape of the container.

(1)

3.2.2.
- Closely packed. ✓ (Any one property mentioned)
- Regular shape / Rigid shape

(1)

3.3.1. Melting ✓ (1)

3.3.2. Heat energy is absorbed to increase the internal (potential) energy of particles✓ and disturb attractive forces between particles. ✓ (2)

3.4.1. Liquid phase ✓ (1)

3.4.2. Solid phase✓ (1)

3.5. LOWER THAN ✓ (1)

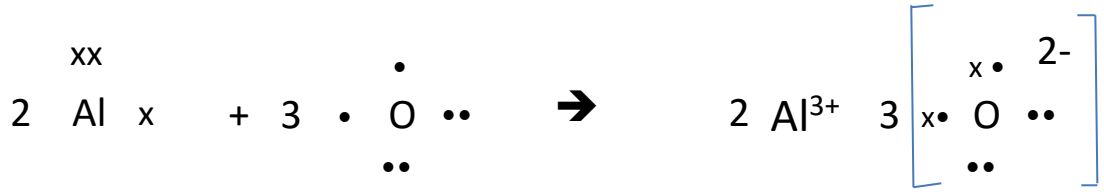
3.6. Substance **Y**✓, melting point and boiling point is 0 and 100 C respectively, which matches water. ✓ (2)

[12]

QUESTION 4

4.1.1. Group 5(15) ✓, there are 5 electrons in the outermost orbitals ✓ (2)

4.1.2. Period 3 ✓, the highest energy level is 3 ✓. (2)



Reactants ✓ Products: Ions and Electrons✓ Ratio✓ (3)

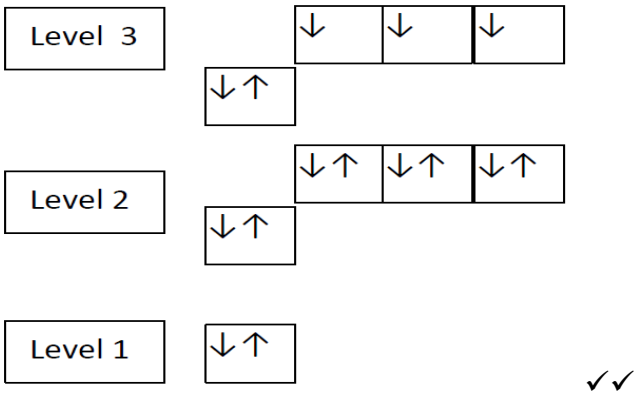
4.3.1. Halogens ✓ (1)

4.3.2. 1 ✓ (1)

4.3.3. 7 electrons ✓ (1)

4.3.4. $Q + 1e^- \rightarrow Q^{-1}$ ✓✓ (2)

4.4.1. (2)



✓✓

4.4.2. Phosphorus ✓ (1)

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QUESTION 5

5.1. Precipitation reaction ✓ (1)

5.2.1. Na_2SO_4 ✓✓ (2)

5.2.2. Na_2CO_3 ✓✓ (2)

5.3.1. Barium sulphate ✓✓ (2)

5.3.2. Barium carbonate ✓✓ (2)

5.4. $BaSO_4$ (s) + $2HNO_3$(aq) → $Ba(NO_3)_2$(aq) + H_2SO_4 (aq) (4)
Reactants ✓ Products ✓ Balance ✓
Correct phases ✓ -

[13]

QUESTION 6

6.1. An electrolyte is the ionic solution that can conduct electricity. ✓✓ (2)

6.2. (Electric) Current. ✓ (1)

6.3. Dissociation is the process in which ionic solids are broken up into ions when dissolved in water ✓✓ (2)

6.4. NaCl (s) → Na^+(aq) + Cl^- (aq) ✓✓ (2)

6.5. Increases ✓ (3)
An increase in concentration increases the number of ions in solution ✓
Thus electrical conductivity increases ✓

[10]

QUESTION 7

7.1.1. B ✓ (1)

7.1.2. A ✓ (1)

7.2.1. Matter cannot be created or destroyed, transforms from one form to another✓✓ (2)

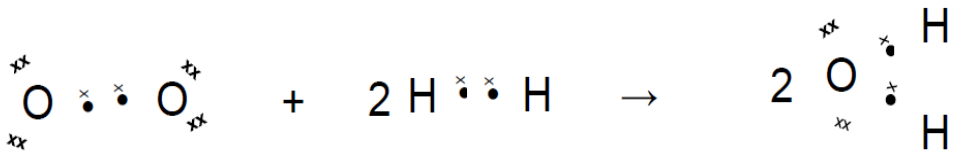
7.2.2. $M_{reactant} = M_{N2} + M_{H2}$ = 14x2 + 1x2x3 = 34 $g.mol^{-1}$✓ (3)

$M_{products} = M_{NH3}$ =14x2 + 1x2x3 = 34 $g.mol^{-1}$✓

(Mass of reactants is equal to the mass of products, therefore) <u>the law is obeyed</u> ✓

7.2.3. Covalent bond ✓ (1)

7.3. (3)



Reactants ✓ Products ✓ balance ✓

[11]

QUESTION 8

8.1.1. Energy needed per mole to remove an electron from an atom in a gaseous phase. ✓✓ (2)

8.1.2. Increases ✓ (1)

8.1.3. As one moves from 1st to 3rd ionization energy (2)
Electrons occupy the lower energy levels which increases the effective force of attraction between nucleus and electrons, thus more energy is required to remove electrons✓✓

8.1.4. As one moves down the group ✓,First ionization energy decreases✓ (2)
Or
As one moves up the group ✓,First ionization energy increases✓

8.2.1. Isotopes are atoms of the same element having the same number of protons, but different numbers of neutrons. (2)

8.2.2. (4)

$$\text{R.A.M} = \frac{\mathbf{M}^{24}_{Mg} \times \%\text{ abundance}}{100\%} + \frac{\mathbf{M}^{25}_{Mg} \times \%\text{ abundance}}{100\%} + \frac{\mathbf{M}^{26}_{Mg} \times \%\text{ abundance}}{100\%}$$

$$= \frac{23{,}985 \times 78{,}99\%\checkmark}{100\%} + \frac{24{,}959 \times 10\%\checkmark}{100\%} + \frac{25{,}983 \times 11{,}01\%\checkmark}{100\%}$$

$$= 24{,}30\ g.mol^{-1}\checkmark$$

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TOTAL MARKS: [100]

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