

HILLCREST HIGH SCHOOL



PHYSICAL SCIENCE EXAM

GRADE 10

TIME: 2 HRS

EXAMINER: MRS SMITH

JUNE 2019

TOTAL : 140

MODERATOR: MS BADENHORST

MRS KNOX-WHITEHEAD

INSTRUCTIONS

1. This question paper consists of 14 pages and 2 SECTIONS:
SECTION A (20) SECTION B (120)
2. Answer all of the questions from SECTIONS A and SECTION B in the ANSWER BOOK provided.
3. Non-programmable calculators may be used.
4. Number the answers correctly according to the numbering system used in this question paper
6. Give brief motivations, discussions, et cetera where required.
7. Final answers to calculations must be rounded off to **two decimal** places where appropriate.
8. Data sheets and a periodic table are attached for your use.
9. Rule off after each question 1 - 10.
10. Write neatly and clearly.
11. Leave a line between each question.

SECTION A : MULTIPLE CHOICE

QUESTION 1:

[2 x 10 = 20]

Four options are provided as possible answers to the following questions. Each question has only one correct answer.

Write only the letter (A-D) next to the question number (1.1 – 1.10) in the answer book.

- 1.1 Which scientist postulated the 'plum pudding' model of the atom?
- A. James Chadwick.
 - B. Niels Bohr
 - C. J.J Thomson
 - D. Ernest Rutherford
- 1.2 Which of the following methods would you use to separate out different colours in a black marker pen?
- A. Filtration
 - B. Chromatography
 - C. Magnetic separation
 - D. Fractional distillation
- 1.3 As we move across the periods from left to right
- A. atomic radius decreases electronegativity decreases
 - B. atomic radius increases and electronegativity increase
 - C. atomic radius increases electronegativity increases
 - D. atomic radius decreases and electronegativity increases
- 1.4 Metal X forms a sulphate with the formula $X_2(SO_4)_3$.
- Which one of the following is the correct formula mass (in g.mol^{-1}) for the NITRATE of X?
- A. 213
 - B. 334
 - C. 342
 - D. 225

1.5 Study the table below

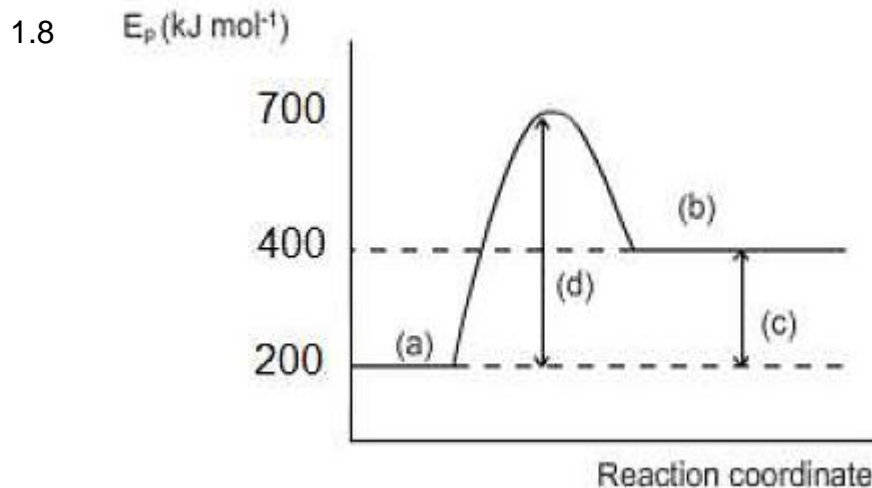
SUBSTANCE	MELTING POINT °C	BOILING POINT °C
magnesium	650	1107
ethanol	-114	78
carbon	3500	4827
sulphur	113	445
oxygen gas	-218	-183

Which substance is in the liquid phase at room temperature?

- A. oxygen gas
 - B. sulphur and magnesium
 - C. carbon
 - D. ethanol
- 1.6 A solution has a concentration of $0,7 \text{ mol.dm}^{-3}$. It is then diluted by taking 30 cm^3 of this solution and adding it to water to create a new solution with a concentration of $0,3 \text{ mol.dm}^{-3}$.

The volume of the water that was added to the original solution is

- A. $12,86 \text{ cm}^3$
 - B. 70 cm^3
 - C. $52,86 \text{ cm}^3$
 - D. 40 cm^3
- 1.7 Which equation represents a synthesis reaction?
- A. $\text{CaCO}_3 (\text{s}) + 2 \text{HCl} (\text{aq}) \rightarrow \text{CaCl}_2 (\text{aq}) + \text{H}_2\text{O} (\text{l}) + \text{CO}_2 (\text{g})$
 - B. $2 \text{KClO}_3 (\text{s}) \rightarrow 2 \text{KCl} (\text{s}) + 3 \text{O}_2 (\text{g})$
 - C. $2 \text{H}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightarrow 2 \text{H}_2\text{O} (\text{l})$
 - D. $\text{CaCl}_2 (\text{aq}) + \text{CuSO}_4 (\text{aq}) \rightarrow \text{CaSO}_4 (\text{s}) + \text{CuCl}_2 (\text{aq})$



The enthalpy change for the reaction is given by the letter

- A. (a)
- B. (b)
- C. (c)
- D. (d)

1.9 During the electrolysis of copper (II) chloride solution, which statement is true?

The conductivity of the electrolyte can be increased by

- A. increasing the amount of solvent in the solution
- B. decreasing the amount of copper ions in the solution
- C. decreasing the amount of solute in the solution
- E. increasing the temperature of the solution

1.10 Which is the correct sequence of processes as water moves from the ocean to land in the water cycle?

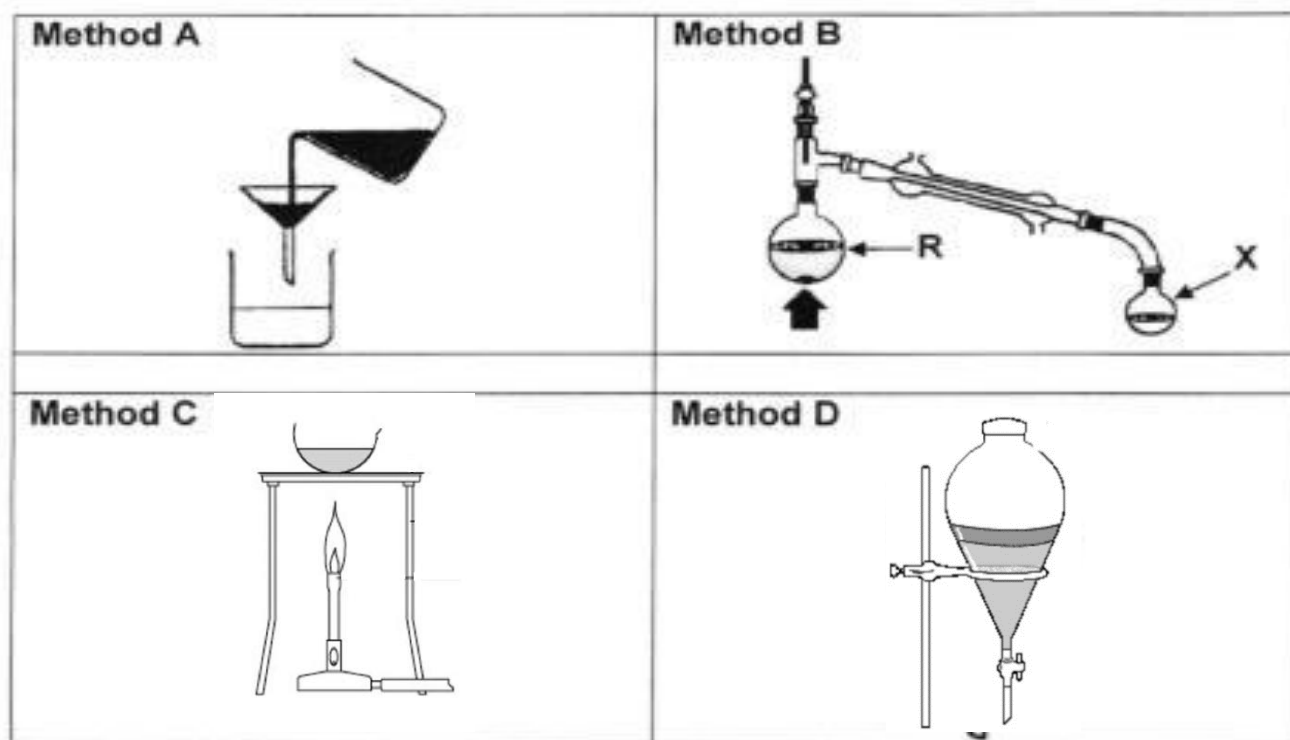
- A. Evaporation, Condensation, Precipitation, Runoff
- B. Evaporation, Precipitation, Runoff, Condensation
- C. Runoff, Precipitation, Evaporation, Condensation
- D. Runoff, Precipitation, Evaporation, Condensation

SECTION B

QUESTION 2

[8]

Four methods to separate mixtures are summarised in the table below.



2.1.1 Is the mixture in R an example of a homogeneous or a heterogeneous mixture? Give a reason for your answer. (2)

2.1.2 What property of the substance is used to separate it (in method B)? (1)

2.1.3 What **phase change** occurs at R during the separation? (1)

2.2 Consider the following mixtures.

P: sodium chloride solution

Q: water and ethanol

R: water and oil

S: sulphur and iron filings

T: sand and water

Which ONE of the above mixtures (P-T) can be separated using:

2.2.1 Method A (1)

2.2.2 Method B (1)

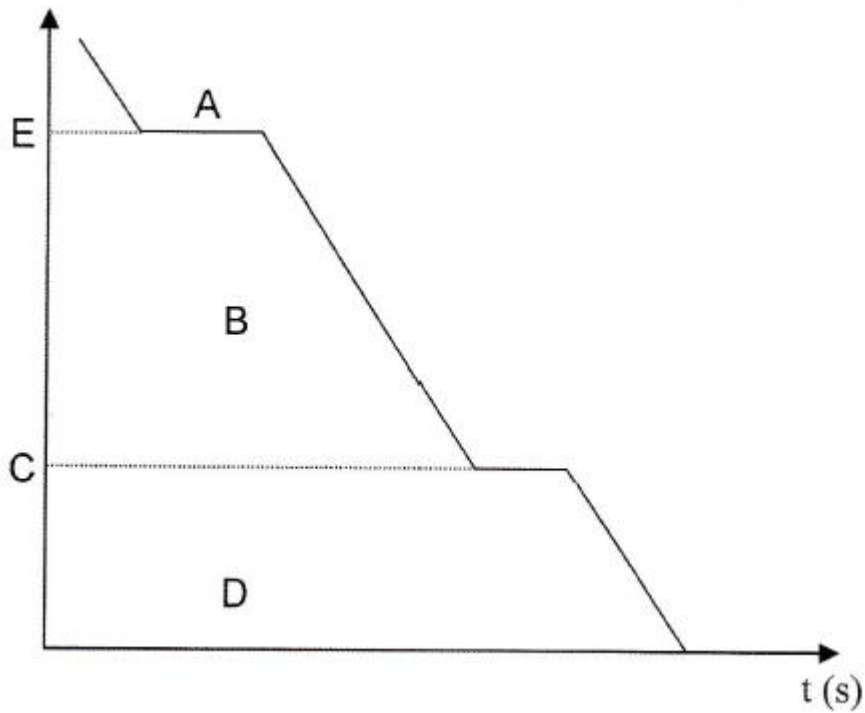
2.2.3 Method C (1)

2.2.4 Method D (1)

QUESTION 3

[12]

The graph below represents the cooling curve of water



3.1 Identify the variable on the Y axis. (2)

3.2 Why does the curve flatten out at A? (2)

3.3 Which point represents freezing point on the graph? (1)

3.4 Copy the table below into your answer booklet

	PARTICLES AT B	PARTICLES AT D
Space between the particles		
Force between the particles		

Complete the table, explaining how the particles at B differ from the particles at D. (4)

3.5 Is this an example of a physical or chemical change?
Explain your answer. (2)

3.6 Name the type of intermolecular force that occurs between the water molecules. (1)

QUESTION 4

[10]

Read the passage and then answer the questions that follow.

People participating in water sports, such as scuba diving, surfing and windsurfing use wetsuits for thermal protection. The garment forms a barrier that prevents sweat from evaporating and taking the body's heat with it. Most wetsuits are made from a thin, halo-hydrocarbon material called neoprene. Neoprene is a synthetic rubber (C₄H₅Cl) containing air bubbles of nitrogen gas between the layers. Nitrogen gas has a low thermal conductivity, which further helps to prevent heat loss. In recent years, open water swimmers also started using wetsuits in competitions. This has caused quite a controversy, as many believe that the wetsuit gives swimmers an advantage because it increases buoyancy as well as reduces friction between the swimmer's body and the water.

4.1 Is a wetsuit a thermal conductor or a thermal insulator?
Explain your answer. (2)

4.2 Neoprene is a halo-hydrocarbon. What group of elements does the prefix 'halo' refer to, do you think? (1)

4.3 Why do people believe that swimmers who wear wetsuits have an unfair advantage in competitions?
State two reasons. (2)

4.4 Calculate the

4.4.1 percentage carbon in one molecule of neoprene (3)

4.4.2 mass of carbon present in 75g of neoprene (2)

QUESTION 5**[5]**

A chemist conducts an investigation to determine the first ionisation energies of the first 18 elements. The results obtained are shown in the table below.

ATOMIC NUMBER	IONISATION ENERGY (kJ mol⁻¹)	ATOMIC NUMBER	IONISATION ENERGY (kJ mol⁻¹)
1	1317	10	2087
2	2378	11	202
3	526	12	744
4	905	13	577
5	807	14	786
6	1092	15	1060
7	1049	16	996
8	1319	17	1256
9	1687	18	1520

5.1 Consider the element with atomic number **13**.

5.1.1 Name this element. (1)

5.2 Use the periodic table together with the information given in the table

5.2.1 to decide which element between the one with an atomic number of 3 and the other with an atomic number of 17 has the higher ionisation energy. (1)

and

5.2.2 explain your answer in QUESTION 5.2.1 by making reference to
(i) valence electrons
(ii) atomic radius and the
(iii) energy needed to remove electrons. (3)

QUESTION 6**[22]**

The table below shows the electron structure and mass numbers of elements found on the Periodic Table. The elements are represented by the letters A – G.

ELEMENTS	Mass number	ELECTRONIC STRUCTURE/CONFIGURATION/ SP NOTATION
A	12	[He] 2s ² 2p ²
B	36	1s ² 2s ² 2p ⁶ 3s ² 3p ⁵
C	24	1s ² 2s ² 2p ⁶ 3s ²
D	23	1s ² 2s ² 2p ⁶ 3s ¹
E	40	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶ 4s ²
F	40	1s ² 2s ² 2p ⁶ 3s ² 3p ⁶
G	23	[Ne] 3s ²

- 6.1 Write down **only the letter** of the element which
- 6.1.1 is a noble gas? (2)
 - 6.1.2 has 20 neutrons in the nucleus of its atoms? (2)
 - 6.1.3 is an isotope of G ? (2)
 - 6.1.4 has diamonds as one of its allotropes (2)
- 6.2 What type of bonding takes place between atoms of
- 6.2.1 A (1)
 - 6.2.2 C (1)
 - 6.2.3 E and B (1)
- 6.3 Draw a Lewis Diagram for a **molecule** of element B (2)
- 6.4 Write down the electron structure/configuration/sp notation for an ion of element E (2)
- 6.5 Element B exists in two isotopic forms by mass : B-35 and B- 37
- 6.5.1 Explain the term 'isotope' (3)
 - 6.5.2 If the element has an abundance of 75% of B-35 and only 25% of B-37, calculate the relative atomic mass of element B . (4)
-

QUESTION 7**[20]**

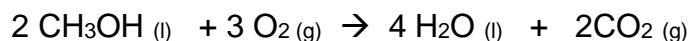
- 7.1 Write down the chemical formulae for the following substances.
- 7.1.1 diphosphorus pentoxide (2)
- 7.1.2 barium chloride (2)
- 7.1.3 sodium thiosulphate (2)
- 7.2 Write down the names of the following compounds, using Stock Notation where necessary
- 7.2.1 KMnO_4 (2)
- 7.2.2 $\text{Cu}(\text{OH})_2$ (2)
- 7.2.3 HNO_3 (2)
- 7.3 Rewrite and balance the following equation:
 $\text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_5 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{N}_2$ (4)
- 7.4 Write the following reaction in symbol form and balance the equation
Nitrogen gas and hydrogen gas reacting to form ammonia. (4)
-

QUESTION 8**[35]**

- 8.1 Calculate :
- 8.1.1 the mass of 1,25 moles of aluminium sulphite $\text{Al}_2(\text{SO}_3)_3$ (3)
- 8.1.2 the volume of 3×10^4 moles of ammonia gas at STP. (3)
- 8.1.3 the number of carbon atoms in 72,8 dm^3 propane (C_3H_8) gas at STP. (5)
- 8.2 Calculate the mass of sodium nitrate NaNO_3 that must be dissolved in 750 cm^3 of water to make a solution of concentration 3 $\text{mol}\cdot\text{dm}^{-3}$ (5)
- 8.3 A hydrocarbon is a compound comprising of carbon and hydrogen atoms. A sample of hydrocarbon is found to contain 85,7% carbon, It also has a molecular mass of 84 $\text{g}\cdot\text{mol}^{-1}$.
Determine the
- 8.3.1 percentage hydrogen in the sample (2)
- 8.3.2 empirical formula, and (4)
- 8.3.3 the molecular formula of the hydrocarbon (3)

8.4 Methanol (CH₃OH) can be burnt in oxygen to produce energy as it decomposes to form water and carbon dioxide.

The reaction is as follows:



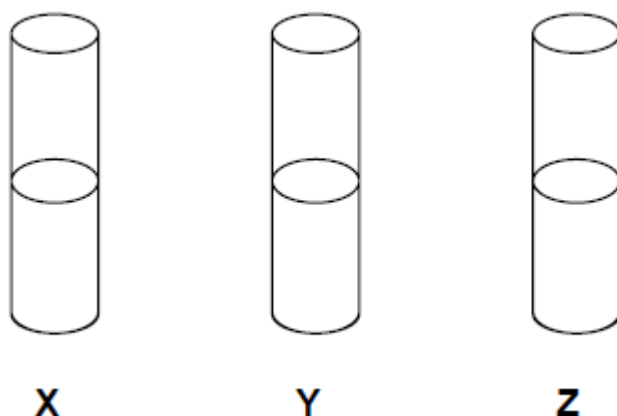
8.4.1 If 120g of methanol is decomposed, what is the theoretical yield (amount) of water that should be obtained in grams? (7)

8.4.2 If only 100 g of water was obtained in reality, calculate the percentage yield of the water in this reaction. (3)

QUESTION 9

[8]

The test tubes labelled X, Y and Z each contain a solution of an **unknown potassium salt**.



The following observations were made during a practical investigation to identify the solutions in the test tubes.

- A **A white precipitate formed in both test tubes X and Y when barium chloride (BaCl₂) was added**
- B **The precipitate in test tube Y is insoluble in hydrochloric acid (HCl)**
- C **A white precipitate formed when silver nitrate (AgNO₃) was added to test tube Z**
- D **The precipitate in test tube X dissolved in hydrochloric acid and a gas was released**

9.1 Use the above information to identify the solutions in each of the test tubes

9.1.1 X (2)

9.1.2 Y (2)

9.1.3 Z (2)

9.2 Write a balanced equation for the reaction that took place in test tube X before the hydrochloric acid was added. (2)

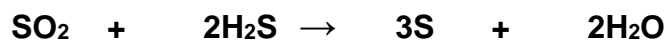
TOTAL [140]

Extension Question for Miss Badenhorst's class

Only complete this if you have finished the rest of the exam

QUESTION 10 [8]

Consider the balanced equation:



6dm³ of SO₂ and 11.2dm³ of H₂S are allowed to react together at STP.

10.1.1 Show by means of calculation which reactant is used up first (limiting reagent). (5)

10.1.2 What volume remains over after the reaction, of the reactant that is in excess? (3)

[8]

Total 148

FORMULA SHEET

mass formula	$n = \frac{m}{M}$	
particle formula	$n = \frac{No}{NA}$	$N_A = 6.02 \times 10^{23}$
volume formula	$n = \frac{V}{V_0}$	$V_0 = 22.4 \text{ dm}^3$
concentration formulae	$C = \frac{n}{V}$ $C_1V_1 = C_2V_2$	

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

1 1 H 1	2 (II) 4 Be 9	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
19 K 39	20 Ca 40	21 Sc 45	22 Ti 48	23 V 51	24 Cr 52	25 Mn 55	26 Fe 56	27 Co 59	28 Ni 59	29 Cu 63,5	30 Zn 65	31 Ga 70	32 Ge 73	33 As 75	34 Se 79	35 Br 80	36 Kr 84
37 Rb 86	38 Sr 88	39 Y 89	40 Zr 91	41 Nb 92	42 Mo 96	43 Tc 98	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tl 204	82 Pb 207	83 Bi 209	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 Ac	101 La 139	102 Ce 140	103 Pr 141	104 Nd 144	105 Pm	106 Sm 150	107 Eu 152	108 Gd 157	109 Tb 159	110 Dy 163	111 Ho 165	112 Er 167	113 Tm 169	114 Yb 173	115 Lu 175
			117 Ts 289	118 Og 294	119 Nh 286	120 Fl 289	121 Mc 288	122 Lv 293	123 Ts 294	124 Og 294	125 Nh 295	126 Fl 299	127 Mc 301	128 Lv 303	129 Ts 304	130 Og 304	131 Lr 260

