basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 11

PHYSICAL SCIENCES: CHEMISTRY (P2)/ *FISIESE WETENSKAPPE: CHEMIE (V2)*

NOVEMBER 2016

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 10 pages.
Hierdie memorandum bestaan uit 10 bladsye.

QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 D ✓✓ (2)

1.3 D ✓✓ (2)

1.4 C ✓✓ (2)

1.5 A ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

1.8 A ✓✓ (2)

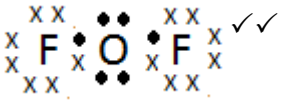
1.9 D ✓✓ (2)

1.10 C ✓✓ (2)
[20]

QUESTION 2/*VRAAG 2*

2.1 Electronegativity is a measure of the tendency of an atom in a molecule to attract bonding electrons. ✓✓
Elektronegatiwiteit is 'n maatstaf van die neiging van 'n atoom in 'n molekuul om bindingselektrone aan te trek (2)

2.2



✓✓

Marking Criteria/*Nasienkriteria*
- O atom shown with 8 electrons around it.
  O-atoom met 8 elektrone rondom getoon
- Two electron pairs on O atoms shared with two F atoms as shown.
  Twee elektronpare op O-atome gedeel met twee F-atome, soos getoon

(2)

2.3 ΔEN (O – F) = 4 – 3,5 = 0,5✓
0 < ΔEN < 1, the bond is weakly polar/*die binding is swak polêr*✓ (2)

2.4
- The bonds in both molecules are polar✓ due to the difference in electronegativity✓ between O and F and C and O.
- The shape of the OF_2 molecule is angular and because the charge distribution is asymmetrical around the central atom the molecule is polar.✓
- The shape of the CO_2 molecule is linear and because the charge distribution is symmetrical around the central atom the molecule is non-polar.✓
- *Die bindings in albei molekules is polêr as gevolg van die verskil in elektronegatiwiteit tussen O en F en tussen C en O.*
- *Die vorm van die OF_2-molekule is hoekig en omdat die ladings asimmetries versprei is rondom die sentrale atoom is die molekuul polêr*
- *Die vorm van die CO_2-molekuul is lineêr en omdat die ladings simmetries versprei is rondom die sentrale atoom is die molekuul nie-polêr* (4)

2.5.1 X = bond energy ✓
Y = bond length ✓
X = bindingsenergie
Y = bindingslengte (2)

2.5.2 The energy needed to break one mole of its molecules into separate atoms.✓✓
Die energie benodig om een mol van sy molekules in aparte atome op te breek (2)

2.5.3 The higher the bond order,✓ the shorter the bond length✓, the stronger the bond and the bond energy increases✓.
Hoe hoër die bindingsorde, hoe korter is die bindingslengte, hoe sterker die binding en die bindingsenergie neem toe (3)
[17]

QUESTION 3/*VRAAG 3*

3.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure.✓✓
Die temperatuur waarteen die dampdruk van 'n stof aan die atmosferiese druk gelyk is (2)

3.2 What is the relationship between intermolecular forces and boiling point?✓✓
Wat is die verband tussen intermolekulêre kragte en kookpunt? (2)

3.3 Glycerine,✓It has the highest boiling point.✓
Glisirien, dit het die hoogste kookpunt (2)

3.4 No✓, boiling point is only affected by the atmospheric pressure✓.
Nee, kookpunt word slegs deur die atmosferiese druk beïnvloed. (2)

3.5 Avoid direct heating with open flame✓
Work in a well-ventilated room/use a fume cupboard ✓
Vermy dit om naby 'n oop vlam te werk
Werk in 'n goed geventileerde vertrek/gebruik 'n dampkas (2)

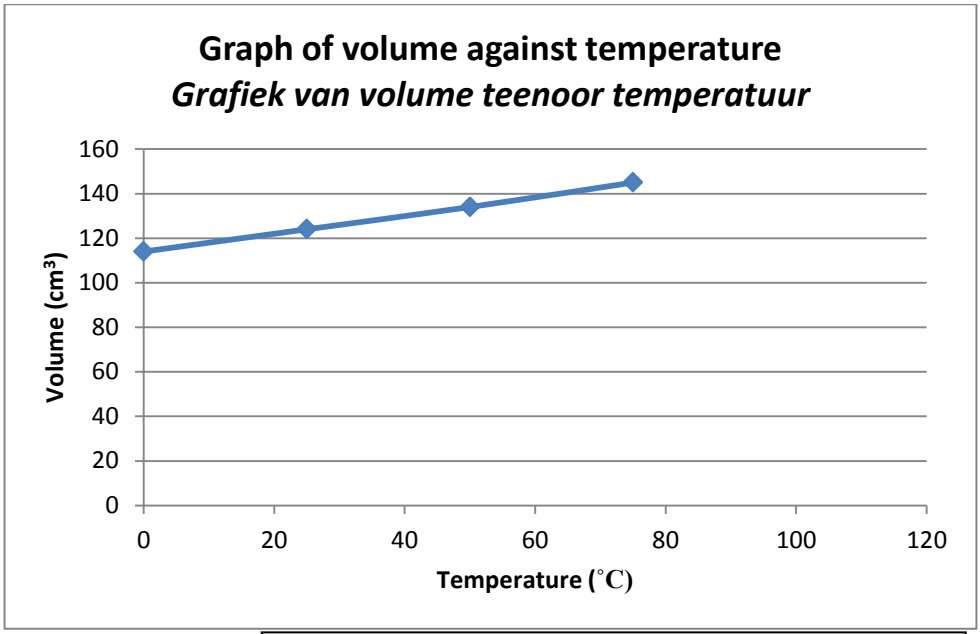
3.6 Nail polish remover✓, lowest boiling point✓, weakest intermolecular forces, less energy is required to overcome intermolecular forces and can easily change to vapour✓.
Naellakverwyderaar, laagste kookpunt, swakste intermolekulêre kragte, minder energie is nodig om die kragte te oorkom en kan maklik in 'n damp verander. (3)

3.7 Sunflower oil has a large molecular mass.✓
Sonneblomolie het 'n grote molekulêre massa (1)
[14]

QUESTION 4/*VRAAG 4*

4.1 When the temperature of a gas increases, the average speed of the particles also increases✓. The molecules collide with the walls of the container more often with greater impact✓. These collisions will push back the walls, so that the gas occupies a greater volume than it did at the start✓.
Wanneer die temperatuur van 'n gas toeneem, sal die gemiddelde spoed van die deeltjies ook toeneem. Die molekules bots meer dikwels en heftiger met die kante van houer. Hierdie botsings sal die kante van die houer wegdruk sodat die gas 'n groter volume beset as voorheen.
OR/*OF*
When the temperature of a gas decreases✓, the average speed of the particles also decreases✓. Number of collisions decreases and the volume decreases✓
Wanneer die temperatuur van 'n gas afneem, sal die gemiddelde spoed van die deeltjies ook afneem. Die aantal botsings neem af en die volume neem af. (3)

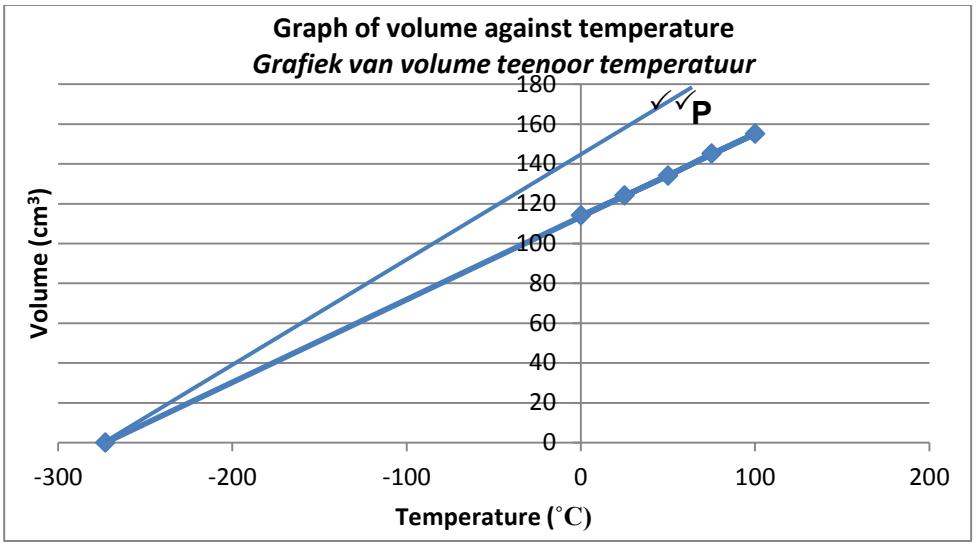
4.1.2



Marking Criteria/*Nasienkriteria*
- Labelling x-axis with correct unit✓
  Benoem x-as met korrekte eenheid
- Labelling y-axis with correct unit✓
  Benoem y-as met korrekte eenheid
- Plotting points ✓
  Stip van punte
- Shape of the graph✓
  Vorm van die grafiek

(4)

4.1.3 and/*en* 4.1.6



x-intercept = -273 ºC ✓
x-afsnit = -273 ºC (1)

4.1.4 It is the absolute zero 0 K (-273ºC)✓, which is the coldest possible temperature at which the particles will have no kinetic energy.✓
Dit is die absolute nulpunt 0 K (-273 ºC) wat die koudste moontlike temperatuur is waarby die deeltjie geen kinetiese energie sal hê nie (2)

4.1.5 $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ ✓

$\frac{155}{373} = \frac{V_2}{393}$ ✓

$V_2 = 163{,}31\ cm^3$ ✓ (3)

4.1.6 straight line above graph (steeper gradient) drawn in QUESTION 4.1.2✓✓
reguitlyn bo grafiek (groter helling) in VRAAG 4.1.2 geteken (2)

4.2.1 pV = nRT✓
$(96 \times 10^3)(0{,}32 \times 10^{-3})$✓ = n(8,31)(300)✓
n = 0,012 mol

$n = \frac{m}{M}$

$0{,}012 = \frac{0{,}77}{M}$ ✓

$M = 64{,}17\ g{\cdot}mol^{-1}$ ✓ (5)

4.2.2 SO_2 ✓ (1)
[21]

QUESTION 5/*VRAAG 5*

5.1 Amount of solute per litre of solution.✓✓
Hoeveelheid oplosmiddel per liter oplossing (2)

5.2 $c = \frac{m}{MV}$ ✓
$c = \frac{8}{(156)(0,5)}$ ✓
$c = 0,10\ mol.dm^{-3}$ ✓ (3)

5.3.1 Empirical formula is the simplest whole number ratio between the elements in a compound.✓✓
Empiriese formule is die eenvoudigste heelgetalverhouding tussen die elemente in 'n verbinding (2)

5.3.2

Element	$\frac{g}{100g}$	$n = \frac{m}{M}$	**Simplest ratio/ *Eenvoudigste verhouding***
K	26,58	26,58/39 = 0,68✓	1 x 2 = 2✓
Cr	35,35	35,35/52 = 0,68✓	1 x 2 = 2✓
O	38,07	38,07/16 = 2,38✓	3,5 x 2 = 7✓

Empirical formula/*Empiriese formule*= $K_2Cr_2O_7$✓ (7)
[14]

QUESTION 6/*VRAAG 6*

6.1 Limiting reagent in a reaction is the reactant that is consumed completely. It determines the maximum amount of product that is made.✓✓
Beperkte reagens in 'n reaksie is die reagens wat volledig opgebruik word. Dit bepaal die maksimum hoeveelheid produk wat gemaak word. (2)

6.2 $n(CH_3COOH) = cV$✓
$= (0,2)(0,1)$
$= 0,02$ mol✓

$$n(NaHCO_3) = \frac{m}{M}$$

$$n = \frac{10}{84}$$ ✓
$= 0,12$ mol✓
Mole ratio/*Molverhouding* 1 : 1
0,02 mol CH_3COOH reacts with/*reageer met* 0,02 mol $NaHCO_3$✓
CH_3COOH is the limiting reagent./*is die beperkte reagens* ✓ (6)

6.3 Mass of $NaHCO_3$ in excess:/*Massa $NaHCO_3$ in oormaat*:
$m = nM$ ✓
$m = (0,12 - 0,2)(84)$ ✓
$m = 8,4$ g ✓ (3)

6.4 0,02 mol $CH_3COOH \rightarrow$ 0,02 mol CO_2✓
$V = nV_m$✓
$= (0,02)(22,4)$✓
$= 0,448\ dm^3$✓ (4)
[15]

QUESTION 7/*VRAAG 7*

7.1 Exothermic✓, energy is given out.✓
Eksotermies, energie word afgegee. (2)

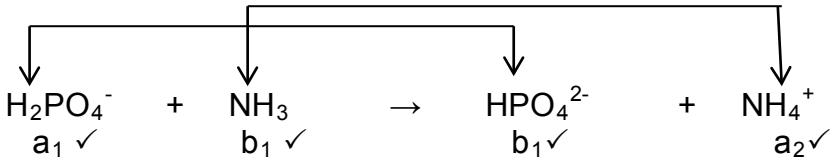
7.2 Energy is needed to break the bond between atoms/ions in molecules.✓✓
Energie is nodig om die bindings tussen atome/ione te breek (2)

7.3 Produces a greenhouse gas✓ and which can contribute to global warming.✓
Verwaardig 'n kweekhuisgas wat tot aardverwarming kan bydra. (2)
[6]

QUESTION 8/*VRAAG 8*

8.1 Acid is a proton donor ✓✓
Suur is 'n protonskenker (2)

8.2.1 conjugate pairs/*gekonjugeerde pare*



(4)

8.2.2 A substance which can act as an acid or a base.✓
'n Stof wat as 'n suur of 'n basis kan optree (1)

8.2.3 $H_2PO_4^-/HPO_4^{2-}$ ✓✓ (2)

8.3.1 $Na_2CO_3 + 2HC\ell \rightarrow NaC\ell + H_2O + CO_2$ balancing/*balansering* ✓ (1)

8.3.2 n = cV✓
= (0,2)(0,1) ✓
= 0,02 mol ✓ (3)

8.3.3 $n_{Mg(OH)2}$ = (0,02)(0,1) ✓
= 0,002 mol

$n_{HC\ell(excess)}$ = 2(0,002) = 0,004 mol✓

$n_{HC\ell\ react}$ with Na_2CO_3 = 0,02 – 0,004 ✓= 0,016 mol

n_{Na2CO3} = 0,008 mol✓

m_{Na2CO3} = nM = (0,008)(106) ✓
= 0,848 g✓

$$\%purity = \frac{0,848}{10} \times 100 \checkmark = 8,48\% \checkmark$$

(8)
[21]

QUESTION 9/*VRAAG 9*

9.1 Oxidation is the increase in oxidation numbers ✓✓
Oksidasie is die toename in oksidasiegetalle (2)

9.2.1 Cu(s) ✓✓ (2)

9.2.2 Silver ion/*Silwerioon*✓✓ (2)

9.2.3 $Cu \rightarrow Cu^{2+} + 2e^-$ ✓✓ (2)

9.3.4 $Cu \rightarrow Cu^{2+} + 2e^-$
$Ag^+ + e^- \rightarrow Ag$ ✓
$Cu + 2Ag^+$✓ $\rightarrow Cu^{2+} + 2Ag$✓ balancing/*balansering* ✓ (4)

9.3 $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$
+1 0
Ag^+ oxidation number changes from +1 to 0, gaining electrons, reduction. ✓✓
Ag^+ se oksidasiegetal verander van +1 na 0, wen elektrone, reduksie (2)
[14]

QUESTION 10/*VRAAG 10*

10.1 Open cast mine/*Oopgroefmyn* ✓
Underground mine/*Ondergrondse myn* ✓ (2)

10.2 Create job opportunities✓/Local communities benefit from infrastructure ✓/
Provides opportunities for other industries
Skep werksgeleenthede/Plaaslike gemeenskappe verkry voordeel ten opsigte van infrastrukture
Verskaf geleenthede aan ander nywerhede (2)

10.3
Changing landscape
Air pollution
Resource consumption
Water poisoning
✓✓ any two
Veranderende landskap
Lugbesoedeling
Hulpbronverbruik
Watervergiftiging
enige twee (2)

10.4 It is too soft ✓
Dit is te sag (1)

10.5 Used in computer circuits ✓/Used as a heat protector in space suits/any other relevant answer
Gebruik in rekenaarstroombane/Gebruik as 'n hittebeskermer in ruimtepakke/ enige ander relevante antwoord (1)
[8]

TOTAL/*TOTAAL*: 150