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 2017

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 12 pages.
Hierdie nasienriglyne bestaan uit 12 bladsye.

QUESTION/*VRAAG 1*

1.1 C ✓✓ (2)

1.2 A ✓✓ (2)

1.3 C ✓✓ (2)

1.4 A ✓✓ (2)

1.5 C ✓✓ (2)

1.6 D ✓✓ (2)

1.7 A ✓✓ (2)

1.8 D ✓✓ (2)

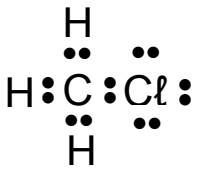
1.9 B ✓✓ (2)

1.10 C ✓✓ (2)
[20]

QUESTION/*VRAAG 2*

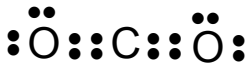
2.1 A covalent bond is the sharing of electrons between two atoms to form a molecule. ✓✓
'n Kovalente binding is die deel van elektrone tussen twee atome van 'n molekuul. ✓✓ (2)

2.2 2.2.1



✓✓ (2)

2.2.2



✓✓ (2)

2.3 None/zero ✓/*Geen/nul* ✓ (1)

2.4 H_2O ✓ (1)

2.5.1 H_2O is angular/bent/*hoekig* ✓ (1)

2.5.2 CO_2 is linear/*lineêr* ✓ (1)

2.6 (The charge distribution in) $CH_3Cℓ$ is asymmetrical and CH_4 is symmetrical. ✓
(Die verspreiding van lading in) $CH_3Cℓ$ is asimmetries en CH_4 is simmetries.

OR/*OF*

The chlorine has a higher electronegativity than the hydrogen. ✓
Die chloor het 'n hoër elektronegatiwiteit as waterstof. (1)
[11]

QUESTION/*VRAAG 3*

3.1
- Both water and ethanol have hydrogen bonds ✓
  Beide water en etanol het waterstofbindings ✓
- which are the same in relative strength. ✓
  wat dieselfde relatiewe sterkte is. ✓
- Substances with comparable relative strength in intermolecular forces will dissolve. ✓
  Stowwe wat vergelykbare relatiewe sterkte in intermolekulêre kragte het, sal in mekaar oplos ✓ (3)

3.2
- The intermolecular forces between the molecules of iodine and bromine are both London forces (Van der Waals forces/Induced dipole forces). ✓
  Die intermolekulêre kragte tussen molekules van jodium en broom is beide London kragte (van der Waalskragte/geïnduseerde kragte). ✓

(3)

- Iodine molecules have a bigger molecular mass than the molecules of bromine/iodine molecules have a larger surface area than molecules of bromine/iodine molecules have more electrons than that of bromine and thus have a larger polarity (any option) ✓
  Jodiummolekules het 'n groter molekulêre massa as die molekules van broom/jodiummolekules het 'n groter oppervlak as broommolekules/ jodiummolekules het meer elektrone as die van broom en het daarom 'n groter polariteit (enige opsie) ✓
- The bigger the molecules/larger the surface are of the molecules, the stronger the intermolecular forces. ✓
  Hoe groter die molekule/oppervlakte van die molekule, hoe sterker is die intermolekulêre kragte. ✓

3.3
- The intermolecular forces between phosphine molecules are dipole-dipole forces/Van der Waals forces. ✓
  Die intermolekulêre kragte tussen fosfien se molekules is dipool-dipoolkragte/Van der Waalskragte ✓
- The intermolecular forces between ammonia molecules are hydrogen bonds. ✓
  Die intermolekulêre kragte tussen die molekules van ammoniak is waterstofbindings ✓
- The dipole-dipole forces are weaker than the hydrogen bonds. ✓
  Die dipool-dipoolkragte is swakker as die waterstofbindings ✓
- Weaker forces will cause the molecules to evaporate faster/stronger forces will evaporate slower ✓
  Swakker kragte sal veroorsaak dat molekules vinniger verdamp/sterker kragte sal veroorsaak dat molekules stadiger verdamp ✓ (4)

3.4 Bromine ✓/*Broom* ✓ (1)

3.5 **NEGATIVE MARKING FROM 3.4/*NEGATIEWE NASIEN VANAF 3.4***
- The boiling point of bromine is lower than the other two liquids therefore it has weaker intermolecular forces. ✓
  Die kookpunt van broom is laer as die ander twee vloeistowwe en het daarom swakker intermolekulêre kragte. ✓
- If the intermolecular forces are weaker, the vapour pressure will be higher. ✓
  Indien die intermolekulêre kragte swakker is, sal die dampdruk van die vloeistof hoër wees. ✓

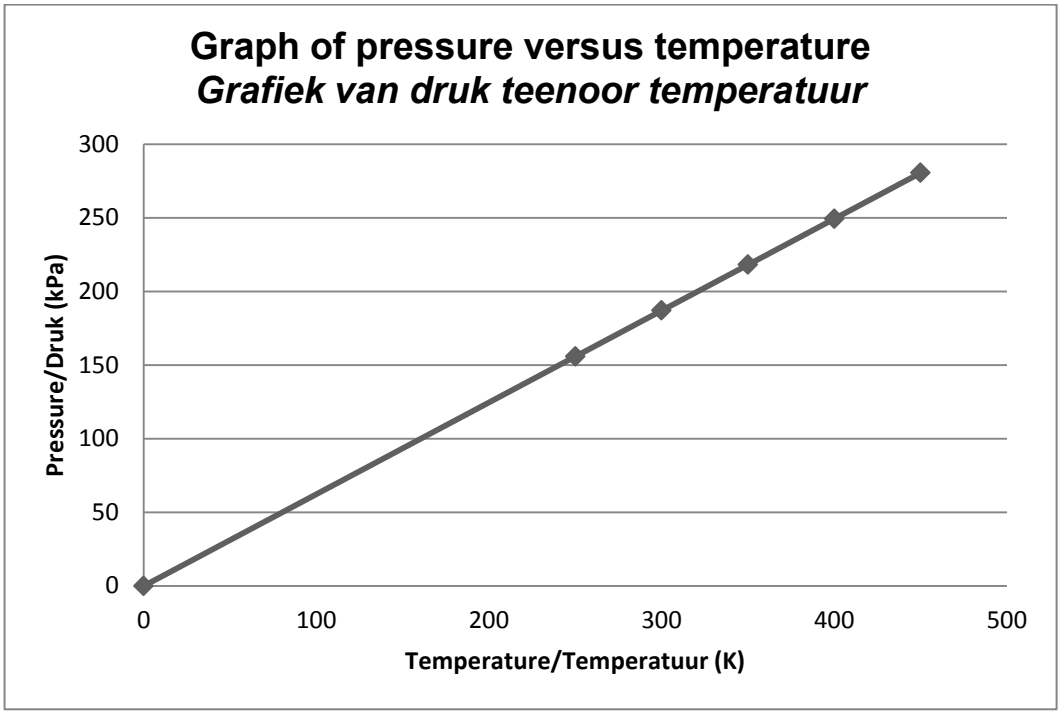
OR/*OF*

- The boiling point of water and ethanol are higher than bromine, therefore it has stronger intermolecular forces.
  Die kookpunt van water en etanol is hoër as broom en het daarom sterker intermolekulêre kragte.
- If the intermolecular forces are stronger, the vapour pressure will be lower.
  Indien die intermolekulêre kragte sterker is, sal die dampdruk laer wees. (2)

[13]

QUESTION/*VRAAG 4*

4.1



Refer to the last page of the marking guidelies for the graph drawn to scale.
Verwys na die laaste bladsy van die nasienriglyne vir die skaalgrafiek.

Criteria for marking the graph	
Use of correct scale on both axis *Korrekte skaal op die asse*	✓
At least three (3) points plotted correctly *Ten minste drie (3) punte korrek gestip*	✓
Line of best fit drawn *Beste passing lyn getrek*	✓
Graph drawn to the origin *Grafiek getrek deur die oorsprong*	✓

(4)

4.2 Pressure of an enclosed gas is directly proportional to the temperature ✓ if the volume stays constant. ✓
Druk van 'n ingeslote gas is direk eweredig aan die temperatuur ✓ indien die volume konstant bly. ✓

OR/*OF*

As the pressure of an enclosed gas increases, the temperature increases ✓ proportionately. ✓
Indien die druk van 'n ingeslote gas verhoog, sal die temperatuur ✓eweredig verhoog ✓ (2)

4.3 At very low temperature values, the gas will liquify, not acting like a gas anymore. ✓✓
Teen baie lae tempertuurwaardes sal die gas vervloei en nie soos 'n gas optree nie. ✓✓ (2)

4.4
- If the temperature increases, the average kinetic energy of the particles increases. ✓
  Indien die temperatuur verhoog, neem die gemiddelde kinetiese energie van die deeltjies toe ✓
- The particles move faster. ✓
  Die deeltjies beweeg vinniger. ✓
- The number of collisions between the particles increase (and force per unit area). ✓
  Die aantal botsings tussen die deeltjies neem toe (en die krag per eenheid oppervlak neem toe) ✓
- If the number of collisions increases, the pressure increases. ✓
  Indien die aantal botsings toeneem sal die druk toeneem. ✓ (4)

4.5 High temperature ✓/*Hoë temperatuur*
Low pressure ✓/*Lae druk* (2)

4.6 Accept any combination of coordinates from the graph for example:/
Aanvaar enige kombinasie van koördinate vanaf die grafiek byvoorbeeld:

$$\text{Gradient} = \frac{280,5 - 155,8}{450 - 250} \quad \checkmark \checkmark$$
$$= 0,62 \checkmark$$

OR/*OF*

$$\text{Gradient} = \frac{280,5 - 0}{450 - 0}$$
$$= 0,62$$

OR/*OF*

$$\text{Gradient} = \frac{249,3 - 0}{400 - 0}$$
$$= 0,62$$

OR/*OF*

$$\text{Gradient} = \frac{218,1 - 0}{350 - 0}$$
$$= 0,62$$

(3)

4.7 **POSITIVE MARKING FROM 4.6/*POSITIEWE NASIEN VANAF 4.6***

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

$n = \frac{48}{32}$ ✓

n = 1,5 mole/*mol* ✓

From/*Vanaf* pV = nRT

Gradient = $\frac{nR}{V}$ ✓

(**NOTE:** Pressure is in kPa on graph – to use equation it should be in Pa)
(***LET WEL:*** *Druk vanaf die grafiek is in kPa en moet eers omgeskakel word na Pa om die formule te gebruik)*

$620 = \frac{1,5(8,31)}{V}$ ✓

$V = 0,02\ m^3$ ✓

($20,1\ dm^3$) (5)
[22]

QUESTION/*VRAAG 5*

5.1 $\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$ ✓

$\frac{105\,000(12,6)}{298} = \frac{27\,640(36,3)}{T_2}$ ✓✓

$T_2 = 226\ K$

$T_2 = -47\ °C$ ✓ (4)

5.2 pV = nRT ✓
(105 000)(12,6) ✓= n(8,31)(298) ✓
n = 534,25 mole/*mol* ✓ (4)
[8]

QUESTION/*VRAAG 6*

6.1.1 $2H_2O_2$ (aq) ✓ $\rightarrow$ $2H_2O$ (ℓ) + O_2 (g) ✓ (2)

6.1.2 The catalyst lowers the activation energy of the reaction ✓✓
'n Katalisator verlaag die aktiveringsenergie van die reaksie. ✓✓ (2)

6.1.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$n = \frac{V}{V_m}$ ✓ $n = \frac{0,6}{24,45}$ ✓ n = 0,0245 mole/*mol* O_2 produced/*gevorm* $H_2O_2 : O_2$ 2 : 1 ✓ n = 0,049 mole/*mol* H_2O_2 reacted/*reageer* $n = \frac{m}{M}$ ✓ $0,049 = \frac{m}{34}$ ✓ m = 1,67 g ✓	From the balanced equation: *Vanaf gebalanseerde vergelyking*: 68g H_2O_2 → 24,45 dm^3 O_2 ✓✓ X g H_2O_2 → 600 x 10^{-3} dm^3 ✓ $X = \frac{68 \times 0,6}{24,45}$ ✓✓ X = 1,67 g ✓

(6)

6.2.1 Magnesium ✓, the mass of magnesium after 3 minutes/at the end of the reaction was zero ✓
Magnesium ✓, die massa magnesium na 3 minute/aan die einde van die reaksie was nul ✓ (2)

6.2.2 $c = \frac{n}{V}$ ✓

$0,36 = \frac{n}{0,5}$ ✓

n = 0,18 mole/*mol*HCℓ used/*gebruik*

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

$n = \frac{1,2}{24}$ ✓

n = 0,05 mole/*mol* ✓ Mg reacted/*reageer*

Mg : HCℓ
1 : 2 ✓

0,1 mole/*mol* ✓ HCℓ reacted/*reageer*

Moles of HCℓ left in the test tube = 0,18 – 0,1 = 0,08 mole ✓/*Mol HCℓ ongereageer in die proefbuis = 0,18 – 0,1 = 0,08 mol* (7)

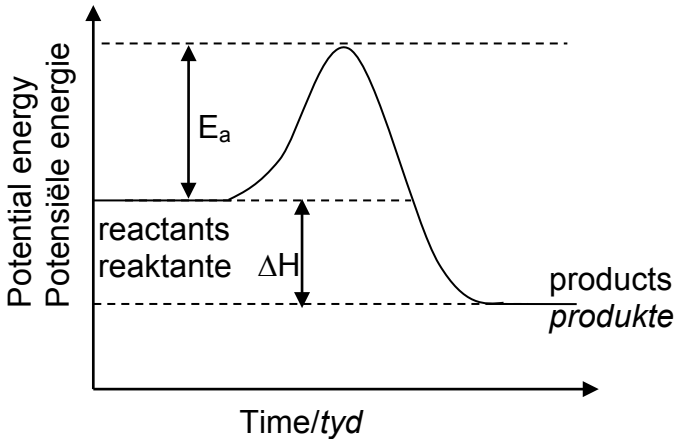
[19]

QUESTION/VRAAG 7

7.1 The minimum energy needed for a reaction to take place. ✓✓
Die minimum energie benodig vir die reaksie om plaas te vind. ✓✓ (2)

7.2 An exothermic reaction releases energy **OR** $\Delta H < 0$ ✓✓
'n Eksotermiese reaksie stel energie vry **OF** $\Delta H < 0$ ✓✓ (2)

7.3



MARKING CRITERIA/*NASIENKRITERIA*	
Activation energy E_a correct position and labelled *Aktiveringsenergie E_a korrekte posisie en benoem*	✓
Heat of reaction ΔH correct position and labelled *Reaksiewarmte ΔH korrekte posisie en benoem*	✓
Products have lower energy than reactants *Produkte het laer energie as reaktanse*	✓

(3)

7.4 $C : \frac{82,76}{12} = 6,896$ ✓

$H : \frac{17,24}{1} = 17,24$ ✓

Divide by the smallest answer
Deel deur die kleinste antwoord

$\frac{6,896}{6,896} \quad \frac{17,24}{6,896}$ ✓

1 : 2,5

2 : 5

C_2H_5 ✓ (4)

[11]

QUESTION/*VRAAG 8*

8.1.1 A base is proton acceptor ✓✓
'n Basis is 'n protononttvanger ✓✓ (2)

8.1.2 $H_2SO_4(aq) + 2NaOH\ (aq)$ ✓ $\rightarrow Na_2SO_4\ (aq) + 2H_2O\ (\ell)$ ✓ balance/*balans* ✓ (3)

8.1.3 Sodium sulphate ✓✓/*Natriumsulfaat* ✓✓ (2)

8.1.4 HSO_4^- ✓✓ (2)

8.1.5 HSO_4^- and/*en* H_2SO_4 ✓✓
H_2O and/*en* H_3O^+ ✓✓ (4)

8.2.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$c = \frac{m}{MV}$ ✓ $c = \frac{6}{(40)(0,5)}$ ✓ $c = 0,3\ mol.dm^{-3}$ ✓	$n = \frac{m}{M}$ $n = \frac{6}{40}$ ✓ $n = 0,15$ mole / *mol* $c = \frac{n}{V}$ ✓ $c = \frac{0,15}{0,5}$ ✓ $c = 0,3\ mol.dm^{-3}$ ✓

(4)

8.2.2
$n = \frac{m}{M}$
$n = \frac{6}{40}$ ✓
n = 0,15 mole/*mol* NaOH

NaOH : $NH_4C\ell$
1 : 1 ✓
$n = \frac{m}{M}$
$0,15 = \frac{m}{53,5}$ ✓
m = 8,025 g $NH_4C\ell$
$\frac{8,025}{10} \times 100 = 80,25\ \%$ pure/*suiwer* ✓
100 – 80,25 ✓ = 19,75 % impurities/*onsuiwerhede* ✓
OR/*OF*
10 – 8,025 = 1,975
$\frac{1,975}{10} \times 100 = 19,75\%$ impurities/*onsuiwerhede*

(6)
[23]

QUESTION/*VRAAG 9*

9.1 Cr^{6+} (+6) ✓✓ (2)

9.2 Gain of electrons ✓
Opneem van elektrone ✓ (1)

9.3 Fe^{2+}, ✓ the oxidation number increases from +2 to +3 ✓
Fe^{2+}, ✓die oksidasiegetal neem toe van +2 na +3 ✓ (2)

9.4 $Cr^{6+}/Cr_2O_7^{2-}$ ✓✓ (2)

9.5 $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ (1)

9.6 $6Fe^{2+} \rightarrow 6Fe^{3+} + 6e^-$ ✓
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$
$Cr_2O_7^{2-} + 14H^+ + 6Fe^{2+} \rightarrow 2Cr^{3+} + 7H_2O + 6Fe^{3+}$ ✓✓ (3)
[13]

QUESTION/*VRAAG10*

10.1 Miners do not have to risk their lives going deep or being trapped underground. ✓
Mynwerkers het nie 'n lewensgevaarlike risiko om ondergronds vas te val nie.✓
No risk of sink holes ✓
Daar ontstaan nie sinkgate nie ✓

OR/*OF*

Any other relevant answer/*Enige ander relevante antwoord* (2)

10.2 Reduction, ✓ oxidation number of iron decreases from 6+ to 0. ✓/
Reduksie, ✓ *die oksidasiegetal van yster neem af van 6+ na 0*. ✓ (2)

10.3 Carbon is a non-renewable recource ✓
Koolstof is 'n nie-hernubare bron ✓
Carbon dioxide as product can increase global warming ✓
Koolstofdioksied as produk kan aardverwarming vererger ✓

OR/*OF*

Any other relevant answer/*Enige ander relevante antwoord* (2)

10.4 The gold does not oxidize easily like iron. ✓✓/*Die goud oksideer nie so maklik soos yster nie*. ✓✓ (2)

10.5 It acts as oxidising agent. ✓✓/*Dit tree op as oksideermiddel*. ✓✓ (2)
[10]

TOTAL/*TOTAAL*: 150

ANSWER SHEET/ANTWOORDBLAD

Hand in this ANSWER SHEET with the ANSWER BOOK./Lewer hierdie ANTWOORDBLAD saam met die ANTWOORDEBOEK in.

NAME/NAAM: _____ **CLASS/KLAS:**_____

QUESTION/VRAAG 4.1

GRAPH OF PRESSURE VERSUS TEMPERATURE/*GRAFIEK VAN DRUK TEENOOR TEMPERATUUR*