GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION/ *PROVINSIALE EKSAMEN*

JUNE/*JUNIE* 2022

GRADE/*GRAAD* 11

MARKING GUIDELINES/*NASIENRIGLYNE*

PHYSICAL SCIENCES (PHYSICS AND CHEMISTRY)/
***FISIESE WETENSKAPPE* (*FISIKA EN CHEMIE*)**

7 pages/*bladsye*

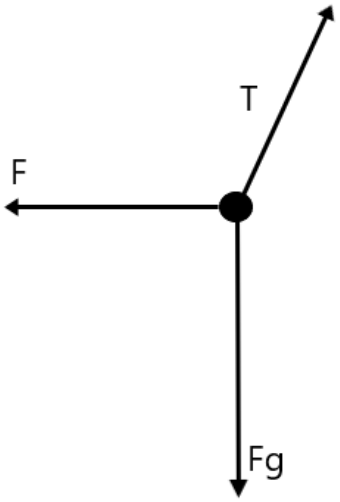
QUESTION/*VRAAG* 1

1.1 B ✓✓ (2)
1.2 B ✓✓ (2)
1.3 D ✓✓ (2)
1.4 B ✓✓ (2)
1.5 C ✓✓ (2)
1.6 C ✓✓ (2)
1.7 D ✓✓ (2)
1.8 A ✓✓ (2)
1.9 D ✓✓ (2)
1.10 B ✓✓ (2)
[20]

QUESTION/*VRAAG* 2

2.1 The magnitude of the electrostatic force exerted by two point charges (Q_1 and Q_2) on each other is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance (r) between them. ✓✓/*Die grootte van die elektrostatiese krag wat twee puntladings (Q_1 en Q_2) op mekaar uitoefen is direk eweredig aan die produk van die groottes van die ladings en omgekeerd eweredig aan die kwadraat van die afstand (r) tussen hulle*. ✓✓ (2)

2.2



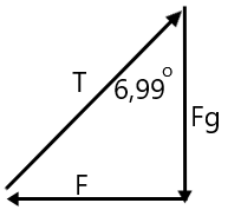
Marking guidelines/*Nasienriglyne:*

✓ F/T

✓ F/ F_A

✓ F_g/w

-1 for every extra force added/-1 *vir elke ekstra krag bygevoeg*



(3)

2.3 $F_g = m \times g$
$= 0,15 \div 1\,000 \times 9,8$ ✓
$= 1,47 \times 10^{-3}$ N

Marking guidelines/*Nasienriglyne*:
- ✓ Fg substitution/*Invervanging*
- ✓ Formula/*Formule*, tanθ
- ✓ Substitution tanθ
- ✓ Final answer/*Finale antwoord*

$\tan\theta = \frac{F}{F_g}$
$F = F_g \times \tan 6,99°$ ✓
$= 1,47 \times 10^{-3} \times \tan 6,99°$ ✓
$= 1,8 \times 10^{-4}$ N ✓

(4)

2.4 When object **A** exerts a force on object **B**, object **B** SIMULTANEOUSLY exerts an oppositely directed force of equal magnitude on object **A**. ✓✓ (2)
*Wanneer voorwerp **A** 'n krag op voorwerp **B** uitoefen sal voorwerp **B** GELYKTYDIG 'n krag van gelyke grootte en in die teenoorgestelde rigting op voorwerp **A** uitoefen.* ✓✓

2.5 $F = \frac{kQ_1Q_2}{r^2}$ ✓

$1,8 \times 10^{-4} = \frac{(9 \times 10^9)Q^2}{(20 \div 1\,000)^2}$ ✓ ✓

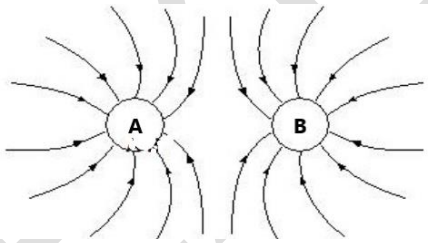
$= -2 \times 10^{-8}$ C on each/*op elk* ✓

Marking guidelines/*Nasienriglyne:*
- ✓ Formula/*Formule*
- ✓ Substitution F and k/ *Invervanging F en k*
- ✓ Substitution/*Invervanging* r/d
- ✓ Final answer/*Finale antwoord*

(4)

2.6 The electrostatic force experienced by a unit positive charge placed at that point. ✓✓/*Die elektrostatiese krag op 'n positiewe eenheidslading uitgeoefen wat op daardie punt geplaas word.* ✓✓ (2)

2.7



Marking guidelines/*Nasienriglyne*:
- ✓ Shape/*Vorm*
- ✓ All field rules applied/*Alle sketsreëls toegepas*
- ✓ Direction of arrows/*Rigting van pyle*

(3)

2.8 $E_{A \text{ on } p} = \frac{kQ}{r^2}$ ✓

$= \frac{9 \times 10^9 (3{,}58 \times 10^{-9})}{(0{,}04)^2}$ ✓

= 20 137,5 $N.C^{-1}$ Away from sphere **A**/to the right//*Weg van sfeer **A**/na regs*

$E_{B \text{ on } p} = \frac{kQ}{r^2}$

$= \frac{9 \times 10^9 (3{,}58 \times 10^{-9})}{(0{,}02)^2}$ ✓

= 80 550 $N.C^{-1}$ Away from sphere **A**/**B**/to the right//*Weg van sfeer **A**/**B**/na regs*

$E_{net} = E_{A \text{ on } p} + E_{B \text{ on } p}$

= 20 137,2 + 80 550 ✓ (**A**+**B**)

= 100 687,2 $N.C^{-1}$ ✓ Away from sphere **A**/**B**/to the right

*Weg van sfeer **A**/**B**/na regs*✓ (6)

2.9
- **B** will be attracted to **A**. ✓/***B** sal aangetrek word na **A**.*✓
- Thus will drop down to touch **A**. ✓/*Sal dus afbeweeg om **A** aan te raak.* ✓
- Both **A** and **B** will be discharged. ✓/*Beide **A** en **B** sal ontlaai word.* ✓
- The system will be neutralised. ✓/*Die sisteem sal geneutraliseer word*✓ (4)

[30]

QUESTION/*VRAAG* 3

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

3.2
- Both iodine and bromine have only London forces between the molecules ✓/ *beide jodium en broom het slegs London kragte tussen die molekules,* ✓
- but iodine is much heavier than bromine. ✓/*jodium is egter swaarder as broom.*✓
- Thus, iodine will have stronger London forces between the molecules ✓/*Dus het jodium sterker London kragte tussen die molekules.* ✓
- More energy will be needed to overcome the bonds between the iodine molecules. ✓/*Meer energie word benodig om die kragte tussen jodium molekules te oorkom.* ✓ (4)

3.3
- Intermolecular forces between ammonia molecules are hydrogen bonds. ✓/ *Intermolekulêre kragte tussen ammoniak molekules is waterstofbindings.*✓
- Intermolecular forces between phosphine molecules are dipole-dipole forces. ✓/*Intermolekulêre kragte tussen fosfien molekules is dipool-dipool kragte.* ✓ **or/*of***
- Hydrogen bonds are much stronger than dipole-dipole forces. ✓/ *Waterstofbindings is sterker as dipool-dipool kragte.* ✓
- Intermolecular forces between NH_3 is stronger than that between PH_3. ✓/ *Intermolekulêre kragte tussen NH_3 is sterker as tussen PH_3.* ✓
- Thus, more energy will be needed to overcome the hydrogen bonds. ✓/*Dus, word meer energie, benodig om die waterstofbindings te oorkom.* ✓ (4)

3.4 The pressure exerted by a vapour at equilibrium with its liquid in a closed system. ✓✓/*Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem.* ✓✓ (2)

3.5
- Water has the lowest rate of evaporation ✓/*Water het die laagste tempo van verdamping*✓
- As it has hydrogen bonds which are the strongest intermolecular forces ✓/ Want d*it het waterstofbindings wat die sterkste intermolekulêre kragte is*. ✓
- The stronger the intermolecular forces the lower the vapour pressure and the longer it will take to evaporate. ✓ **OR** Strength of intermolecular forces is inversely proportional to the vapour pressure. ✓/*Hoe sterker die intermolekulêre kragte hoe laer is die dampdruk en hoe langer sal dit neem om te verdamp.* ✓ ***OF*** *Die sterkte van die intermolekulêre kragte is omgekeerd eweredig aan die dampdruk*✓ (3)

3.6
- Iodine molecules are non-polar and have London forces between the molecules. ✓/*Jodium molekules is nie-polêr en het London kragte tussen die molekules*.✓
- Water molecules are polar and have hydrogen bonds between them. ✓/*Water molekules is polêr en het waterstofbindings tussen hulle.* ✓
- Polar and non-polar substances do not mix. ✓/*Polêr en nie-polêre stowwe meng nie*. ✓ (3)

[18]

QUESTION/*VRAAG* 4

4.1 The amount of substance having the same number of particles as there are atoms in 12 g carbon -12 ✓✓/*Die hoeveelheid stof wat dieselfde aantal deeltjies het as wat daar in 12 g koolstof is*✓✓ (2)

4.2 $2SO_2 + O_2 \rightarrow 2\ SO_3$

Marking guidelines/*Nasienriglyne*
✓ reactants/*reaktante*
✓ products/*produkte*
✓ balancing/*balansering* (3)

4.3 4.3.1 SO_3 : $n = \frac{m}{M}$
$= \frac{14}{80}$ ✓
= 0,175 mol

$SO_2 : SO_3$
2 : 2
Thus, n (SO_2) = 0,175 mol ✓

Marking guidelines/*Nasienriglyne*
✓ substitution/*substitusie*
✓ using mole ratio/*gebruik molverhouding*
✓ substitution/*substitusie* 22,4 dm^3
✓ final answer/*finale antwoord*

$n = \frac{v}{V_m}$
$v = n \times Vm$
= 0,175 x 22,4 ✓
v = 3,92 dm^3 ✓ (4)

4.3.2 ratio of O_2 to SO_3
$O_2 : SO_3$
1 : 2
n(SO_3) : 0,175 mol
Thus n (O_2)= 0,0875 mol ✓
$\boldsymbol{n} = \frac{m}{M}$
$\boldsymbol{m} = n \times M$ ✓
= 0,0875 x 32 ✓
$\boldsymbol{m}$ = 2,8 g of/*van* O_2 ✓ (4)

Marking guidelines/*Nasienriglyne*
✓ using mole ratio/*gebruik molverhouding*
✓ Formula/*Formule*
✓ substitution/*substitusie*
✓ final answer/*finale antwoord*

4.4

Element	**g / 100 g** ✓	**n = m / M**	**Simplest ratio/ *Eenvoudigste verhouding***
C	85,7	85,7 / 12 = 7,14✓	7,14 / 7,14 = 1 ✓
H	14,3	14,3 / 1 = 14,3✓	14,3 / 7,14 = 2 ✓

(5)

4.5 $M(CH_2) = 12 + 2(1)$
= 14 $g.mol^{-1}$ ✓
$\frac{56,12}{14}$ = 4 times/*keer*
Molecular formula/*Molekulêre formule:* C_4H_8 ✓ (2)
[20]

QUESTION/*VRAAG* 5

5.1 The flask is open. ✓/*Die fles is oop.* ✓
The O_2 gas is able to escape. ✓/*Die O_2 gas kan ontsnap.* ✓
Thus the mass will decrease./*Dus sal die massa afneem.* (2)

5.2 5.2.1 60,79 g ✓✓ (Only substance left in flask./*Die enigste stof oor in die fles.*) (2)

5.2.2 $n_{KCl} = \frac{m}{M}$ ✓

$= \frac{60,9}{74,5}$

= 0,817 mol

Ratio/*Verhouding* 2 : 3 ✓

0,817 x 2 = 1,634 mol O_2

∴ $m_{(O2)}$ = n x M
= 1,634 x 32 ✓
= 52,29 g (actual mass reacted/*werklike massa gereageer*) ✓ (4)

5.2.3 Ratio 2 : 2 ✓

0,817 x 1 = 0,817 mol $KClO_3$

Mass = n x M
= 0,817 x 122,5 ✓
= 100,83 g (actual mass reacted/*werklike massa gereageer*)

$$\% \text{ Purity/}Suiwerheid = \frac{\text{actual mass/}werklike\,massa}{\text{given massa/}gegewe\,massa} \times 100$$

$$= \frac{100,83}{130} \times 100 \quad ✓$$

= 76,99 % ✓

(4)

[12]

TOTAL/*TOTAAL* : 100