KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA



NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES

COMMON TEST

JUNE 2022

MARKING GUIDELINE



NB: This marking guideline consists of 7 pages.

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QUESTION 1

1.1 B ✓✓
1.2 B ✓✓
1.3 A ✓✓
1.4 D✓✓
1.5 D ✓✓
1.6 C✓✓

[12]

QUESTION 2

2.1 They attract each other✓because they have opposite charges. ✓ (2)

2. 2 The net/total charge of an isolated system remains constant during any physical process✓✓ (2)

2.3

$$Qafter = \frac{Q_1 + Q_2}{2}$$

$$= \frac{(+5 + (-11)}{2} \checkmark$$

Q = – 3 nC✓ (2)

2.4 Q ✓ (1)

2.5 **Positive marking from question 2.1.3**

+ 5 + x = – 3 ✓
x = – 8 nC

OR

–11 – x = – 3✓
x = – 8 nC

$$n = \frac{Q}{e}$$

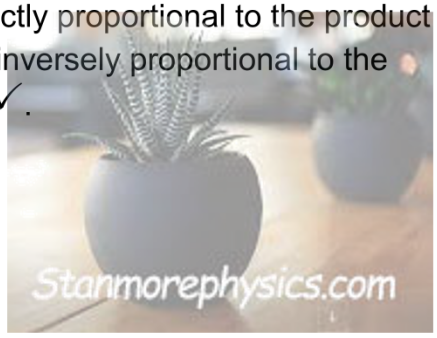
$$= \frac{8x10^{-9}}{1{,}6\,x10^{-19}} \checkmark$$

= 5 x 10^{10} ✓ electrons (3)

[10]

QUESTION 3

3.1 The magnitude of the electrostatic force exerted by one point charge (Q_1) on another point charge (Q_2) is directly proportional to the product of the magnitudes of the charges ✓ and inversely proportional to the square of the distance (r) between them ✓. (2)



3.2 They are directly proportional ✓ (1)

3.3 Gradient = $\frac{\Delta F}{\Delta \frac{1}{r^2}}$

$= \frac{8-0}{0,5-0}$ ✓

= 16 ✓ (Accept range 15-17) (2)

3.4 **Positive marking from question 3.3**

$F = \frac{kQ_1Q_2}{r^2}$ ✓

16 ✓ = 9 x10^9 x Q^2 ✓

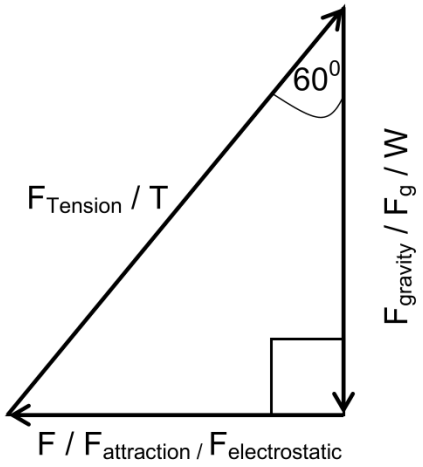
Q = 4,22 x10^{-5} C ✓ (4)

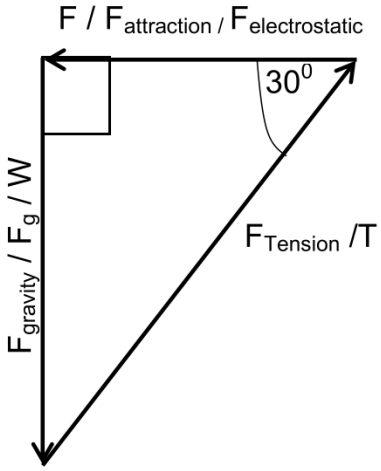
[9]

QUESTION 4

4.1.1 The net force acting on sphere B is zero. ✓ (1)

4.1.2





NB : Ignore the sizes of the force vectors.

Marking Rubric : Triangle of forces	
Criteria	Mark allocation
Forces correctly drawn and labelled	3 x 1 = 3
angle correctly shown	1

(4)

4.1.3 $F = \frac{kQ_1Q_2}{r^2}$

$= \frac{(9 \times 10^9)(3{,}2 \times 10^{-7})(6 \times 10^{-8})}{(0{,}025)^2}$ ✓✓

$= 0{,}2765$ N

$\tan\theta = \frac{F}{Fgravity}$

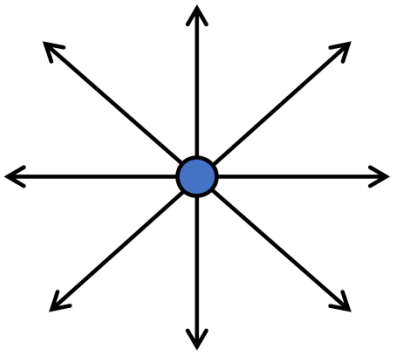
$\tan 60^0$ ✓ $= \frac{0{,}2765}{Fg}$ ✓

$Fg = 0{,}159N$ ✓ (5)

4.2

4.2.1 The electric field at a point is the electrostatic force experienced per unit positive charge placed at that point ✓✓ (2 or 0) (2)

4.2.2



Marking Rubric : Sketch of Electric field	
Criteria	Mark allocation
Correct direction of field lines	1
Shape of electric field	1
No field lines crossing each other/ or in the sphere	1
NB: if shape incorrect	0/3

(3)

4.2.3 $E(P \rightarrow R) = \frac{kQ}{r^2}$

$= \frac{9 \times 10^9 \times 6 \times 10^{-9}}{(0{,}040)^2}$ ✓

$= 33750\ NC^{-1}$

$E(Q \rightarrow R) = \frac{kQ}{r^2}$

$= \frac{9 \times 10^9 \times 2 \times 10^{-9}}{(0{,}020)^2}$ ✓

$= 45000\ NC^{-1}$

$E_{Net} = \frac{45000 - 33\,750}{}$ ✓

$= 11\,250\ NC^{-1}$ ✓

Accept : $33\,750 - 45\,000$ ✓

$= -11\,250\ NC^{-1}$ ✓ (Ignore sign of answer) (5)

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4.2.4 (Positive marking from question 4.2.3)

$F = E \cdot Q$ ✓

$= (11\ 250)(1{,}6 \times 10^{-19})$ ✓

$= 1{,}8 \times 10^{-15}$ N ✓ (3)

[23]

QUESTION 5

5.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓✓ (2)

5.2 Ammonia has ONE site for hydrogen bonding ✓while water has TWO sites for hydrogen bonding.✓
Therefore, force of attraction between water molecules are stronger than that of ammonia molecules. ✓
Thus more energy is needed to overcome intermolecular forces in water, ✓ therefore higher boiling point. (4)

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5.3 Water. ✓
Higher boiling point. ✓ (2)
[8]

QUESTION 6

6.1 Simplest ratio of elements in a compound. ✓✓ (2)

6.2

	C	H	N	O	
Mass	57,14g	6,16g	9,52g	27,18g	
n = m/M	$\frac{57{,}14}{12}$	$\frac{6{,}16}{1}$	$\frac{9{,}52}{14}$	$\frac{27{,}18}{16}$	✓
No of moles	4,76	6,16	0,68	1,70	✓
Divide by smallest	$\frac{4{,}76}{0{,}68}$	$\frac{6{,}16}{0{,}68}$	$\frac{0{,}68}{0{,}68}$	$\frac{1{,}70}{0{,}68}$	✓
Ratio	7	9	1	2,5	✓
	14	18	2	5	X2

Empirical Formula: $C_{14}H_{18}N_2O_5$ ✓

(5)

6.3 $M = 14(12) + 18(1) + 2(14) + 5(16) = 294\ g.mol^{-1}$ ✓ (1)

[8]

QUESTION 7

7.1 The reactant that is completely used up in a chemical reaction.✓✓ (2)

7.2

O_3	NO
n = m/M ✓	n = m/M
= 0,8 / 48	= 0,75 / 30
= 0,02mol ✓	= 0,03mol✓

Therefore O_3 is limiting✓ (4)

7.3 $n\,O_3 : nO_2$
$1 : 1$ ✓
Therefore $nO_2 = n\,O_3$
$= 0,02mol$✓ (2)

7.4

	$O_3(g)$	:	$NO(g)$	:	$O_2(g)$	:	$NO_2(g)$
Ratio	1		1		1		1
Moles at end	0		0,01		0,02		0,02

Total moles of gas at end $= nNO + nO_2 + nNO_2$
$= 0,01$ ✓ + $0,02 + 0,02$ ✓
$= 0,05$ mol ✓ (3)

7.5 **Positive marking from 7.3**

Mass of $O_2 = nM$
$= (0,02)(32)$ ✓
$= 0,64g$ ✓

Percentage yield $= \frac{\text{actual yield}}{\text{theoretical yield}} \times \frac{100}{1}$ (4)

$= \frac{0,48}{0,64} \times \frac{100}{1}$ ✓

$= 75\%$ ✓

[15]

QUESTION 8

8.1.1 The number of moles per unit volume of a substance. ✓✓ (2)

8.1.2 $n\ NaHCO_3 = m/M$

$= \frac{1,35}{84}$ ✓

$= 0,016$ mol

$M = 23 + 1 + 12 + 3(16)$

$= 84\ g.mol^{-1}$

$n\ NaHCO_3 : nHCl$

$1 : 1$ ✓

Therefore, $nHCl = 0,016$ mol ✓

$n = C \times V$

$0,016 = 1,0 \times V$ ✓

$V = 0,016\ dm^{-3}$ ✓



(5)

8.1.3 $n\ NaHCO_3 : nCO_2$

$1 : 1$ ✓

$n = m/M$

$0,016 = \frac{m}{44}$ ✓

$m = 0,70g$ ✓ (3)

8.2 $n\ CO_2 = m/M$

$= \frac{0,5}{44}$ ✓

$= 0,011$ mol

$M = 12 + 2(16)$

$= 44\ g.mol^{-1}$

$n\ CaCO_3 : nCO_2$

$1 : 1$ ✓

Therefore: $n\ CaCO_3 = 0,011$mol

$m = nM$

$= (0,011)(100)$ ✓

$= 1,10g$

$M = 40 + 12 + 3(16)$

$= 100\ g.mol^{-1}$



$\%\ purity = \frac{\text{Pure sample}}{\text{Impure sample}} \times \frac{100}{1}$

$= \frac{1,10}{1,5} \times \frac{100}{1}$ ✓

$= 73,33\%$ ✓ (5)

[15]

TOTAL MARKS: 100

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