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Department:
Education
KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES
NOVEMBER 2022

MARKS: 150

TIME: 3 hours

MARKING GUIDELINE

This MARKING GUIDELINE consists of **8** pages.



QUESTION 1

1.1 C ✓✓ (2)

1.2 B ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 C ✓✓ (2)

1.6 C ✓✓ (2)

1.7 D ✓✓ (2)

1.8 C ✓✓ (2)

1.9 B ✓✓ (2)

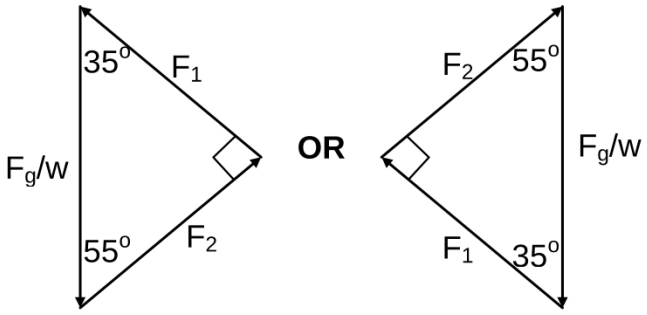
1.10 B ✓✓ (2)

[14]

QUESTION 2

2.1 A force that balances all other forces acting on an object and brings about equilibrium. ✓✓ (2)

2.2



Marking Criteria
- ✓ F_g/w (Label and arrow)
- ✓ F_1 (Label and arrow)
- ✓ F_2 (Label and arrow)
- ✓ Any two angles

(4)

2.3 **Mark according to learner answer:**

Learner uses F_1

$$F_g = mg$$

$$\frac{F_g}{\sin 90^o} = \frac{F_1}{\sin 55^o} \checkmark$$

$$m(9,8) = \frac{35 \sin 90^o \checkmark}{\sin 55^o \checkmark}$$

$$m = 4,36 \text{ kg} \checkmark$$

Learner uses F_2

$$F_g = mg$$

$$\frac{F_g}{\sin 90^o} = \frac{F_2}{\sin 35^o} \checkmark$$

$$m(9,8) = \frac{50 \sin 90^o \checkmark}{\sin 35^o \checkmark}$$

$$m = 8,895 \text{ kg} \checkmark$$

Learner uses Theorem of Phythagoras

$$F_g = mg$$

$$F_g = \sqrt{F_1^2 + F_2^2} \checkmark$$

$$m(9,8) = \sqrt{35^{2\checkmark} + 50^2} \checkmark$$

$$m = 6,23 \text{ kg} \checkmark$$

(4)

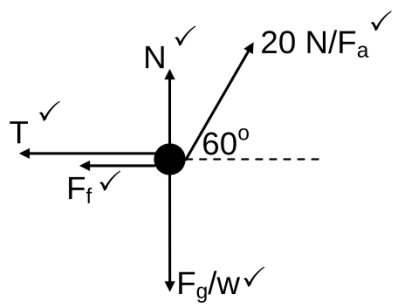
2.4 $F_{net} = F_g - F_1 = m(9,8) - 35$ ✓
$F_{net} = (4,36)(9,8) - 35 =$ <u>7,73N down</u>✓
OR $F_{net} = (8,895)(9,8) - 35 =$ <u>52,171N</u> down✓
OR $F_{net} = (6,23)(9,8) - 35 =$ <u>20,05N down</u>✓ (2)

[12]

QUESTION 3

3.1 The force that opposes the motion of a moving object relative to a surface. ✓✓ (2)

3.2



(5)

3.3 When a resultant/net force acts on an object, the object will accelerate in the direction of the force at an acceleration directly proportional to the force and inversely proportional to the mass of the object. ✓✓ (2)

3.4

For toy train Q

$F_{net} = ma$ ✓

$F_X - f - T = ma$ ✓

$(20\cos 60^o) - 3 - T = 4a$

$T = 7 - 4a$ (1)

For toy wagon P

$F_{net} = ma$

$T - f = ma$ ✓

$T - 2 = 3a$

$T = 2 + 3a$ (2)

(1) = (2) ✓

$7 - 4a = 2 + 3a$

$7a = 5$ ✓

$a = 0{,}71\,m.s^{-2}$

(5)

3.5

$T = 2 + 3a$

$= 7 + 3(0{,}71)$ ✓

$= 4{,}13\,N$ ✓

OR

$T = 7 - 4a$

$= 7 - 4(0{,}71)$ ✓

$= 4{,}16\,N$ ✓

(2)

[16]

QUESTION 4

4.1 The magnitude of the induced emf across the ends of a conductor is directly proportional to the rate of change in the magnetic flux linkage with the conductor. ✓✓ (2)

4.2 4.2.1 South Pole ✓ (1)

4.2.2 B to A ✓ (1)

[4]

QUESTION 5

5.1 The magnitude of the electrostatic force exerted by two point charges on each other is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance between them. ✓✓ (2)

OR

The magnitude of the electrostatic force exerted by two charges on each other is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance between their centres. ✓✓ (2)

5.2

$$F = k\frac{Q_1Q_2}{r^2} \checkmark$$

$$= (9 \times 10^9)\frac{(3 \times 10^{-9})(5 \times 10^{-9})}{(0,2)^2} \checkmark$$

$$= 3,375\ N \checkmark \quad (3,38\ N)$$

(4)

5.3

$$E_{PR} = \frac{kq}{r^2} \checkmark$$

$$= \frac{(9 \times 10^9)(3 \times 10^{-9})}{(0,35)^2} \checkmark$$

$$= 2,204 \times 10^2\ N.C^{-1}$$

$$E_{QR} = \frac{kq}{r^2}$$

$$= \frac{(9 \times 10^9)(5 \times 10^{-9})}{(0,15)^2} \checkmark$$

$$= 2,000 \times 10^3\ N.C^{-1}$$

$$E_{net} = E_{QR} - E_{PR}$$

$$= 2,00 \times 10^3 - 2,204 \times 10^2 \checkmark$$

$$= 7,780 \times 10^3\ N.C^{-1} \checkmark$$

(5)

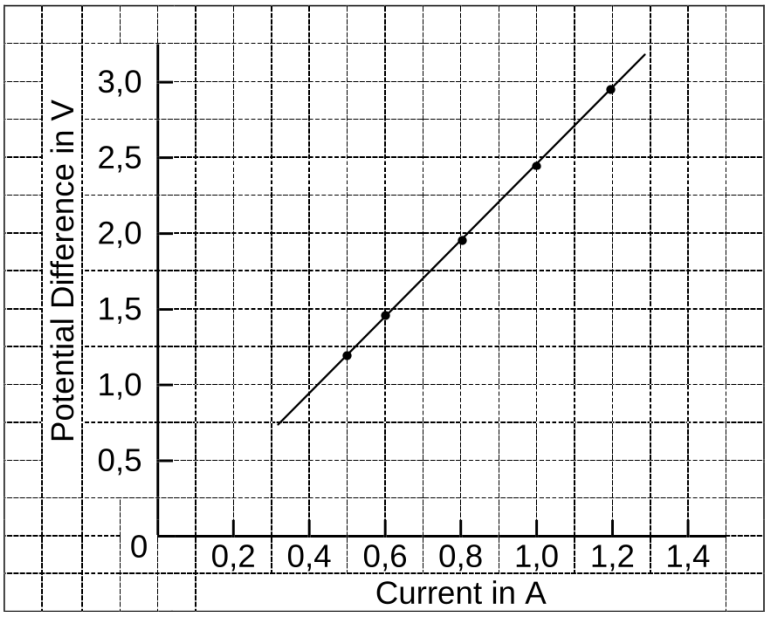
[11]

QUESTION 6

6.1 6.1.1 Ohm's Law ✓✓ (2)

6.1.2 Current ✓ (Temperature) (1)

6.1.3



Marking Criteria
- ✓ Label x-axis
- ✓ Label y-axis
- ✓✓ 3 points plotted correctly
- ✓ 2 points plotted correctly

(4)

6.1.4 Resistance ✓✓ (2)

6.2 6.2.1 $V_{6\Omega} = IR$ ✓

$= (2)$✓(6) ✓

$= 12\ V$✓ (4)

6.2.2 $V_{L_1} = 18 - 12$ ✓ $= 6\ V$

$V_{L_1} = IR$

6✓$= (2)$✓(R)

$R = 3\ \Omega$ ✓ (4)

6.2.3 $V = IR$ ✓

$18 = (3)R$ ✓

$R = 6\ \Omega$

$\frac{1}{R_p} = \frac{1}{6} + \frac{1}{X}$ ✓

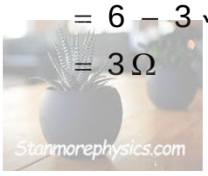
$\frac{1}{3} = \frac{1}{6} + \frac{1}{X}$ ✓

$X = 6\ \Omega$ ✓

$R_p = R_T - R_{L_1}$

$= 6 - 3$ ✓

$= 3\ \Omega$



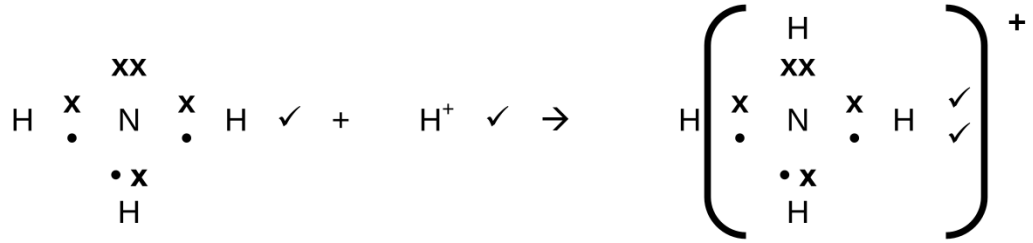
(6)
[23]

QUESTION 7

7.1 The sharing of electrons between two atoms to form a molecule.✓✓ (2)

7.2 7.2.1 Dative covalent bond ✓ (Co-ordinate covalent bond) (1)

7.2.2



(4)
[7]

QUESTION 8

8.1 The temperature at which the vapour pressure of a substance is equal to the atmospheric (external) pressure. ✓✓ (2/0) (2)

8.2 8.2.1 The boiling points increase. ✓ (1)

8.2.2 There is an increase molecular mass from HCℓ to HI. ✓
An increase in molecular mass increases the strength of the intermolecular forces. ✓
More energy is required to disrupt/break the intermolecular forces resulting in a higher boiling point. ✓ (3)

8.2.3 HCℓ contain dipole forces, ✓ while HF has hydrogen bonding.✓
Hydrogen bonds are stronger than dipole forces ✓
Therefore more energy is required to disrupt/break the intermolecular forces in HF than in HCℓ resulting in HF having a higher boiling point. ✓ (4)
[10]

QUESTION 9

9.1 Boyle's law ✓ (1)

9.2 What is the relationship between the pressure of an enclosed gas and the volume it occupies when temperature is kept constant? ✓✓ (2)

9.3 So that condensation of the gas does not occur. ✓ (1)

9.4 9.4.1 D ✓ (1)

9.4.2 $p_1V_1 = p_2V_2$ ✓
$(15)(160) = 30V_2$ ✓
$V_2 = 80\ cm^3$ ✓
(3)
[8]

QUESTION 10

10.1 10.1.1 360 $kJ.mol^{-1}$ ✓ (1)

10.1.2 $\Delta H = H_p - H_r$
$= 120 - 270$
$= -150\ kJ.mol^{-1}$ ✓ (1)

10.1.3 Remains the same ✓ (1)

10.2 Assume we have 100g of sample.

Element	%	m	$n = \frac{m}{M}$	Mole Ratio	Ratio
Fe	72, 41	72,41g	1,29 ✓	1 ⟩ ÷1,29 ✓	3 ⟩ x3 ✓
O	27, 59	27,59g	1,72 ✓	1,33	4

Empirical Formula: Fe_3O_4 ✓ (5)
[8]

QUESTION 11

11.1 An acid is a proton/H^+ ion donor. ✓✓ (2)

11.2 11.2.1 HSO_3^- ; H_2SO_3 ✓✓ OR

H_2O ; OH^- ✓✓ (2)

11.2.2 HSO_3^- ✓ or H_2O ✓ (1)

11.3 $n_{MgCO3} : n_{CO_2} = 1 : 1$ ✓

$$n_{MgCO_3} = \frac{m}{M}$$

$$= \frac{0,15}{84} \checkmark$$

$$= 0,00179 \text{ mol}$$

$$n_{CO_2} = 0,00179 \text{ mol}$$

$$n_{CO_2} = \frac{V}{V_m} \checkmark$$

$$0,00179 = \frac{V}{22,4} \checkmark$$

$$= 0,04 \text{ dm}^3$$ (5)

11.4 11.4.1 $c = \frac{m}{MV}$ ✓

$$= \frac{8}{(58)(0,25)} \checkmark$$

$$= 0,552 \text{ mol.dm}^{-3} \checkmark$$ (3)

11.4.2 $Mg(OH)_2(aq) : 2NH_4C\ell$ ✓

$1 : 2$

$$n_{Mg(OH)_2} = \frac{m}{M} = \frac{8}{58} \checkmark = 0,14 \text{ mol}$$

$$n_{NH_4C\ell} = 2 \times 0,14 \checkmark = 0,18 \text{ mol}$$

$$m_{NH_4C\ell} = nM = 0,18 \times 53,5 \checkmark = 9,63 \text{ g}$$

$$\%\text{Purity} = \frac{\text{Pure mass} \times 100}{\text{Impure mass}}$$

$$90,95 = \frac{9,63 \times 100}{\text{Impure mass}} \checkmark$$

$$\text{Impure mass} = 10,59 \text{ g} \checkmark$$ (6)

[19]

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QUESTION 12

12.1 A loss of electrons. ✓✓ / An increase in oxidation number. ✓✓ (2)

12.2 12.2.1 Cr^{6+} (+6) ✓ (1)

12.2.2 $Fe^{2+,}$ ✓ the oxidation number increases from +2 to +3 ✓ (2)

12.2.3 $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ ✓✓ (2)

12.2.4 $6Fe^{2+} \rightarrow 6Fe^{3+} + 6e^-$ ✓(for correct equation) ✓(for x 6)

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

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

[11]

TOTAL: 150