Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES

MARKING GUIDELINES

COMMON TEST

MARCH 2024

NATIONAL

SENIOR CERTIFICATE

GRADE 11

NB: This memorandum consists of 7 pages.

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QUESTION ONE

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

7 x 2 = [14]

QUESTION TWO

2.1 It is a single vector that can represent a number of vectors acting on an object in both magnitude and direction. ✓✓ (2 or 0) (2)

2.2.1 **OPTION 1** : Σ Rx = (–30) +(50) + (-22cos55^0)+(45 cos70^0) ✓= 22,772 N✓

OPTION 2 : Σ Rx = (–30) + (50) +(-22sin35^0)+(45sin20^0) ✓= 22,772 N✓

OPTION 3 : Σ Rx = 50cos0^0+30 cos180^0 + (45cos70^0)+22cos235^0 ✓ = 22,772 N ✓ (2)

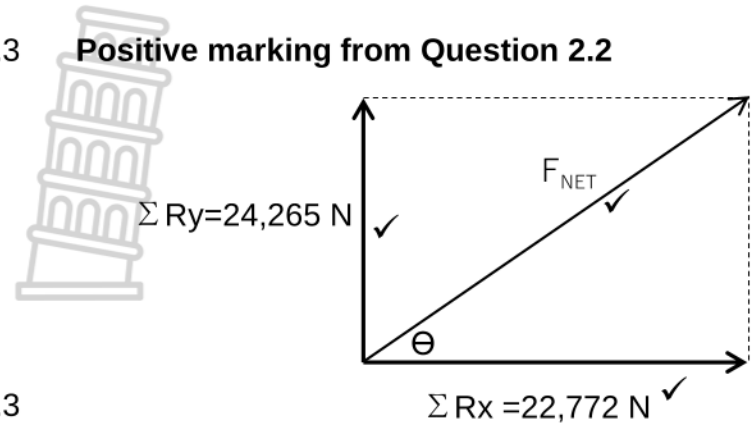
2.2.2 **OPTION 1** : Σ Ry = 45 sin 70^0 + (– 22sin55^0) ✓= 24,265 N ✓

OPTION 2 ; Σ Ry = (45 cos 20^0) +(– 22cos35^0) ✓= 24,265 N✓

OPTION 3 : Σ Ry = 45 sin 70^0 + 22 sin 235^0 ✓= 24,265 N✓ (2)

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2.3 **Positive marking from Question 2.2**



2.3

Marking Rubric : Force diagram	
Criteria	Mark allocation
Force ΣRx drawn correctly	1 mark
Force ΣRy drawn correctly	1 mark
Resultant force drawn correctly	1 mark

(3)

2.4

$R_{NET}^2 = R_X^2 + R_Y^2$

$= (22,772)^2$ ✓ $+ (24,265)^2$ ✓

$R_{NET} = 33,28$ N ✓

$\text{Tan } \Theta = \frac{24,265}{22,772}$ ✓

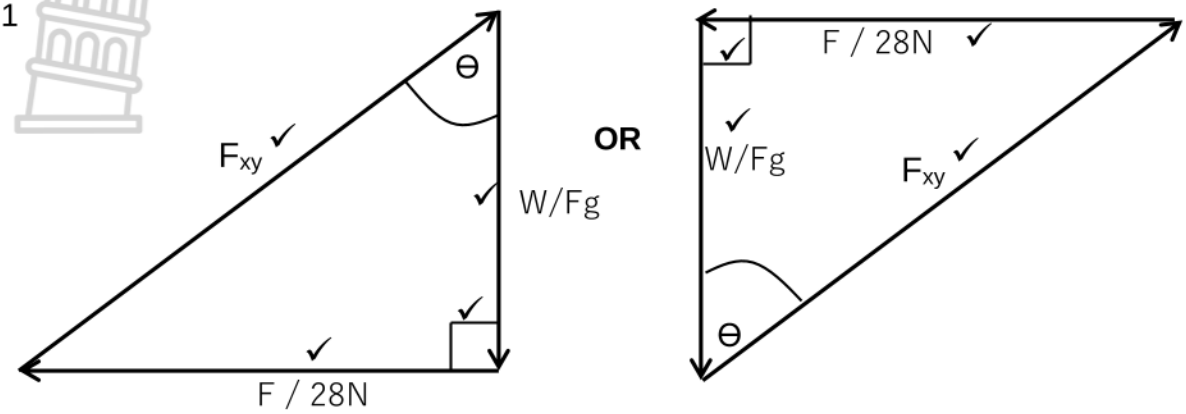
$\Theta = 46,82°$ ✓ (North of East) OR at a bearing of 43,18°

(5)

[14]

QUESTION 3

3.1



Marking Rubric : Force diagram	
Criteria	Mark allocation
Three forces drawn correctly and labelled.	3 x 1 mark
At least one angle correctly drawn	1 mark

(4)

3.2.1 $F_{xy}^2 = (28)^2$✓ + $(20,58)^2$✓

$= 34,7$ N✓ (3)

3.2.2 $\tan \Theta = \frac{28}{20,58}$✓

$\Theta = 53,68^0$✓ (2)

[9]

QUESTION 4

4.1 If a non zero <u>resultant force</u> acts on an object at rest, the object accelerates in the direction of the resultant force, this <u>acceleration is directly proportional to the force</u> ✓and <u>inversely proportional to the mass of the object.</u>✓ (2)

4.2 What is the relationship <u>between the acceleration of the trolley and the net forced exerted on it?</u> ✓✓ (2)

4.3 The mass of the system, the gradient of the track, the frequency of the timer, The friction experienced by the trolley along the track. (Accept any one) ✓ (1)

4.4 X : <u>4,9</u> N✓

Y: <u>2,5</u> ms^{-2}✓ (2)

4.5 $F_{g//} = f_k$
$mg \sin\theta$ ✓ = $\mu_k mg \cos\theta$✓
$\mu_k = \frac{sin\theta}{cos\theta} = \frac{\sin 8°}{cos8°}$✓
μ_k = 0,14✓ (4)

4.6.1 Gradient/m = $\frac{\Delta a}{\Delta Fnet}$
= $\frac{1,5-0}{2,94-0}$✓✓ (or any other set of values from the graph)
= 0,51✓(kg^{-1})
(3)

4.6.2 Inverse of mass✓✓ (2)

4.6.3 **Positive marking from question 4.6.1**
$\frac{1}{m}$ = 0,51✓
m = 1,96 kg✓ (2)

[18]

QUESTION 5

5.1
5.1.1 $F_N + F\sin\theta = F_g$
$F_N = F_g - F\sin\theta$ } Any 1✓
= 100(9,8) - Fsin15°✓
= 980 - 0,259 F (2)

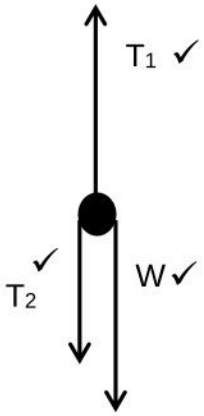
5.1.2 $f_k = \mu_k F_N$ ✓
= 0,5(980 - 0,259F)
f_k = + 490 - 0,129F✓ (2)

5.1.3 $F\cos15^0 + (-f_k) = 0$
$F\cos15^0 = f_k$ } Any 1✓
0,966 F = 490 - 0,129F ✓
F= 447,49 N✓ (3)

5.1.3 Decreases✓ (1)

5.2.1





(3)

5.2.2 **150 kg** **300 kg**

$F_{Net} = ma$
$T_1+(-T_2)+(-W_{15kg})= ma$ ✓ any one

$F_{Net} = ma$
$T_2 + (-300 \times 9{,}8) = 300(0{,}75)$

$T_1+(-3165)+[-(150\times9{,}8)]$ ✓ $= 150(0{,}75)$ ✓

$T_2 = 3165$ N

$T_1 = 4747{,}5$ N ✓

(5)

OR

5.2.2 **150 kg** **200 kg**

$F_{Net} = ma$
$T_1+(-T_2)+(-W_{15kg})= ma$ ✓ any one

$F_{Net} = ma$
$T_2 + (-200 \times 9{,}8) = 200(0{,}75)$

$T_1+(-2110)+(-(150\times9{,}8))$ ✓ $= 150(0{,}75)$ ✓

$T_2 = 2110$ N

$T_1 = 3692{,}5$ N ✓

(5)

5.3.1 Every body in the universe attracts every other body with a gravitational force that is directly proportional to the product of their masses ✓ and inversely proportional to the square of the distance between their centres. ✓
(Marks must only be awarded if the definition is in context with the gravitational law) (2)

5.3.2 $a = \frac{Gm}{r^2}$ ✓

3,8 ✓ $= \frac{6{,}67 \times 10^{-11} \cdot 6{,}4 \times 10^{23}}{r^2}$ ✓

$r = 3{,}35\ x10^{6}\ m$✓ (4)

5.3.3 W=mg

= (6,45 x 9,8) ✓

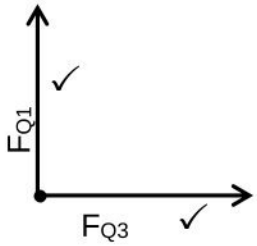
= 63,21 kg✓ (2)

[24]

QUESTION 6

6.1 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)

6.2



(2)

6.3 **$F_{Q3 \rightarrow Q2}$**

$$F = \frac{kQ_1Q_2}{r^2} \quad \checkmark$$

$$= \frac{9\times10^9(3\times10^{-6})(4\times10^{-6})}{(0,23)^2} \checkmark$$

$$= 2,04 \text{ N}$$

$F_{Q1 \rightarrow Q2}$

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

$$= \frac{9\times10^9(6\times10^{-6})(3\times10^{-6})}{(0,3)^2} \checkmark = 1,80 \text{ N}$$

$$F_{NET}^2 = (F_{Q3})^2 + (F_{Q1})^2$$

$$= (2,04)^2 + (1,8)^2 \checkmark$$

$$F_{NET} = 2,72 \text{ N} \checkmark$$

(5)

[9]

QUESTION 7

7.1 Electric field is a region (in space)✓ where (in which) an (electric) charge experiences a (electric) force. ✓ (2)

7.2 $E = \frac{kQ}{r^2}$ ✓

$= \frac{9\times10^{9}\,(20\times10^{-9})}{(0,6)^2}$ ✓

$= 5\,00\ N\cdot C^{-1}$

$E_{NET} = E_{Q1} + E_{Q2}$

$1300 = 500 + E_{Q2}$ ✓

$E_{Q2} = 800\ N\cdot C^{-1}$

$E = \frac{kQ}{r^2}$

$800 = \frac{9\times10^{9} \times Q_2}{(0,4)^2}$ ✓

$Q_2 = 1,42 \times 10^{-8}\ C$ negative ✓ (5)

7.3 Positive marking from question 7.2



- Correct pattern✓
- Arrow direction✓

(2)

7.4 $F = q_e E$ ✓

$= (1,6 \times 10^{-19})(1300)$ ✓

$= 2,08 \times 10^{-16}\ N$ ✓ (3)

[12]

TOTAL : 100 MARKS