Education and Sport Development

Department of Education and Sport Development
Departement van Onderwys en Sportontwikkeling
Lefapha la Thuto le Tlhabololo ya Metshameko

NORTH WEST PROVINCE

NATIONAL SENIOR CERTIFICATE

GRADE 12

TECHNICAL SCIENCES P1

JUNE 2018

MARKING GUIDELINES

MARKS: 150

This memorandum consists of 10 pages

QUESTION 1

1.1 D ✓✓ (2)

1.2 B ✓✓ (2)

1.3 B ✓✓ (2)

1.4 A ✓✓ (2)

1.5 B ✓✓ (2)

1.6 C ✓✓ (2)

1.7 D ✓✓ (2)

1.8 C ✓✓ (2)

1.9 D ✓✓ (2)

1.10 B ✓✓ (2)

[20]

QUESTION 2

2.1 D ✓✓ (2)

2.2 C ✓✓ (2)

2.3 E ✓✓ (2)

2.4 A ✓✓ (2)

2.5 B ✓✓ (2)

2.6 G ✓✓ (2)

2.7 H ✓✓ (2)

2.8 J ✓✓ (2)

2.9 M ✓✓ (2)

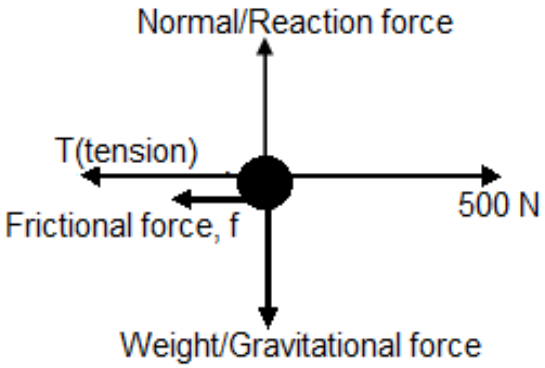
2.10 L ✓✓ (2)

[20]

QUESTION 3

3.1 When a net/resultant force acts on an object, the object accelerates in the direction of the net/resultant force. (This acceleration is directly proportional to the net force and inversely proportional to the mass of an object.) ✓✓ (2)

3.2



NOTE:

One mark is allocated for each force represented by an arrow pointing in the correct direction and correctly labelled.

(5)

3.3.1 $F_N = W = mg$

$F_N = (115 \times 9.8)$ ✓

$F_N = 1127N$ ✓ (2)

3.3.2 Take to the right as positive

For 10kg crate

$F_{net}=ma$✓

$T + F_f = ma$

$T - ✓\frac{450}{3} - = 10a$✓

$T = 10a + 150$---------- 1

For 115kg crate

$F_{net} = ma$

$T + f + F_A = ma$

$-T \checkmark - \frac{2(450)}{3} + 500 \checkmark = 115a \checkmark$

$T = -115a + 200$---------- 2

$T = 10a + 150$

$-T = 115a - 200$

$= 125a - 50$

$a = 0.4\ m.s^{-2} \checkmark$ (7)

OR $F_{net} = ma \checkmark$

$-450 + 500 \checkmark = (10 + 115)\ a \checkmark$

$a = 0.4\ m.s^{-2}$ Max 3/7

3.3.3 **POSITIVE MARKING FROM QUESTION 3.3.2**

$T = 10a + 150$

$T = 10\ (0.4) + 150 \checkmark$

$T = 154N \checkmark$

Note:

If T was already calculated in Q 3.3.2 give 2 marks here for correct answer.

OR

$T = -115\ a + 200$

$T = -115(0.4) + 200 \checkmark$

$T = 154N \checkmark$ (2)

3.4 Decreases ✓ (due to frictional force) and finally becomes zero✓ (2)

[22]

QUESTION 4

4.1 Inelastic collision ✓ (1)

4.2 The total linear momentum in a closed system remains constant in magnitude and direction. ✓✓

OR

In a closed system the total momentum before collision is the same as the total momentum after collision. ✓✓ (2)

4.3 Take to the right as positive

$\sum p_i = \sum p_f$

$m_A v_{Ai} + m_B v_{Bi} = (m_A + m_B)v_f$ ✓ 1 mark for any relevant equation

$(2200)(14) + (1200)(-40)$ ✓ $= (2200 + 1200)v_f$ ✓

$v_f = -5.06\ m.s^{-1}$

$= 5.06\ m.s^{-1}$ ✓ west ✓ (5)

1. Wrong formula : 0/5
2. No formula, but all substitutions correct : 4/5
3. No formula , correct substitution , but zero values omitted : 0/5

4.4.1 Equal in size but opposite in direction✓ OR $\Delta p\ (A) = -\ \Delta p\ (B)$ (1)

4.4.2 The **change in momentum** for both cars are equal in magnitude. ✓
The **contact time (Δt)** is the same✓ for both cars.

$m_H\ (\ (v_f - v_i)_H = m_L\ (v_f - v_i)_L$

$(v_f - v_i)_H < (v_f - v_i)_L$ ✓

It is a safer situation for the passengers in the heavier car because of the smaller change in velocity of the car and therefore the statement is correct. ✓ (4)

OR

During collision both cars experience **a force of equal magnitude**. ✓
The net / resultant force acting on the heavy car causes it to experience a smaller acceleration. ✓
Therefore the heavier car will experience a **smaller change in velocity**. ✓
It is a safer situation for the passenger in the heavier car and therefore the statement is correct. ✓

[13]

QUESTION 5

5.1 In an isolated system, the total mechanical energy is conserved/ remains constant.✓✓ (2)

5.2.1 $E_p = mgh$

$E_p = (1,9)(9,8)(2,65)$

$E_p = 49,34\ J$

5.2.2 $E_{mech\ top} = E_{mech\ 1,15\ m}$ **or** $(mgh + \frac{1}{2}mv^2)_{top} = (mgh + \frac{1}{2}mv^2)_{1,15\ m}$ ✓ any one of these.

$49,34$ ✓ $= (1,9)(9,8)(1,15)$ ✓$+ (\frac{1}{2})(1,9)(v_f)^2$ ✓

$29,396 = (v_f)^2$

$v_f = 5,42\ m.s^{-1}$✓ (5)

5.2.3 $E_{mech\ top} = E_{mech\ bottom}$ **or** $(mgh + \frac{1}{2}mv^2)_{top} = (mgh + \frac{1}{2}mv^2)_{bottom}$ ✓ any one of these.

$(1,9)(9.8)(2.65)$ ✓$+ (\frac{1}{2})(1,9)(0)^2$ ✓$= (1,9)(9.8)(0)$ ✓$+ (\frac{1}{2})(1,9)(v_f)^2$ ✓

$0,95\ v_f^2 = 49,34$

$v_f^2 = 51,94$

$v_f = 7,21\ m.s^{-1}$✓ (6)

[16]

QUESTION 6

6.1.1 $\text{Stress} = \frac{Force}{Area}$

$= \frac{50x10^{3}}{6x10^{6}}$ ✓

$= 8.3 \text{ x}10^{-3}\text{m}^2$ ✓

any ONE of these formulae ✓

$\text{Area} = \frac{\pi d^2}{4}$

$d = \sqrt{\frac{\text{Area} \times 4}{\pi}}$ ✓

$d = \sqrt{\frac{8{,}3 \times 10^{-3} \times 4}{\pi}}$ ✓

=0,10279 m

=102,79 mm ✓ (6)

6.1.2

$\text{Young's modulus} = \frac{\text{stress}}{\text{strain}}$ ✓

$\text{strain} = \frac{\text{stress}}{\text{Young's modulus}}$

$\text{strain} = \frac{6 \times 10^{6}}{70 \times 10^{9}}$ ✓

$= 8{,}57 \times 10^{-5}$ ✓ (3)

6.1.3 $\text{Strain} = \frac{\text{change in length}}{\text{original length}}$

change in length= strain ×original length ✓

change in length= $8,57\times10^{-5}$ ×200 ✓

=0,01714 mm
=$1,714\times10^{-2}$mm } any one ✓
=$1,714\times10^{-5}$m (3)

6.2 Viscosity is the property of the fluid to oppose relative motion between the two adjacent layers. ✓✓ (2)

6.3 $\frac{F_1}{A_1} = \frac{F_2}{A_2}$

$F_1 = \frac{F_2 x\ A_1}{A_2}$ ✓

$F_1 = \frac{450 \times 5,13 \times 10^{-4}}{6,5 \times 10^{-3}}$ ✓✓

=35,52 N ✓ (4)

6.4

OPTION 1	OPTION 2
$Area = \pi r^2$ ✓ $= \pi\,(0,015)^2$ ✓ $= 7,06 \times 10^{-4}\,m^2$ ✓	$Area = \frac{\pi d^2}{4}$ ✓ $= \frac{\pi(0.03)^2}{4}$ ✓ $= 7,06 \times 10^{-4}\,m^2$ ✓

(3)

[21]

QUESTION 7

7.1 Refraction is the bending of light ✓ when it passes from one medium to another. ✓ (2)

7.2 SLOWS DOWN✓ (1)

7.3.1 Critical angle is the angle of incidence in the denser medium such that the refracted ray just passes through the surface of separation of the two media.✓✓

OR

Critical angle is the angle of incidence whose angle of refraction is equal to 90^0. (2)

7.3.2 Angle of incidence should be between 49º and 90º✓✓

OR $49º < \theta < 90º$ (2)

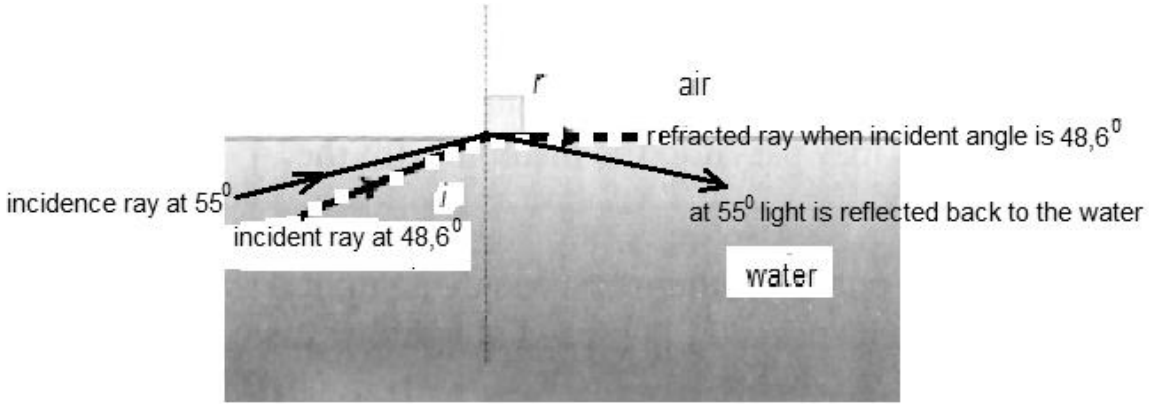
7.3.3 Light must travel from optically denser medium (higher refractive index) to

an optically dense medium medium (lower refractive index) ✓✓ (2)

7.3.4 Periscope, ✓ Optic fibres (used in endoscope and communication) ✓

Car rain sensors, optical fingerprinting devices, binoculars. ANY TWO

7.3.5



Marking Criteria	Marks
Angle of incidence is greater than critical angle	✓
New incident ray is drawn	✓
The new incident ray in the criteria above is reflected back to water	✓
Credit the 1 mark if the critical angle is indincated (provided the new ray is drawn)	✓

(4)

[15]

QUESTION 8

8.1 They do not require a medium to propagate/travel.✓

OR They can travel in vacuum. (1)

8.2

Gamma rays√	x-rays√	Visible light√	Infra red√	microwaves√

(5)

8.3 Gamma rays.√ They have the highest frequency. ✓✓ (3)

8.4 c =λf✓

$E = \frac{hc}{\lambda}$ ✓

$= \frac{6.67x10^{-34}}{0.015x10^{-9}}$ ✓✓

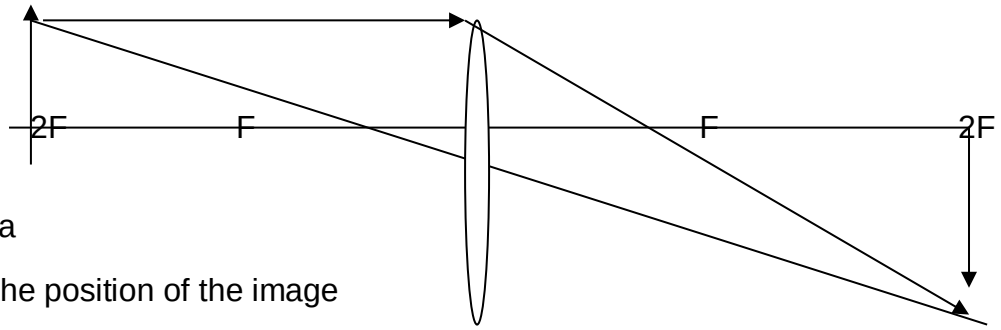
=4 .45 x 10^{-23}J✓ (5)

[14]

QUESTION 9

9.1 Used to correct hyperopia . ✓ (1)

9.2



Criteria

✓ for the position of the image

✓for the position of the object

✓ for the focal length

✓for all lines correctly drawn (5)

9.3 The image is real✓ , inverted✓ and same size as the object. ✓ (3)

[8]

TOTAL : 150