education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

GRADE 12

PHYSICAL SCIENCES MONTHLY TEST

APRIL 2020

TOPIC: MOMENTUM & IMPULSE

MEMORANDUM

MARKS: 55

This memorandum consists of 4 pages

QUESTION 1

1.1 B✓✓

1.2 C✓✓

1.3 A✓✓

1.4 A✓✓

1.5 D✓✓ **[10]**

QUESTION 2

2.1 $K / E_k = ½ mv^2$✓

$37,5 = ½ (12)v^2$ ✓

$v = 2,5 \text{ m·s}^{-1}$✓ (3)

2.2 The total linear momentum remains constant / is conserved (in magnitude and direction) ✓ in a closed system✓

OR

In a closed system✓, the total linear momentum before collision is equal to the total linear momentum after collision. ✓ (2)

2.3 $\Sigma p(\text{before}) = \Sigma p(\text{after})$ ✓

$(30)v_i +$ ✓ $(12)(2,5) =$ ✓ $(30 + 12)(3,2)$ ✓

$\therefore v_i = 3,48 \text{ m·s}^{-1}$✓ (5)

2.4.1 Collision where only momentum not kinetic energy is conserved (2)

2.4.2

OPTION 1

Trolley X:

$F_{net}\Delta t = m\Delta v$ OR $F_{net}\Delta t = \Delta p$✓

$F_{net}(0,2)$ ✓ $= 30(3,2 – 3,48)$ ✓

$F_{net} = -42$ N

$\therefore$ magnitude of $F_{net} = 42$ N✓

OPTION 2

Trolley X:

$v_f = v_i + a\Delta t$

$3,2 = 3,48 + a(0,2)$ ✓

$a = -1,4 \text{ m·s}^{-2}$✓

OPTION 3

Trolley Y:

$F_{net}\Delta t = m\Delta v$ O✓R $F_{net}\Delta t = \Delta p$

$F_{net}(0,2)$✓$= 12(3,2 – 2,5)$✓

$F_{net} = 42$ N✓

OPTION 4

Trolley Y:

$v_f = v_i + a\Delta t$

$3,2 = 2,5 + a(0,2)$✓

$a = 3,5 \text{ m·s}^{-2}$✓

$F_{net} = ma$

$= (30)(-1,4) = -42$ N✓

Magnitude of $F_{net} = 42$ N✓

$F_{net} = ma$

$= (12)(3,5)$✓

$= 42$ N✓ (4)

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QUESTION 3

3.1 Impulse is the product of the resultant/net force acting on an object and the time the resultant/net force acts on the object. ✓✓ (2 or 0)

3.2.1

OPTION 1
Take direction towards left as positive

$\Sigma p_i = \Sigma p_f$ ✓

$0 = Mv_{cannon} + mv_{ball}$

Any one

0✓ $= (1250)$✓ $v + \underline{1,25\ (-80)}$✓

$v = 100 / 1250 = 0,08\ m{\cdot}s^{-1}$, left✓

OPTION 2
Take direction towards right as positive

$\Sigma p_i = \Sigma p_f$ ✓

$0 = Mv_{cannon} + mv_{ball}$

Any one

0✓ $= (1250)$✓ $v + \underline{1,25\ (80)}$✓

$v = 100 / 1250 = -0,08\ m{\cdot}s^{-1}$

$v = 0,08\ m{\cdot}s^{-1}$, left ✓ (5)

3.2.2

OPTION 1
Take direction towards left as positive

$F_{net}\Delta t = m\Delta v = mv_f - mv_i$ ✓✓

$F\ (1,0) = (1250)\ ((0)-(0,08))$ ✓

$F = -100$ N

$F_{net} = 100$ N ✓

OR

$v_f = v_i + a\,\Delta t$

$\underline{0 = 0,08 + a\ (1,0)}$ ✓

$a = -0,08$

$F_{net} = m \times a$ ✓

$= 1250 \times (-0,08) = -100$ N

$= 100$ N✓

OPTION 2
Take direction towards right as positive

$F_{net}\Delta t = m\Delta v = mv_f - mv_i$ ✓✓

$F_{net}\ (1,0) = (1250)\ ((0) - (-0,08))$ ✓

$F_{net} = 100$ N ✓

(4)

[11]

QUESTION 4

4.1 The total linear momentum of a closed system✓ remains constant ✓ (2)

4.2 The kinetic energy remains constant. ✓ OR

The kinetic energy before the collision equals kinetic energy after the collision. (1)

4.3 $\Sigma p_{before} = \Sigma p_{after}$ ✓

$\underline{(5)(4) = (6,5)v_f}$ ✓

$v_f = 3,077\ m\cdot s^{-1}$ ✓

$\Delta p = m(v_f - v_i)$

$= 5\ (3,077 - 4)$ ✓

$= -4,62\ kg\cdot m\cdot s^{-1}$

$= 4,62\ kg\cdot m\cdot s^{-1}$✓, left/west/ opposite to direction of motion (5)

[8]

QUESTION 5

5.1 The net/resultant force acting on an object is equal to rate of change of momentum of the object in the direction of the net/resultant force✓✓(2 or 0) (2)

5.2 $\sum p_{before} = \sum p_{after}$ or $m_1v_{i1} + m_2v_{i2} = m_1v_{f1} + m_2v_{f2}$✓

$(1300)(20) + 0$ ✓ $= (1100)(14) + (1300)v_{f2}$✓

$\therefore v_{f2} = \dfrac{26000 - 15400}{1300} = 8,15\ m.s^{-1}$✓ (4)

5.3.1 Crumpling forces are internal forces. (Internal forces do not make the principle invalid) OR Only external forces make the principal invalid✓ (1)

5.3.2 $F_{net} = m\dfrac{\Delta v}{\Delta t}$ ✓

If Δt is increased ✓ F_{net} (exerted on passenger) decreases✓ (3)

TOTAL: 55 **[10]**