HILLCREST HIGH SCHOOL
PHYSICAL SCIENCE
GRADE 12
PAPER 1- Physics

JUNE 2023 MEMO

TOTAL 100

1.1 D
1.2 B
1.3 C
1.4 C
1.5 C
.

Question 2

2.1 The total linear momentum of an isolated (closed) system remains constant / is conserved (in magnitude and direction.) ✓✓ (2)

2.2 total p before = total p after

$mv_i + mv_i = (m + m)\, v_f$ ✓

(85 x 8) ✓ + (40 x 0) ✓ = (85 + 40) ✓ v_f

$v_f = 5{,}44\ m.s^{-1}$ (4)

2.3 $(U + K)_{bottom} = (U + K)_{top}$

$mgh + \frac{1}{2}mv^2 = mgh + \frac{1}{2}mv^2$ ✓

0 ✓ + $\frac{1}{2}(125)\,(5{,}44^2)$ ✓ = (125 x 9,8 x h) ✓ + 0 ✓

h = 1,51 m ✓ (6)

[12]

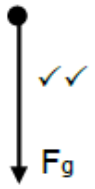
Question 3

3.1 An object which has been given an initial velocity and then it moves under the influence of the gravitational force only ✓✓

3.2 3,43 m.s^{-1}. ✓ penalise if there is no unit / *penaliseer indien geen eenheid* (1)

10841/

3.3



NOTE: ACCEPTED LABELS/ *AANVAARDE BYSKRIFTE*		MARK/ *PUNT*
w	F_g/F_w/weight/0,49N/gravitational force	✓✓

OPTION/*OPSIE* 1

3.4.1 Gradient = acceleration

= Δv/Δt

$= \frac{-3,92 - 0}{0,4 - 0}$ ✓ ✓

= -9,8

= 9,8 m.s^{-2} ✓ down

This must be proved with a calculation.
No marks for just writing the answer.

OPTION/*OPSIE* 2

Gradient = acceleration

= Δv/Δt

$= \frac{0 - 3,43}{0,77 - 0,42}$

= - 9,8

= 9,8 m.s^{-2} ✓ down

OPTION/*OPSIE* 3

$v_f = v_i + a\Delta t$

-3,92 = 0 + g (0,4)

g = -9,8

g = 9,8 m.s^{-2} ✓ down

any equation of motion can be used (3)

OR

vf = vi + aΔt

0 ✓ = 3,43 + g(0,77-0,42) ✓

g = -9,8 = 9,8 m.s^{-2} down ✓

3.4.2 **OPTION/*OPSIE* 1**

Height/*Hoogte* = area under the graph/ *area onder die grafiek*
= ½ bh ✓
= ½ x 0,4 x 3,92✓✓
= 0,78 m ✓

OPTION/*OPSIE* 2

$y = v_i t + ½ gt^2$ ✓
= 0✓ + ½ (9,8)$(0,4)^2$✓
= 0,78 m ✓

OPTION/*OPSIE* 3

Downwards as positive/*Afwaarts as positief*

$v_f^2 = v_i^2 + 2ay$ ✓
$3,92^2$ ✓ = 0 + 2 x (9,8)y ✓
y = 0,78 m ✓

(4)

OPTION/*OPSIE* 4

Downwards as negative/*Afwaarts as negatief*

$v_f^2 = v_i^2 + 2a\Delta y$✓

$(-3,92)^2$ ✓= $(0)^2 + 2(-9,8)\ \Delta y$✓

∴ Δy = -0,784 m
∴ Δy = 0,784 m downwards/*afwaarts*
The height from which the ball was dropped = 0,78 m ✓
Die hoogte waarvan dan die bal laat val is = 0,78 m ✓

OPTION/*OPSIE* 5

$y = \left(\frac{v_f + v_i}{2}\right) t$✓
= $\left(\frac{3,92 + 0}{2}\right)$ ✓0,4✓

= 0,78 m ✓

OPTION 6

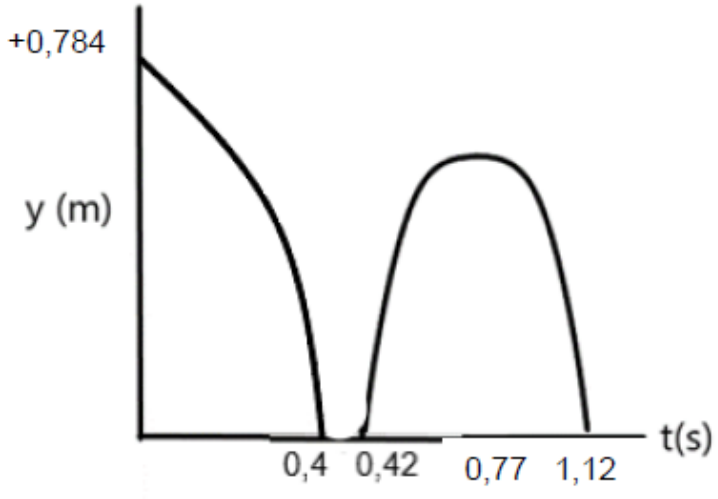
Emech (top) = Emech (bottom)

½ mv^2 + mgh = ½ mv^2 + mgh ✓

0 + (0,5 x 9,8 x h) ✓ = ½ x 0,5 x $3,92^2$ + 0 ✓

h = 0,78 m ✓

3.5 **(Downward taken as negative)*/(Afwaarts geneem as negatief)***
positive marking on the height / positiewe nasien vir die hoogte



Marking Criteria/*Nasienriglyne*	**Mark/*Punt***
Graph starting from the maximum height (0,784 m) *Grafiek begin vanaf maksimum hoogte (0,784 m)*	✓
Time taken to reach the ground indicated *Tyd geneem om grond te bereik aangedui*	✓
Correct shape of the graph/*Korrekte vorm van grafiek*	✓
Ground taken as zero/*Grond geneem as nulverwysing*	✓

(4)

3.6 Net force/resultant force. ✓✓ (2)

3.7 Remember the question is deciding for you – t

Fnet Δt= m(vf- vi) ✓

Fnet (0,02) = 0,05(3,43 –(- 3,92)) ✓

Fnet = 18,375 N

Fnet = Ffloor – Fg ✓

18,375 = Ffloor - (0,05)(9,8) ✓

Ffloor = 18,87 N ✓ (5)

3.8 DECREASES ✓

$F_{net}\,\Delta t = \Delta p$ formula refers to proportionality – allocate marks.
If the change in momentum remains constant,
the net force is inversely proportional to the time of contact.✓
Thus, if the time increases the net force will decrease. ✓ (3)

Question 4

4.1 System on which the net external force is zero/it excludes external forces that originate outside the colliding bodies.

4.2.1
$p = mv$ ✓
$8,4 = m(560)$ ✓
$m = 0,015$ kg ✓ / $1,5 \times 10^{-2}$

Careful- the 8,4 is the momentum (p) not the Δp.

(3)

4.2.2 **POSITIVE MARKING FROM 4.2.1**

$\Sigma p_i = \Sigma p_f$
$(mv_i)_1 + (mv_i)_2 = (mv_f)_1 + (mv_f)_2$ } ✓ Any one
$(0,015)(560) + (3)(-2,5)$ ✓ $= (0,015)(80) + (3)(v)$ ✓
$v = -0,1$
$v = 0,1$ m·s^{-1} ✓

* If $m_{bullet} = 0,02$ kg then $v_f = 0,7$ m.s^{-1}

(4)

4.2.3 **POSITIVE MARKING FROM QUESTION 4.2.1**
OPTION 1
$F_{net} \cdot \Delta t = mv_f - mv_i$ ✓
$F_{net}(0,02) = 0,015(80-560)$ ✓
$F_{net} = -360$
$F_{net} = 360$ N ✓ East/*Oos* ✓ **Accept:** Right/Regs

POSITIVE MARKING FROM QUESTION 4.2.2
OPTION 2
$F_{net} \cdot \Delta t = mv_f - mv_i$ ✓
$F_{net}(0,02) = 3(0,1 - 2,5)$ ✓
$(F_{net})_{block} = -360$

$(F_{net})_{bullet} = 360$ N ✓ East/*Oos* ✓ **Accept:** Right/Regs

If $m_{bullet} = 0,02$ kg the $F_{net} = 480$ N east

(4)
[13]

Question 5 – W,P and E

5.1

OPTION 1

$(E_m)_A = (E_m)_B$
$(mgh + \frac{1}{2}mv^2)_A = (mgh + \frac{1}{2}mv^2)_B$ } Any one ✓
$m(9,8)(0,7) + \frac{1}{2}m(2)^2 = 0 + \frac{1}{2}mv^2$ ✓
$v = 4,21\ m\cdot s^{-1}$ ✓

OPTION 2

$W_{nc} = \Delta E_k + \Delta E_p$ } Any one ✓
$0 = [\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2] + [mgh_f - mgh_i]$
$0 = [\frac{1}{2}mv^2 - \frac{1}{2}m(2)^2] + [0 - m(9.8)(0,7)]$ ✓
$v = 4,21\ m\cdot s^{-1}$ ✓

(3)

5.2 **Marking criteria/*Nasien kriteria***

- Formula for E_k = 11,17
- Substitution of mv=5,79
- Final answer: v = 3,86 m·s^{-1}

You don't have enough info to calculate v yet, thus you need to do a simultaneous equation.

OPTION 1

$p = mv = 5,79$
$E_k = \frac{1}{2}mv^2 = 11,17$

$\frac{1}{2}mv\cdot v = 11,17$ ✓
$\frac{1}{2}(5,79)v$ ✓ $= 11,17$
$v = 3,86\ m\cdot s^{-1}$ ✓

OPTION 2

$p = mv = 5,79$
$m = \frac{5,79}{v}$ →

$E_k = \frac{1}{2}mv^2 = 11,17$ ✓
$\frac{1}{2}\left(\frac{5,79}{v}\right)v^2$ ✓ $= 11,17$
$v = 3,86\ m\cdot s^{-1}$ ✓

(3)

5.3 The work done on an object by a net force is equal to the change in the object's kinetic energy.

The net work done on an object is equal to the change in kinetic energy of the object. ✓✓
Die netto arbeid op 'n voorwerp verrig is gelyk aan die verandering in die kinetiese energie van die voorwerp.

(2)

5.4 **POSITIVE MARKING FROM Q5.2**

OPTION 1

$mv = 5,79$
$m(3,86) = 5,79$ ✓
$m = 1,5\ kg$

OR/OF

$\frac{1}{2}mv^2 = 11,17$
$\frac{1}{2}m(3,86)^2 = 11,17$ ✓
$m = 1,5\ kg$

$W_{net} = \Delta E_k$
$f\Delta x\cos\Theta = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ } Any one ✓
$(3)(X)\cos180°$ ✓ $= 0 - \frac{1}{2}(1,5)(3,86)^2$ ✓
$X = 3,72\ m$ ✓

OPTION 2

$mv = 5,79$

$m(3,86) = 5,79$ ✓

$m = 1,5$ kg

$\frac{1}{2}mv^2 = 11,17$

$\frac{1}{2}m(3,86)^2 = 11,17$ ✓

$m = 1,5$ kg

$W_{nc} = \Delta Ek + \Delta Ep$

$f\Delta x \cos\Theta = [\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2] + [mgh_f - mgh_i]$ } Any one ✓

$(3)(X)\cos 180° = [0 - \frac{1}{2}(1,5)(3,86)^2] + 0$ ✓

$X = 3,72$ m ✓

(5)

[13]

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Question 6 - doppler

6.1 Doppler effect ✓

It is the (apparent) change in frequency (or pitch) of the sound (detected by a listener) ✓ because the sound source and the listener have different velocities relative to the medium of sound propagation. ✓

6.2

$$f_L = \left(\frac{v \pm v_L}{v \pm v_s}\right) f_s \checkmark$$

$$f_L = \left(\frac{v}{v + v_s}\right) f_s$$

$$\overset{\checkmark}{801} = \left(\frac{340}{340 + v_s}\right)^{\checkmark} \times 890 \checkmark$$

$$v_s = 37{,}78 \ m \cdot s^{-1} \checkmark$$

(5)

6.3 Decrease ✓ (1)

6.4 Doppler flow meter is used to determine whether arteries are clogged/ narrowed.✓

OR/OF

To determine the rate of flow of blood.✓

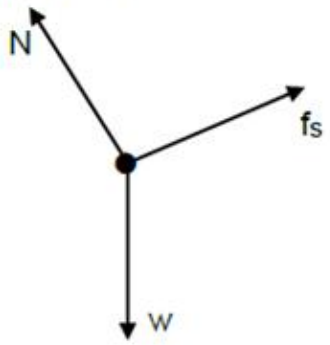
(1)

[10]

Question 7

7.1.1 The force that opposes the tendency of motion of a stationary object relative to a surface. ✓✓ (2)

7.1.2



	Accept the following symbols:
N✓	F_N/Normal force/$F_{surface\ on\ crate}$
f_s✓	f/F_f/frictional force/static frictional force
w✓	F_g/mg/weight/gravitational force/$F_{Earth\ on\ crate}$

7.1.3]

$F_{net} = m \cdot a$ ✓

$f_s - F_{g//} = m \cdot a$

$\mu_s \cdot N - mg \cdot \sin\theta = m \cdot a$

$\mu_s [mg \cdot \cos\theta] - mg \cdot \sin\theta = m \cdot a$

$0{,}35 [m(9.8)\cos 10^\circ] - [m(9.8) \cdot \sin 10^\circ] = m \cdot a$

✓ ÷ m only if both sine & cos used

$[0{,}35(9{,}8)\cos 10^\circ] - [9{,}8 \cdot \sin 10^\circ] = a$

$\therefore a = 1{,}68\ m \cdot s^{-2}$ ✓

(5)

7.2.1

Marking criteria
-1 mark for each key word/phrase omitted in the correct context.

Each 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 centers. ✓✓

OR:

Every particle in the universe attracts every other particle with a (gravitational) force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. ✓✓ (2)

7.2.2

$$g_E = \frac{GM_E}{R_E^2} = 9{,}8 \text{ m·s}^{-2}$$

$$g_M = \frac{GM_M}{R_M^2} \checkmark$$

$$= \frac{G\left(\frac{M_E}{153}\right)}{\left(\frac{R_E}{5}\right)^2} \checkmark$$

$$= \frac{25}{153} \frac{GM_E}{R_E^2}$$

$$= \frac{25}{153} (9{,}8)$$

$$= 1{,}60 \text{ m·s}^{-2} \checkmark \text{ (downwards)}$$

(3)

7.2.3 Equal to ✓ (1)

[16]

careful, the Question is phrased from the perspective of the earth, but you need to consider it from planet X's perspective.

Instead of seeing it as earth's mass is 153x that of planet X, you need to see it as: the planet's mass is $\frac{1}{153}$ that of the earth.