education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: PHYSICS (P1)

MARKING GUIDELINE

COMMON TEST

JUNE 2019

MARKS: 100

This marking guideline consists of 10 pages.

SECTION A

QUESTION 1: Multiple Choice Questions

1.1 C ✓✓ (2)

1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

1.4 A ✓✓ (2)

1.5 D ✓✓ (2)

1.6 D ✓✓ (2)

[12]

SECTION B

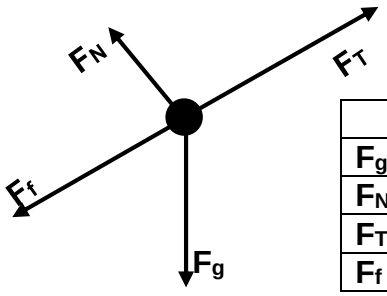
QUESTION 2 (Start on a new page)

2.1 If the resultant/net force acts on an object, the object will accelerate in the direction of the resultant/net force with an <u>acceleration that is directly proportional to the resultant/net force</u> ✓ and <u>inversely proportional to the mass of the object.</u> ✓

OR

The net force is equal to the rate of change of momentum. ✓✓ (2)

2.2



Accepted Labels	
F_g	F_W, W, 58,8 N, Weight, mg, gravitation force
F_N	N, Normal force, 50,92 N
F_T	Tension, T
F_f	f, friction force, f_k

Notes

- Accept components for gravitational force
- Mark awarded for label and arrow
- Do not penalise for length of arrows since drawing is not to scale
- Any other additional forces (*Max* ¾
- If force(s) do not make contact with body Max*:* ¾

(4)

2.3

Consider the motion along the plane

For the 6 kg block

F_{net} = ma✓

$T - F_f - F_{g//} = ma$

$T - 8 - 6 \times 9,8 \sin 30^o$✓ = 6 x 4✓

T = 61,40 N

For the 3 kg block

F_{net} = ma

$F - T - F_f - F_{g//} = ma$

$F - 61,4 - 5 - (3)(9,8) \sin 30^o$✓ = 3 x 4✓

F = 93,10 N✓

NB: If a systems approach is used: Max 4/6 (6)

2.4 DECREASES. ✓ Normal force decreases✓✓ (3)

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QUESTION 3 (Start on a new page)

3.1 Every body in the universe attracts every other body with a force that is directly proportional to the product of their masses✓ and inversely proportional to the square of the distance between their centres✓.

If they mention charges: 0/2 (2)

3.2 **Distance between the Earth and the Sun**

$x = \sqrt{(3\times10^{11})^2 + (4\times10^{8})^2}$ ✓

x = 3 x 10^{11} m✓

Force of Sun on Earth

$F = G\frac{m_1 m_2}{r^2}$ ✓

$F = 6,67 \times 10^{-11} \frac{1,99 \times 10^{30} \times 5,98 \times 10^{24}}{(3,00 \times 10^{11})^2}$ ✓✓

F = 8,82 x 10^{21} N✓ (6)

3.3 $g = G\frac{M}{r^2}$ ✓

$g = 6,67 \times 10^{-11} \frac{7,35 \times 10^{22}}{(1,60\times10^{6})^2}$ ✓

g = 1,92 m•s^{-2}✓ (3)

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QUESTION 4 (Start on a new page)

4.1 0 (m•s^{-1})✓ (1)

4.2

Choose up to be positive

$\Delta y = v_i \Delta t + \frac{1}{2}(-9{,}8)\Delta t^2$✓

$-80{,}60$✓ $= v_i(6) + \frac{1}{2}(-9{,}8)(6)^2$✓

v_i = 15,97 m•s^{-1}

The initial velocity is 15,97 m•s^{-1}✓

Choose down to be positive

$\Delta y = v_i \Delta t + \frac{1}{2}(-9{,}8)\Delta t^2$✓

$80{,}60$✓ $= v_i(6) + \frac{1}{2}(9{,}8)(6)^2$✓

v_i = 15,97 m•s^{-1}

The initial velocity is 15,97 m•s^{-1}✓

OR

Choose up to be positive

$v_f = v_i + a\Delta t$

$v_f = v_i + (-9{,}8)(6)$

$v_f = v_i - 58{,}80$✓ ---------- 1 ✓

$v_f^2 = v_i^2 + 2a\Delta y$

$v_f^2 = v_i^2 + 2(-9{,}8)(-80{,}60)$

$v_f^2 = v_i^2 + 1579{,}76$ ✓---------- 2

Substitute 1 into 2

$(v_i - 58{,}80)^2 = v_i^2 + 1579{,}76$

v_i = 15,97 m•s^{-1}

The initial velocity is 15,97 m•s^{-1}✓

(4)

If the answer is negative, the candidate must say therefore initial velocity is 15,97 m•s^{-1}✓

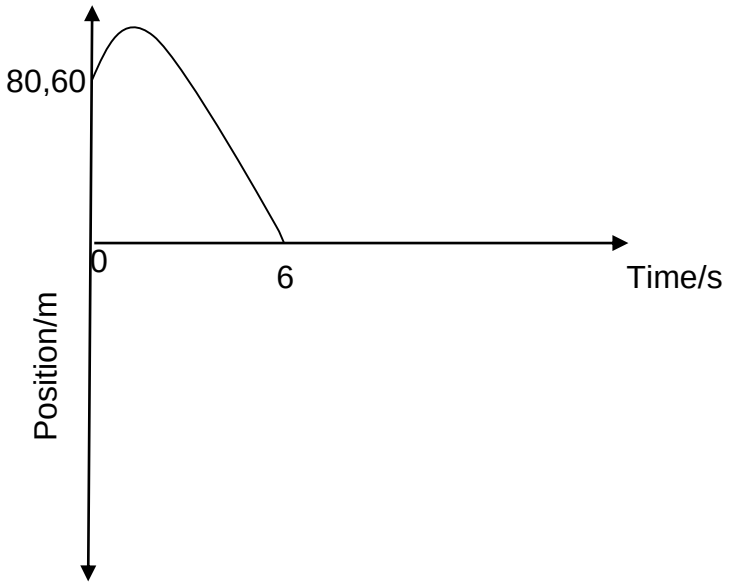
4.3 **POSITIVE MARKING FROM 4.2**
Choosing up to be positive

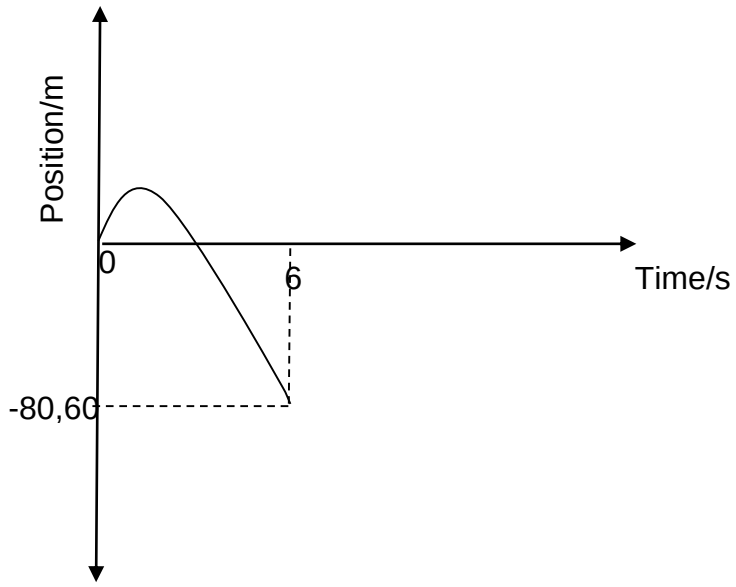
$v_f = v_i + a\Delta t$✓
$v_f = 15,97$✓ $+ (-9,8)(6)$ ✓
$v_f = -\ 42,83\ m•s^{-1}$
The final velocity of the ball is $42,83\ m•s^{-1}$✓

OR

$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$= (15,97)^2$✓ $+ 2(–9,8)\ (–80,60)$ ✓
$\therefore\ v_f = 42,83\ m•s^{-1}$ ✓ (4)

4.4





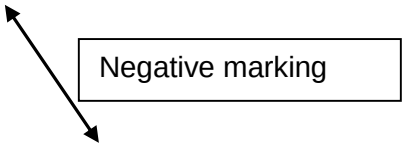
Accept the other options where downwards is taken as positive

Criteria	Marks
Correct height of 80,60 m	✓
Correct shape	✓
End time of 6 s	✓
Correct labels on the axes	✓

(4)

4.5

4.5.1 Remain the same✓



The maximum height reached above the point of projection depends on the initial velocity only. ✓✓

Accept all the options with a correct reason. (3)

4.5.2 Decreases✓ **Mark in relation to the answer in question 4.5.1** (1)

[17]

QUESTION 5 (Start on a new page)

5.1 The total linear momentum of a closed (isolated) system remains constant (is conserved). ✓✓

OR

In an isolated system, the total linear momentum before collision is equal to the total linear momentum after collision ✓✓ (2)

5.2

$\Sigma p_i = \Sigma p_f$
$m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$ ✓

$\underline{(125 + 75)(0) + (5)(0)}$ ✓$= (125 + 75)\, v_{1f} + (5)(4)$✓

$v_{1f} = -0{,}10\ m \cdot s^{-1}$

$\therefore$ the velocity of the boat is $0{,}10\ m \cdot s^{-1}$✓ to the left.✓

(5)

5.3

Total E_k before $= \frac{1}{2}(125 + 75)(0)^2 + \frac{1}{2}(5)(0)^2 = 0$ J✓

Total E_k after $= \underline{\frac{1}{2}(125 + 75)(0{,}1)^2 + \frac{1}{2}(5)(4)^2}$ ✓

$= 41{,}00$ J✓

Total E_k before ≠ Total E_k after ✓

$\therefore$ the scenario represents an inelastic collision

Note:

- If momentum formula is used then 0/4
- If $Ek_f = Ek_i$ is used then 3/4 max

(4)

5.4 **POSITIVE MARKING FROM 5.2**

$F_{net}\,\Delta t = \Delta p = mv_f - mv_i$✓
$= (125 + 75)(0{,}1)$✓ – $(125 + 75)(0)$✓
$= 20$ N.s✓

(4)

[15]

QUESTION 6 (Start on a new page)

6.1 The total mechanical energy/sum of kinetic and gravitational potential energy in a closed/isolated system is constant (conserved).✓✓ (2)

6.2

$E_{m\ top} = (E_k + E_p)_{top}$✓

$= ½mv^2 + mgh$

$= ½\ (0,3)\ (0)^2$✓$+\ (0,3)\ (9,8)\ (0,4)$ ✓

$= 1,18$ J✓

(4)

6.3 Remain the same✓.

Negative marking

The speed of the pendulum bob at the bottom of its swing only depends on the height from where it is initially released. ✓✓

Or

The speed is independent of the mass. (3)

6.4

E_T at C $= mgh + ½\ mv^2$ ✓

$= 0,3 \times 9.8 \times .25 + 0$ ✓

$= 0,735$ J

Total energy after breaking glass = 0,735 J

At X : $E_T = mgh + ½\ mv^2$

0,735 ✓ $= \underline{(0,3 \times 9.8 \times 0.1)}$ ✓ $+ ½\ (0,3 \times v^2)$ ✓

$v = 1,71\ m.s^{-1}$✓

(6)

6.5 Mechanical Energy is converted to other forms during the collision of the bob and glass plate.✓ **(1)**

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QUESTION 7 (Start on a new page)

7.1 An (apparent) change in the observed frequency (pitch), (wavelength)✓ as a result of the relative motion between a source and an observer ✓ (listener) (2)

7.2

$$f_L = f_S(\frac{v \pm v_L}{v \pm v_S})\checkmark$$

✓ $465 = f_S(\frac{343}{343-v_S})$ ✓----------1

✓ $441 = f_S\left(\frac{343}{343+v_S}\right)\checkmark$ ----------2

Equation 1 ÷ Equation 2

$\frac{465}{441} = \frac{(343+v_S)}{(343-v_S)}$

159495 - 465 v_s = 151263 + 441v_s

v_s = 9,09 m•s^{-1}✓ (9,02 m.s^{-1})

(6)

7.3 **Positive marking from 7.2**

$$465 = f_S(\frac{343}{343-v_S})$$

$$465 = f_S\left(\frac{343}{343-9,09}\right)\checkmark\checkmark$$

f_S = 452,67 Hz✓(452,77 Hz)

OR

$$441 = f_S\left(\frac{343}{343+v_S}\right)$$

$$441 = f_S\left(\frac{343}{343+9,09}\right)$$

f_S = 452,67 Hz✓(452,77 Hz) (3)

7.4 HIGHER THAN✓ (1)

7.5 **ANY TWO**
Doppler flow meter (*Measure speed of blood flow)*;✓ Measuring foetal heartbeat *;✓;* Ultra sound*;* Sonar; Radar (for speeding) .

(2)
[14]

TOTAL MARKS [100]