

KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

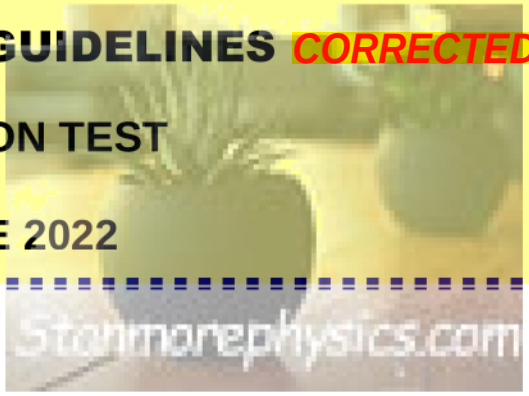
GRADE 12

PHYSICAL SCIENCES P1 (PHYSICS)

MARKING GUIDELINES *CORRECTED*

COMMON TEST

JUNE 2022



MARKS: 100

This marking guideline consists of 10 pages.

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QUESTION 1

1.1 C✓✓ (2)

1.2 B✓✓ (2)

1.3 D✓✓ (2)

1.4 A✓✓ (2)

1.5 C✓✓ (2)

1.6 B✓✓ (2)

1.7 B✓✓ (2)

[14]

QUESTION 2

2.1 Light cord – the mass of the cord can be ignored for calculation purposes / will interfere with the quantities to be calculated. ✓
Inextensible cord – the elastic forces of the cord can be ignored / ensures connected bodies move with the same acceleration. ✓ (2)

2.2 When a net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force and inversely proportional to the mass of the object. ✓✓

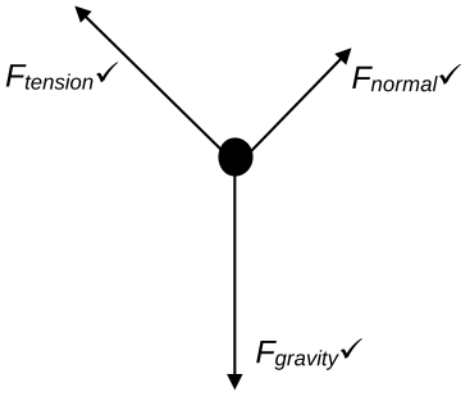
NOTE: If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.

OR

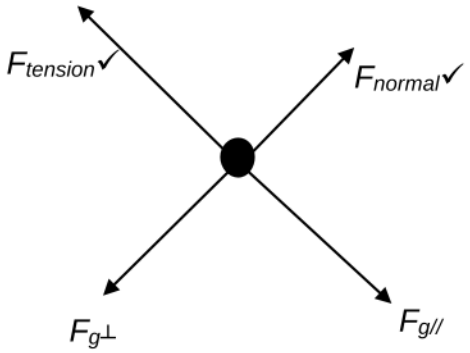
The net (or resultant) force acting on an object is equal to the rate of change of momentum of the object (in the direction of the net force). ✓✓ (2)

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2.3



OR



Both components✓

Notes

- Mark is awarded for label and arrow.
- Do not penalise for length of arrows.
- Deduct 1 mark for any additional force.
- If force(s) do not make contact with body / dot: *Max:2/3*
- If arrows missing but labels are there: *Max:2/3*

Accept the following symbols	
F_{Normal}	N/ Normal
$F_{Tension}$	T/F_T/F_{BA}/ F_{AB}
$F_{Gravityl}$	w/gravity

(3)

2.4

CONSIDERING BLOCK A

Upward Positive

$F_{net} = ma$

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

$\underline{T - 8(9,8)\sin 30^o}$✓ = 8a✓ ------(1)

CONSIDERING BLOCK A

Upward Negative

$F_{net} = ma$✓

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

$\underline{-T + 8(9,8)\sin 30^o}$✓ = 8a✓ -----(1)



CONSIDERING BLOCK B

$F_{net} = ma$

$F_g - T = ma$

$\underline{22(9,8) - T}$ ✓= 22a--------(2)

176,4 = 30a

a = 5,88 $m{\cdot}s^{-2}$✓

CONSIDERING BLOCK B

$F_{net} = ma$

$-F_g + T = ma$

$\underline{-22(9,8) + T}$ ✓= 22a -----(2)

-176,4 = 30a

a = - 5,88 $m{\cdot}s^{-2}$✓

(5)

2.5

2.5.1 decreases✓ (1)

2.5.2 increases✓ (1)

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2.6 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. ✓✓

NOTE: If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.

(2)

2.7

2.7.1

OPTION 1	**OPTION 2**
$F = G\frac{m_1 m_2}{r^2}$ ✓ $F = (6{,}67\times10^{-11})(\frac{(5)(5{,}98\times10^{24})}{(6{,}38\times10^{6})^2})$ ✓ F =49, 00 N ✓	F = mg ✓ = 5(9,8) ✓ = 49 N ✓



(3)

2.7.2

OPTION 1	**OPTION 2 (POSITIVE MARKING FROM 2.7.1)**
$g = \frac{GM}{r^2}$ ✓ $g = \frac{(6{,}67\times10^{-11})(5{,}98\times10^{24})}{(6{,}38\times10^{6})^2}$ ✓ ✓ g = 9,80 m·s^{-2}✓	F = mg ✓ 49✓ = 5g ✓ g= 9,8 m·s^{-2} ✓

(4)

[24]

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QUESTION 3

3.1 Motion during which the <u>only force acting on an object is the gravitational force</u>. ✓✓ (2)

NOTE: If the word ONLY is missing, max 1/2.

3.2

3.2.1

TAKING DOWNWARD AS POSITIVE	TAKING DOWNWARD AS NEGATIVE
$v_f^2 = v_i^2 + 2a\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$v_f^2 = 0 + 2(9,8)(9,50)$ ✓	$v_f^2 = 0 + 2(–9,8)(–9,50)$ ✓
$v_f = 13,65\ m{\cdot}s^{-1}$✓	$v_f = -13,65\ m{\cdot}s^{-1}$✓

(3)

3.2.2

TAKING DOWNWARD AS POSITIVE	TAKING DOWNWARD AS NEGATIVE
$v_f^2 = v_i^2 + 2a\Delta y$ ✓	$v_f^2 = v_i^2 + 2a\Delta y$ ✓
$0 = v_i^2 + 2(9,8)(–4,70)$ ✓	$0 = v_i^2 + 2(–9,8)(4,70)$ ✓
$v_i = 9,60\ m{\cdot}s^{-1}$✓	$v_i = 9,60\ m{\cdot}s^{-1}$✓

(3)

3.2.3

<u>OPTION 1</u> (POSITIVE MARKING FROM QUESTION 3.2.2)	
TAKING DOWNWARD AS POSITIVE	TAKING DOWNWARD AS NEGATIVE
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $9,50$✓ $= 0 + ½(9,8)\Delta t^2$✓ $\Delta t = 1,39$ s Either formula✓ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $–2,20$✓ $= \underline{-9,60\Delta t + ½(9,8)\Delta t^2}$✓ $\Delta t = 1,69$ s ∴ $\Delta t = \underline{1,39 +}$✓ 1,69 $= 3.08$ s✓	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $–9,50$✓ $= 0 + ½(-9,8)\Delta t^2$✓ $\Delta t = 1,39$ s Either formula✓ $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $2,20$✓ $= \underline{9,60\Delta t + ½(–9,8)\Delta t^2}$✓ $\Delta t = 1,69$ s ∴ $\Delta t = \underline{1,39 +}$✓ 1,69 $= 3.08$ s✓



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OPTION 2 (POSITIVE MARKING FROM QUESTION 3.2.2)

TAKING DOWNWARD AS POSITIVE	TAKING DOWNWARD AS NEGATIVE
$v_f = v_i + a\Delta t$ $13,65\checkmark = 0 + (9,8)\Delta t\checkmark$ $\Delta t = 1,39$ s $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ Either formula✓ $-2,20\checkmark = -9,60\Delta t + ½(9,8)\Delta t^2\checkmark$ $\Delta t = 1,69$ s $\therefore \Delta t = 1,39 +\checkmark 1,69$ $= 3.08$ s✓	$v_f = v_i + a\Delta t$ $-13,65\checkmark = 0 + (-9,8)\Delta t\checkmark$ $\Delta t = 1,39$ s $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ Either formula✓ $2,20\checkmark = 9,60\Delta t + ½(-9,8)\Delta t^2\checkmark$ $\Delta t = 1,69$ s $\therefore \Delta t = 1,39 +\checkmark 1,69$ $= 3.08$ s✓

OPTION 3: (POSITIVE MARKING FROM QUESTION 3.2.1)

TAKING DOWNWARD AS POSITIVE	TAKING DOWNWARD AS NEGATIVE
$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ $9,50\checkmark = \left(\frac{0+13,65}{2}\right)\Delta t\checkmark$ $\Delta t = 1,39$ s $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ Either formula✓ $-2,20\checkmark = -9,60\Delta t + ½(9,8)\Delta t^2\checkmark$ $\Delta t = 1,69$ s $\therefore \Delta t = 1,39 +\checkmark 1,69$ $= 3.08$ s✓	$\Delta y = \left(\frac{v_i + v_f}{2}\right)\Delta t$ $-9,50\checkmark = \left(\frac{0+(-13,65)}{2}\right)\Delta t\checkmark$ $\Delta t = 1,39$ s $\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ Either formula✓ $2,20\checkmark = 9,60\Delta t + ½(-9,8)\Delta t^2\checkmark$ $\Delta t = 1,69$ s $\therefore \Delta t = 1,39 +\checkmark 1,69$ $= 3.08$ s✓

(7)

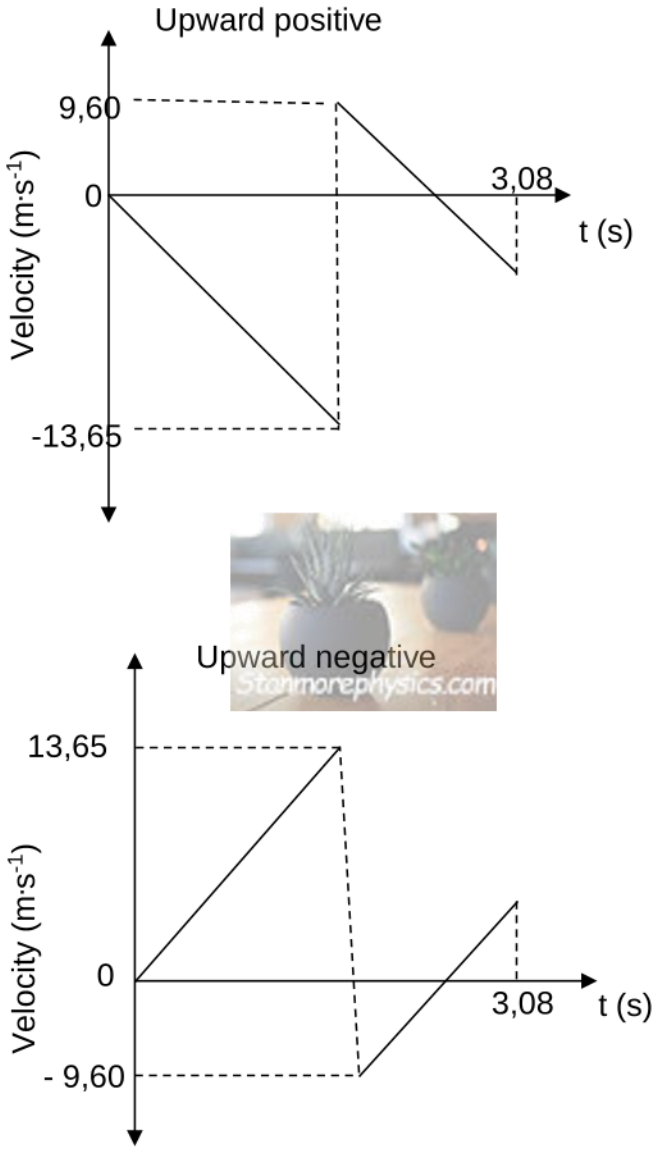
3.3

3.3.1 Less than. ✓ (1)

3.3.2 Equal to.✓ (1)

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3.4 **POSITIVE MARKING FROM Q 3.2.1 & Q 3.2.2**



Criteria for marking the graph	Marks
Correct shape (two parallel straight lines) as shown. Second segment must cut the x-axis	✓
First segment starts at v = 0 m·s^{-1} at t = 0 s.	✓
First segment ends at -13,65 m·s^{-1}/ 13,65 m·s^{-1}	✓
Second segment starts at - 9,60 m·s^{-1}/9,60 m·s^{-1}	✓

(4)

[21]

QUESTION 4

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

OR

The net work done on an object is equal to the change in the object's kinetic energy✓✓. (2)

NOTE: If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.

4.2 $W_{net} = \Delta K$

$W_f = \Delta K$

$W_{nc} = \Delta U + \Delta K$

$f\cos\theta\Delta x = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$ ✓

$(10)(\cos 180^o)(2)$ ✓ $= \frac{1}{2}(7{,}02)(0) - \frac{1}{2}(7{,}02)v_i^2$ ✓

$v_i = 2{,}39\ m{\cdot}s^{-1}$✓ (4)

4.3 The total linear momentum of an isolated system remains constant (is conserved). ✓✓

ACCEPT: In an isolated system total linear momentum before collision is equal to the total linear momentum after the collision✓✓

NOTE: If any one of the underlined key words in the **correct context** is omitted deduct 1 mark. (2)

4.4 **POSITIVE MARKING FROM Q4.2**

$\Sigma p_i = \Sigma p_f$

$m_1v_{i1} + m_2v_{i2} = (m_1 + m_2)v$ ✓

$0{,}02v_{i1} + 7(0)$ ✓ $= (7{,}02)(2{,}39)$ ✓

$v_{i1} = 838{,}89\ m{\cdot}s^{-1}$✓ (4)

[12]

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QUESTION 5

5.1 $E_{M(A)} = E_{M(P)}$

$(K + U)_A = (K+U)_P$ ✓

$Wnc = \Delta U + \Delta K$

$(½ mv^2 + mgh)_A = (½mv^2 + mgh)_P$

$½(5)(4)^2$ ✓ $+ (5)(9,8)h$ ✓ $= 285 + 0$ ✓

$h = 5$ m ✓ (5)



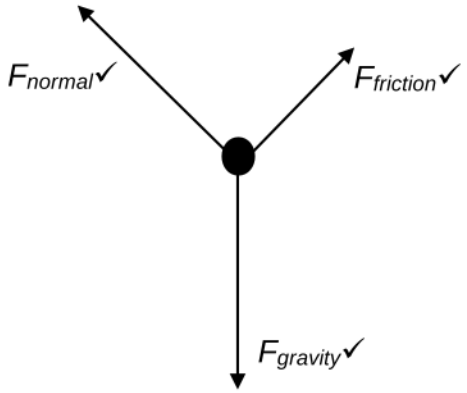
5.2 The path PQ is frictionless (smooth) and horizontal, ✓ (no energy is lost to friction or gained or lost as potential energy) (1)

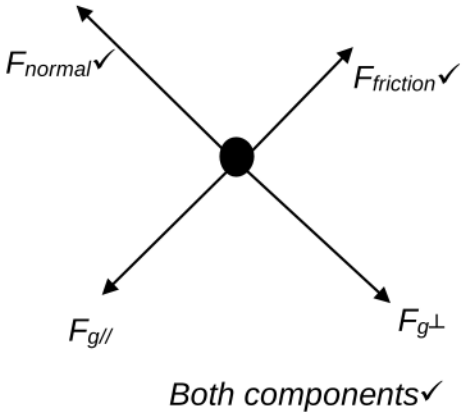
5.3 Force for which the work done in moving an object between two points depends on the path taken. ✓✓

NOTE: If any one of the underlined key words in the **correct context** is omitted deduct 1 mark.

(2)

5.4





Both components✓

Notes

- Mark is awarded for label and arrow.
- Do not penalise for length of arrows.
- Deduct 1 mark for any additional force.
- If force(s) do not make contact with body / dot: *Max:2/*3
- If arrows missing but labels are there: *Max:2/*3

Accept the following symbols	
F_{normal}	N; Normal
$F_{friction}$	f_s/f/friction/F_r
$F_{gravity}$	W/F_g/mg/98N

(3)

5.5 $W_{net} = \Delta K$
$W_g + W_f = \Delta K$ ✓

$mg \sin\alpha \Delta x \cos 180 + 18 \Delta x \cos 180 = 0 - 285$

$-\frac{(5)(9,8)(3)}{\Delta x}\Delta x + 18 \Delta x \cos 180$ ✓ $= -285$ ✓

$\Delta x = 7,67$

$\sin \alpha = \frac{3}{7,67}$ ✓

$\alpha = 23,03^o$ ✓

OR

$W_{nc} = \Delta E_p + \Delta E_k$ ✓

$f\Delta x \cos 180^o = mgh_2 - mgh_1 + Ek_f - Ek_i$

$18\Delta x(-1)$ ✓ $= (5 \times 9,8 \times 3) - 0 + 0 - 285$ ✓

$\Delta x = 7,67$

$\sin \alpha = \frac{3}{7,67}$ ✓

$\alpha = 23,03^o$ ✓

(5)

[16]



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QUESTION 6

6.1 Doppler effect 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. ✓✓ (2)

OR Doppler effect is the (apparent) change in frequency (or pitch) of the sound detected by a listener, because there is relative motion between the sound source and the listener✓✓ (2)

6.2 As the car is moving away from the observer, the observed frequency will be lower than the source frequency. ✓ As the car slows down the observed frequency increases until it is equal to the original source frequency. ✓ (2)

6.3 The speed of sound is very much lower than the speed of light. ✓ Doppler is only noticeable if the speed of source of sound is relatively close to the speed of the wave✓, hence the effect is noticeable with sound but not light. (2)

6.4 $f_L = \frac{v \pm v_L}{v \pm v_s} f_s$ ✓

$f_L = (\frac{340 \pm 0}{340 - 15})(265)$ ✓✓✓

f_L = 277,23 Hz ✓ (5)

6.5 ANY THREE:

Medicine

• Measures blood flow rate.✓
• Observation of foetus heart rate.✓

Maritime

• SONAR positioning underwater.✓

Law enforcement

• Radar monitoring of speeding cars. ✓

Astronomy

• To observe the motion of celestial bodies / stars / galaxies (3)

[13]

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