KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

FINAL

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES P1 (PHYSICS)

MARKING GUIDELINES

JUNE 2024



MARKS : 100

This Marking guideline consists of 7 pages.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

1.1 B✓✓ (2)
1.2 A✓✓ (2)
1.3 D✓✓ (2)
1.4 B✓✓ (2)
1.5 D✓✓ (2)
1.6 B✓✓ (2)
[12]

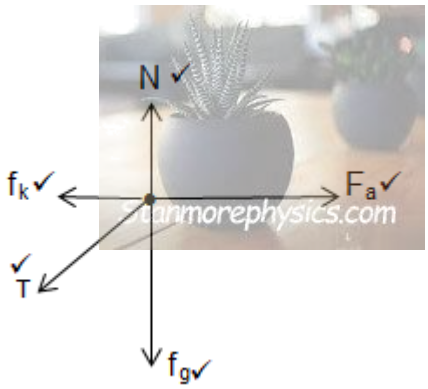
QUESTION 2

2.1 When a net force is applied to an object, it accelerates the object in the direction of the net force. The acceleration is directly proportional to the net force✓ and inversely proportional to the mass of the object.✓

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 or 0)** (2)

2.2



Notes: Accepted Labels		MARK
w	F_g/F_w/weight/40 x 9,8 N/mg/gravitational force	✓
f	F_f/f_k/friction	✓
N	F_N/Normal	✓
T	F_T/Tension force	✓
F	**$F_{Applied}$** / 200 N	✓
	Any additional force: deduct 1 mark maximum	
	Lines must touch the dot, otherwise	
	Do not penalise if angle is shown/not shown	
	No mark for the component of force	

(5)

2.3

40 kg:

$F_{net} = ma$ ✓
$F_A + (-f_k) + (-T\cos\theta) = ma$
$200 + (-20) + (-T\cos\theta)$ ✓$= (40)(2,5)$ ✓
$T\cos\theta = 80N$

Block m:
$F_{net} = ma$
$T\cos\theta + (-f_k) = ma$
$80 - 10$✓$= m(2,5)$ ✓
$m = 28kg$✓

(6)

Systems approach = 3/6

2.4 It is a ratio of forces.✓✓ (2)

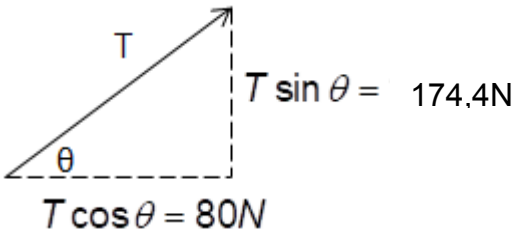
2.5 **POSITIVE MARKING FROM 2.3**

$f = \mu_k N$ ✓

$10 = (0,1)[(28)(9,8) - T\sin\theta]$ ✓✓

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$T\sin\theta = 174,4$



$tan\,\theta = \frac{174,4}{80}$✓

$\theta = 65,36^0$✓ (6)

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QUESTION 3

3.1 A motion during which the only force acting on an object is the gravitational force.✓✓ **(2 or 0)** (2)

3.2 **T**✓ (Do not mark this question, but award the 1 mark to all candidates.) (1)

3.3 **Marking Criteria**

- Mark for formula to calculate t
- Mark for substitution
- Mark for the answer t = 3.06

DOWNWARD NEGATIVE:

$v_f = v_i + a\Delta t$ ✓

$0 = 30 + (-9,8)\Delta t$ ✓

$\Delta t = t_x = 3,06s$✓

DOWNWARD POSITIVE:

$v_f = v_i + a\Delta t$ ✓

$0 = -30 + (9,8)\Delta t$ ✓

$\Delta t = t_x = 3,06s$✓ (3)

3.4

DOWNWARD NEGATIVE:

Tennis ball:

$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓

$\Delta y = (30)(5,2) + \frac{1}{2}(-9,8)(5.2)^2$✓

$\Delta y = 23,50m$

POSITIVE MARKING FROM 3.3 for the stone calculation (6)

Stone:

$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$

$23{,}50\checkmark = \underline{v_i(2{,}14) + \frac{1}{2}(-9{,}8)(2{,}14)^2}\checkmark$

$v_i = 21{,}47 m \cdot s^{-1}\checkmark$ Upwards✓

DOWNWARD POSITIVE:

Tennis ball:

$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2\checkmark$

$\underline{\Delta y = (-30)(5{,}2) + \frac{1}{2}(9{,}8)(5.2)^2}\checkmark$

$\Delta y = -23{,}50 m$

Stone:

$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$

$-23{,}50\checkmark = \underline{v_i(2{,}14) + \frac{1}{2}(9{,}8)(2{,}14)}\checkmark$

$v_i = -21{,}47 m \cdot s^{-1}$

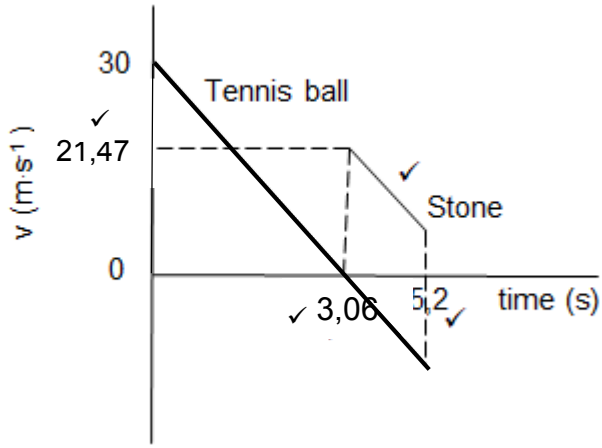
$v_i = 21{,}47 m.s^{-1}\checkmark$ Upwards✓

3.5 **Criteria for marking** (4)

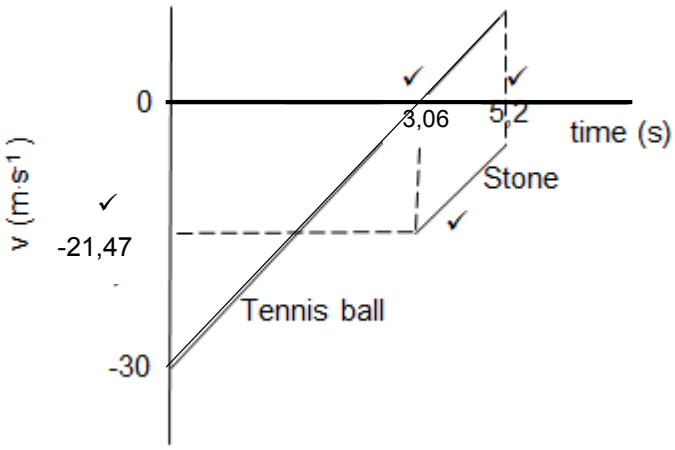
- Initial velocities of both indicated
- Time at which the stone was fired
- Time taken for the stone to hit the ground
- The two graphs must be parallel

POSITIVE MARKING FROM 3.3 & 3.4

DOWNWARD NEGATIVE:



DOWNWARD POSITIVE:



[16]

QUESTION 4

4.1

4.1.1 Impulse is the <u>product of the resultant / net force acting on an object and the time</u> the net force acts on the object.✓✓ **(2 or 0)** (2)

4.1.2 $p = mv$ ✓
$p = (0,03)(70)$ ✓
$p = 2,10$ kg·m·s^{-1}✓ (3)

4.1.3

Option 1	**Option 2**
200 cannon balls per minute = frequency = 3.33 s^{-1}✓ $\therefore f = \frac{1}{\Delta t}$ $3.33 = \frac{1}{\Delta t}$✓ $\Delta t = 0,30$ $F_{net} = \frac{\Delta p}{\Delta t}$✓ $F_{net} = \frac{m(v_f - v_i)}{\Delta t}$ $F_{net} = \frac{0.03(70-0)}{0,30}$✓ $F_{net} = 7N$✓	Δt = 60/200✓✓ = 0,30 s $F_{net} = \frac{\Delta p}{\Delta t}$✓ $F_{net} = \frac{m(v_f - v_i)}{\Delta t}$ $F_{net} = \frac{0.03(70-0)}{0,30}$✓ $F_{net} = 7N$✓

(5)

4.2

4.2.1 The total linear momentum of an isolated system remains constant (is conserved).✓✓ (2)

4.2.2 $\sum p_{before} = \sum p_{after}$
$m_1v_{i_1} + m_2v_{i_2} = (m_1 + m_2)v_f$ ✓ ANY
$(20)v_{i_1} + (10)(0)$ ✓ $= (20 + 10)(5)$ ✓
$v_{i_1} = 7,5$m·s^{-1}✓ (4)

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QUESTION 5

5.1

5.1.1 The total mechanical energy in an isolated system remains constant.✓✓ **(2 or 0)** (2)

5.1.2 NO.✓ (1)

5.1.3 **OPTION 1:**

$\sum \text{Mech}_i = \sum \text{Mech}_f$

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

$\underline{(20)(9{,}8)(5)✓ + \frac{1}{2}(20)(0)^2✓} = \underline{(20)(9{,}8)(0) + \frac{1}{2}(20)v^2✓}$

$v = 9{,}90 \text{m·s}^{-1}✓$

OPTION 2:

$W_{nc} = \Delta E_k + \Delta E_p✓$

$0 = \Delta E_k + \Delta E_p$

$\underline{0✓ = \frac{1}{2}(20)(v_f^2 - 0^2)}\ ✓ + (20)(9{,}8)(0 - 5)\ ✓$

$v = 9{,}90 \text{m·s}^{-1}✓$ (5)

5.1.4 Non-conservative force is a force for which the work done in moving an object between two points depends on the path taken.✓✓ **(2 or 0)** (2)

5.1.5 **POSITIVE MARKING FROM 5.1.3**

$W_{nc} = \Delta E_k + \Delta E_p$

$W_{f_k} = \frac{1}{2}m(v_f^2 - v_i^2) + mg(h_f - h_i)$ ✓

$20\Delta x \cos 180^0✓ = \frac{1}{2}(20)(0^2 - 9{,}90^2)\ ✓ + (20)(9{,}8)(4 - 0)\ ✓$

$\Delta x = 9{,}81 \text{m}$

$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$

$\sin\theta = \frac{4}{9{,}81}✓$

$\theta = \sin^{-1}(\frac{4}{9{,}81})$

$\theta = 24{,}06°✓$ (6)

5.2

5.2.1 Power is the rate at which work is done/energy is transferred.✓✓ **(2 or 0)**

OR

Power is the rate at which energy is transferred (2)

5.2.2 $P_{av} = Fv_{av}✓$

$P_{av} = mgv_{av}$

$P_{av} = (100)(9{,}8)(0{,}1)\ ✓$

$P_{av} = 98W✓$ (3)

[21]

QUESTION 6

6.1

6.1.1 Doppler effect is the 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 0)** (2)

6.1.2 $\mathbf{f_L = \frac{v \pm v_L}{v \pm v_s} f_s}$✓

5200✓$= \frac{340+0}{340-140} f_s$✓

$f_s = 3058{,}82\text{Hz}$✓ (4)

6.1.3 **POSITIVE MARKING FROM 6.1.2**

$v = f \times \lambda$ ✓
$\underline{340 = (3058{,}82)\lambda}$ ✓
$\lambda = 0{,}11m$✓ (3)

6.2.1 The spectral lines from the star are shifted towards longer wavelengths.✓✓
Or
Light emitted from the star is shifted towards the longer wavelength. (2)

6.2.2 Decrease✓ (1)

6.3 Determine whether arteries are clogged /narrowed.✓
Determine heartbeat of a foetus.✓ (2)

[14]

TOTAL: [100]