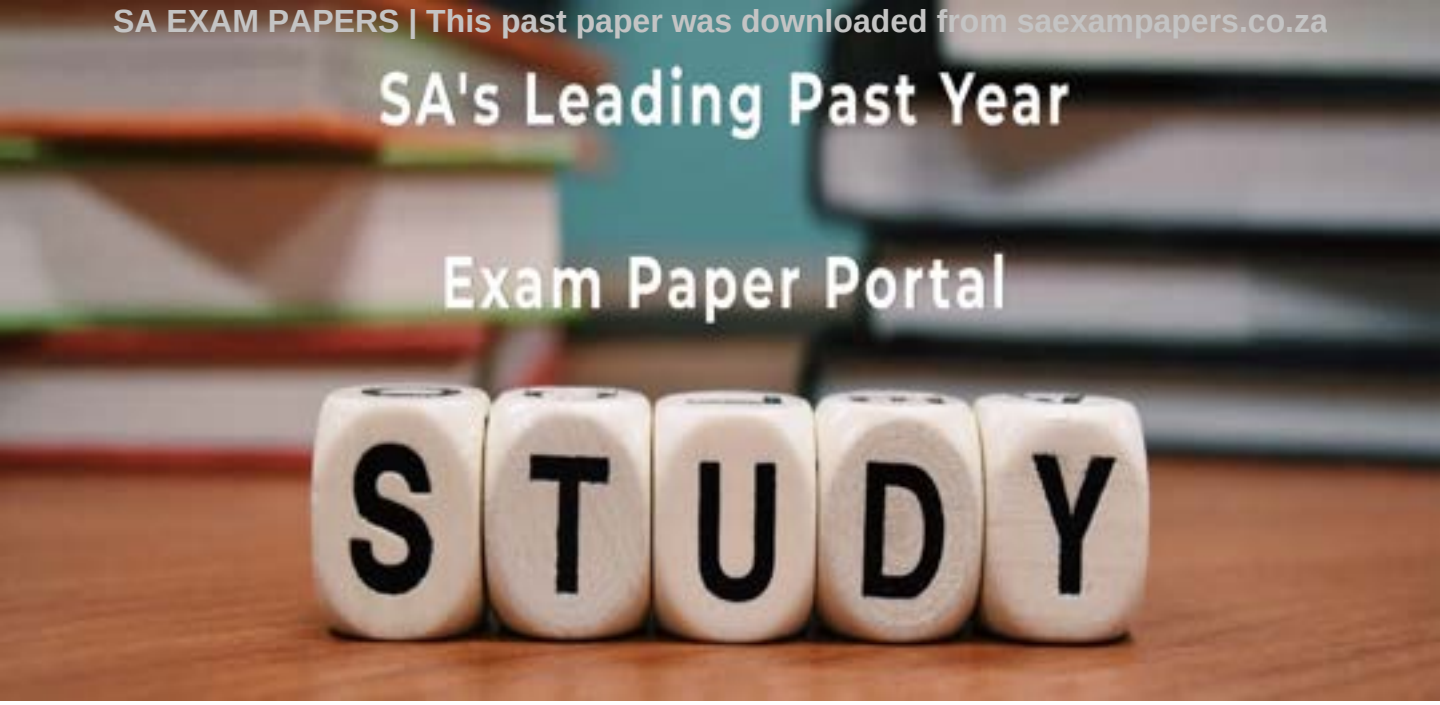

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PROVINCIAL ASSESSMENT/
PROVINSIALE ASSESSERING

GRADE/*GRAAD* 12

PHYSICAL SCIENCES: PHYSICS (P1)
FISIESE WETENSKAPPE: FISIKA (V1)
JUNE/*JUNIE* 2025
FINAL MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 144

These marking guidelines consist of 15 pages.
Hierdie nasienrigyne bestaan uit 15 bladsye.

QUESTION 1/*VRAAG 1*

1.1	B ✓✓	(2)
1.2	D ✓✓	(2)
1.3	C ✓✓	(2)
1.4	A ✓✓	(2)
1.5	A ✓✓	(2)
1.6	C ✓✓	(2)
1.7	C ✓✓	(2)
1.8	A ✓✓	(2)
1.9	D ✓✓	(2)
1.10	A ✓✓	(2)

[20]

QUESTION 2/*VRAAG 2*

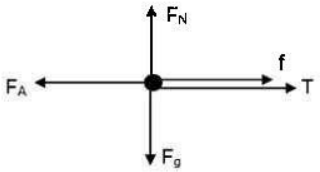
2.1

Marking criteria
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark. */Indien enige van die onderstreepte word/frases **nie in die korrekte konteks is***

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. ✓ */Wanneer 'n netto krag op 'n voorwerp inwerk, sal die voorwerp versnel in die rigting van die krag en die versnelling is direk eweredig aan die krag en omgekeerd eweredig aan die massa van die voorwerp.*

(2)

2.2



NOTE/NOTA
If force – diagram/
Indien 'n kragtediagram **(5/5)**

Accept the following symbols: *Aanvaar die volgende simbole*	
F_N ✓	F_N/ N /Normal force/*Normaalkrag*
T ✓	F_T /Tension/*Spanning*
Fg ✓	w /mg/weight/gravitational force/*gravitasiekrag*
f ✓	Fk/f/Ff /Force of friction/kinetic frictional force/*kinetiese wrywingskrag*
F_A✓	FE/FA/F/Applied force/*Toegepaste krag*

NOTES/*NOTA*
- Mark awarded for label and arrow. / *Punte toegeken vir benoemimg en pyltjie.*
- Do not penalise for the length of arrows. / *Moet nie penaliseer vir die lengte van die pyltjies nie.*
- Any other additional force(s)/ *Enige ekstra kragte*: **Max 4/5**
- If everything is correct, but no arrows. / *Alles korrek maar geen pyle:* **Max 4/5**

(5)

2.3

2.3.1

$F_{net} = ma$}
(Direction of motion as +/Rigting van beweging as +)

Car / Kar

$-T - f_k + F_E = ma$} ✓ Any one/ enige een

$-T - 1800 + 8000 = 900a$ ✓

$-T = 900a - 6200$ ..... (1)

Trailer

$T - f_k = ma$}

$T - 300 = 150a$ ..... (2) ✓

Substituting (1) and (2)

$T - 300 = 150a$

$-(900a - 6200) - 300 = 150a$ ✓

$a = 5,6\ m.s^{-2}$ left ✓

(5)

2.4 Increase ✓ ✓ (2)

[14]

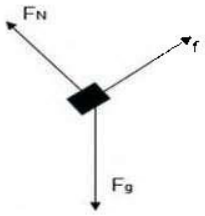
QUESTION 3/*VRAAG 3*

3.1

Marking criteria
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark. /*Indien enige van die onderstreepte word/frases* ***nie in die korrekte konteks is.***

The force that opposes the motion of an object and which acts parallel to the surface. ✓ ✓ / *Die krag wat die geneigdheid vir beweging van 'n stielstaande voorwerp reletief / parallel tot die oppervlak teenstaan.* (2)

3.2



NOTE/NOTA
Freebody – diagram /
vryliggamdiagram **(3/3)**

Accept the following symbols: *Aanvaar die volgende simbole*	
F_N ✓	F_N/ N /Normal force/N*ormaalkrag*
f ✓	F_k/f/Ff /Force of friction/kinetic frictional force/*kinetiese wrywingskrag*
Fg ✓	w /mg/weight/gravitational force/*gravitasiekrag*

NOTES/*NOTA*
- Mark awarded for label and arrow. / *Punte toegeken vir benoemimg en pyltjie.*
- Do not penalise for the length of arrows. / *Moet nie penaliseer vir die lengte van die pyltjies nie.*
- Any other additional force(s)/ *Enige ekstra kragte*: **Max 2/3**
- If everything is correct, but no arrows. / *Alles korrek maar geen pyle:* **Max 2/3**

(3)

3.3

$F_{g//} = F_g \sin\theta$ ✓ any one/*enige een*
$= mg \sin\theta$
$= (25)(9,8) \sin 30^\circ$ ✓
$F_{g//} = 122,5$ N ✓

(3)

3.4

OPTION 1/OPSIE 1	OPTION 2/OPSIE 2
$\tan\theta = \mu_s$ $= 0,6$ $\theta = \tan^{-1}(0,6)$ ✓ $\theta = 30,96^\circ$ ✓	$F_{g\parallel} = f$ $mg\sin\theta = \mu_s N$ $\mu_s = mg\sin\theta / mg\cos\theta$ $\theta = \tan^{-1}(0,6)$ ✓ $\theta = 30,96^\circ$ ✓

(2)

3.5 Frictional force decreases ✓ ✓. Frictional force is directly proportional the normal force/ As the normal force decreases with an increase in the angle of inclination frictional force will also decrease. ✓/ *Wrywingskrag neem af. Wrywingskrag is direk eweredig aan normaalkrag/indien die hoek van die helling groter word, sal normaalkrag en wrywingskrag verminder.*

(3)

[13]

QUESTION 4 /*VRAAG 4*

4.1

Marking criteria
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark. /*Indien enige van die onderstreepte word/frases* ***nie in die korrekte konteks is.***

In an isolated/ closed system the total (linear) momentum is conserved/ remains constant. ✓ ✓/ *In 'n geslote sisteem bly die totale momentum behoue/konstant.* (2)

4.2

4.2.1

$$\Sigma p_i = \Sigma p_f$$
$$mv_{ic} + mv_{it} = mv_{fc} + mv_{ft}$$ Any one ✓/*Enige een*

$$(650)(16{,}67) ✓ + (1000)(8{,}33) ✓ = (650)(v_{fc}) + (1000)(10) ✓$$

$V_{fc} = 14{,}10\ m.s^{-1}$ to the right ✓ / na regs

4.2.2 **POSITIVE MARKING FROM QUESTION 4.2.1.**
POSITIEWE NASIEN VANAF VRAAG 4.2.1.

If system approched is used ($½mv_{ic}^2 + ½m\,v_{it}^2 = ½mv_{fc}^2 + ½mv_{ft}^2$)
NOTE: Award marks for only the formula and conclusion. **(2/6)**

Before collision/Voor botsing

$½mv_{ic}^2 + ½mv_{it}^2$ ✓

$½(650)(16{,}67)^2 + ½(1000)(8{,}33)^2$ ✓

90313,89+34694,45

125008,34 J ✓

After collision/Na botsing

$½mv_{fc}^2 + ½mv_{ft}^2$

$½(650)(14{,}10)^2 + ½(1000)(10)^2$ ✓

64613,25+50 000

114 613,25 J ✓

12500,34 J ≠ 114 613,25 J

∴ Inelastic ✓/Onelasies (6)

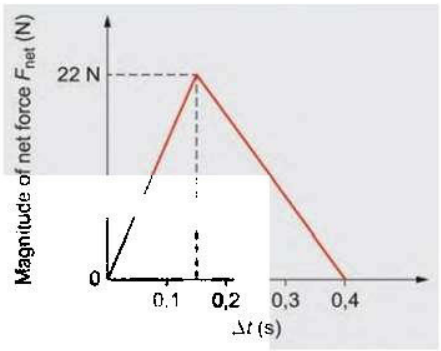
4.3 Newton's third law. ✓/*Newton se derde wet*
When the car and the truck collide, the force that the car exerts on the truck is equal in magnitude ✓ but opposite in direction to the force that the car exerts on the truck. ✓/*Wanneer die kar en die trok bots, sal die krag wat die kar op die trok uitoefen net so groot wees as die krag wat die trok op die kar uitoefen, maar in teenoorgestelde rigting.* (3)

[16]

QUESTION 5 /*VRAAG 5*

5.1 The product of the resultant/ net force acting on an object and the time the net force act on an object. ✓✓/ *Die produk van die resultant/netto krag op die voorwerp en die tyd wat die netto krag op die voorwerp uitgeoefen is.* (2)

5.2



Marking criteria/ *Nasienkriteria*
Shape. ✓/ Vorm
Both axis with S.I units. ✓/ Beide asse met SI eenhede.

(2)

5.3

5.3.1

OPTION 1/OPSIE 1	OPTION 2/OPSIE 2
$F_{net}.\Delta t$ = Area under graph /Area onder die grafiek = ½ x b x h ✓ = ½ x 0,4 x 22 ✓ $F_{net}.\Delta t$ = 4,4 N.s ✓	$F_{net}.\Delta t$ = 22 x 0.4 ✓ = 8,8/2 ✓ $F_{net}.\Delta t$ = 4,4 N.s ✓

(3)

5.3.2

POSITIVE MARKING FROM QUESTION 5.3.1/*POSITIEWE NASIEN*
$F_{net}\Delta t = \Delta p$ $F_{net}\Delta t = m(v_f - v_i)$ any one ✓/*enige een* 4,4 ✓ = $\frac{0,65(v_f - 0)}{}$ ✓ v_f = 6,77 $m.s^{-1}$ ✓

(4)

5.4 Increase. ✓/ *Toeneem* (1)

5.5 There must be an increase in change of velocity, to maintain a constant impulse when mass decreases. ✓ ✓/*Daar moet 'n toename in die verandering van snelheid wees om 'n konstante impuls te behou as die massa afneem* (2)

[14]

QUESTION 6 /*VRAAG 6*

6.1 Negative. ✓/ *Negatief* (1)

6.2

6.2.1 Gradient= $\frac{v_2 - v_1}{t_2 - t_1}$ ✓

$= \frac{0 - (-9,8)}{3 - 2}$ ✓

$= 9,8\ (m.s^{-1})$ ✓ (3)

6.2.2 (Gravitational) acceleration. ✓/ *(Gravitasie)versnelling.* (2)

6.3

6.3.1 **OPTION 1**

Gradient= $\frac{v_2 - v_1}{t_2 - t_1}$ ✓

$9,8 = \frac{14,7 - v_1}{2 - 0}$ ✓

$v_1 = -4,9\ m.s^{-1}$

$\therefore v_1 = 4,9\ m.s^{-1}$ upwards ✓/*opwaarts*

OPTION 2

$v_f = v_i + a\Delta t$ ✓

$14,7 = v_i + (9,8)(2)$ ✓

$v_i = -4,9\ m.s^{-1}$

$\therefore v_i = 4,9\ m.s^{-1}$ upwards ✓/*opwaarts* (3)

6.3.2 $14,7\ m.s^{-1}$ ✓ downwards. ✓/ afwaarts (2)

6.3.3 $9,8\ m.s^{-1}$ ✓ upwards. ✓/ opwaarts (2)

6.4

6.4.1 Removed (1)

6.4.2 Removed (1)

6.4.3 Maximum height after the first bounce. ✓ (1)

6.5 Removed (4)

[14]

QUESTION 7 /*VRAAG 7*

7.1 An object which has been given an initial velocity and moves under the influence of gravitational force only. ✓✓/*'n Voorwerp wat 'n beginsnelhei gegee is en dan beweeg slegs onder die invloed van gravitasiekrag* (2)

7.2 $\underline{0\ m.s^{-1}}$✓ (1)

7.3

OPTION 1/*OPSIE 1* **(Upwards as positive)/ *Opwaarts as positief***	**OPTION 2/*OPSIE 2*** **(Downwards as positive)/ *Af as positief***
$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $(0)^2 = (v_i)^2 + \underline{2(-9,8)\ (30)}$ ✓ $v_i = 24,25\ m.s^{-1}$✓upwards✓/ opwaarts	$v_f^2 = v_i^2 + 2a\Delta y$ ✓ $v_f^2 = (0)^2 + \underline{2(9,8)\ (30)}$ ✓ $V_f = 24,25\ m.s^{-1}$ ✓ downwards✓/ afwaarts
OPTION 3 /OPSIE 3 **(Upwards as positive)/ *Opwaarts as positief***	**OPTION 4/OPSIE 4** **(Downwards as positive)/ *Af as positief***
$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\underline{-30 = (0)\ \Delta t + \frac{1}{2}\ (-9,8)\ \Delta t^2}$ ✓ $-30 = 0 - 4,9\ \Delta t^2$ $\Delta t = 2,47\ s$ Both ✓/*Albei* $v_f = v_i + a\Delta t$ $v_f = (0) + (-9,8)\ (2,47)$ ✓ $v_f = \underline{24,21\ m.s^{-1}\ downwards}$✓/ Afwaarts	$\Delta y = v_i\Delta t + \frac{1}{2}a\Delta t^2$ $\underline{30 = (0)\ \Delta t + \frac{1}{2}\ (9,8)\ \Delta t^2}$ ✓ $30 = 0 + 4,9\ \Delta t^2$ $\Delta t = 2,47\ s$ Both ✓/ *Albei* $v_f = v_i + a\Delta t$ $(0) = v_i + (9,8)\ (2,47)$ ✓ $v_f = -24,21\ m.s^{-1}$ $v_f = \underline{24,21\ m.s\text{-}1\ upwards}$ ✓/ opwaarts

(4)

7.4 **POSITIVE MARKING FROM QUESTION 7.3./POSITIEWE NASIEN**

Ball/Bal X

$\Delta y_x = y_f - y_i$
$= y_f - 0$
$\Delta y_x = y_{fx}$

Ball/Bal Y

$\Delta y_y = y_f - y_i$
$= y_f - 30$
$\Delta y_y = y_f - 30$
$\Delta y_y + 30 = y_{fy}$

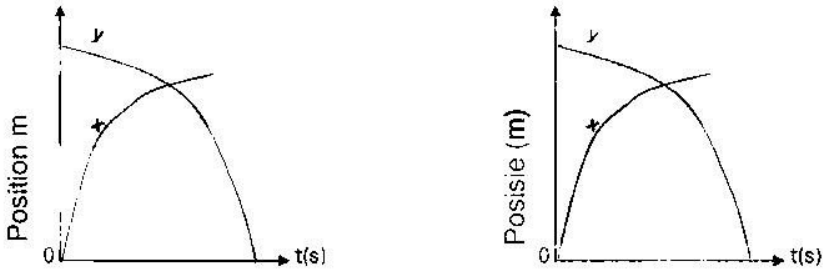
Ball/Bal X

$\Delta y_x = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓
$= (24,25)(\Delta t) + \frac{1}{2}(-9,8)\Delta t^2$ ✓
$= 24,25\,\Delta t - 4,9\,\Delta t^2$ ..... 1 ✓

Ball/Bal Y

$\Delta y_y = v_i \Delta t + \frac{1}{2} a \Delta t^2$
$= (0)(\Delta t) + \frac{1}{2}(-9,8)\Delta t^2$ ✓
$= -4,9\,\Delta t^2$ ..... 2 ✓

$y_{fx} = y_{fy}$
$\Delta y_y = \Delta y_x + 30$
$24,25\,\Delta t - 4,9\,\Delta t^2 = -4,9\,\Delta t^2 + 30$ ✓
$24,25\,\Delta t = 30$
$\Delta t = 1,24$ s ✓ (7)



Marking criteria/*Nasienkriteria*	
Note: 1 shape labelled **(3/3)** and No shape labelled **(1/3)**	
Shape for ball X/*Vorm van bal X*	✓
Shape for ball Y/*Vorm van bal Y*	✓
Both axis with S.I units /*Beide asse met S.I eenhede*	✓

(3)
[17]

QUESTION 8 /*VRAAG 8*

8.1 The mechanical energy in an isolated system remains constant. ✓✓ /*Die totale meganiese energie bly konstant in 'n geïsoleerde sisteem.* (2)

8.2

$$E_{mechA} = E_{mechC}$$
$$(mgh_c + \tfrac{1}{2}mv_c^2) = (mgh_c + \tfrac{1}{2}mv_c^2)$$ Any one ✓/ *Enige een*

$\underline{(120)(9,8)(8) + \tfrac{1}{2}(120)(0)^2}$ ✓ = $\underline{(120)(9,8)(2) - \tfrac{1}{2}(120)v_c^2}$ ✓

$$9408 = 2352 + 60\ v_c^2$$
$$v_c = 10,84\ m.s^{-1} ✓$$

(4)

8.3 **POSITIVE MARKING FROM QUESTION 8.2. / POSITIEWE NASIEN**

Option 1/Opsie 1
$W_{nc} = \Delta Ek + \Delta Ep$ $W_f = (\tfrac{1}{2}mv^2 - \tfrac{1}{2}mv^2) + (mghf - mghi)$ Any one ✓/*Enige een* $W_f = \underline{(\tfrac{1}{2}(120)(1,1)^2 - \tfrac{1}{2}(120)(10,84)^2)}$ ✓ + $\underline{((120)(9,8)(5) - (120)(9,8)(2))}$ ✓ $W_f = -6977,74 + 3528$ $W_f = -3449,74$ J ✓ ***Accept range/Aanvaar:***between/*tussen* (3449 J – 3456 J)
Option 2/Opsie 2
$E_{mechA} = Ep + Ek$ $= mgh + \tfrac{1}{2}mv_f^2$ Any one ✓/ *Enige een* $= \underline{(120)(9,8)(5) + \tfrac{1}{2}(120)(1,1)^2}$ ✓ = 5 952,6 J $E_{mechA} = mgh$ $= (120)(9,8)(8)$ $= 9408$ J ✓ Heat generated/Hitte gegenereer = 9408 – 5952,6 = 3455,4 J ✓ ***Accept range/Aanvaar:*** between/*tussen* (3449 J – 3456 J)

(4)
[10]

QUESTION 9 /*VRAAG 9*

9.1

Marking criteria
If any of the underlined key words/phrases in the **correct context** is omitted deduct 1 mark. /*Indien enige van die onderstreepte word/frases* ***nie in die korrekte konteks is*** **nie**, trek 1 punt af

A force for which the work done in moving an object between two points depends on the path taken. ✓✓/*'n krag waarvoor die arbeid verrig om 'n voorwerk tussen twee punte te beweeg, afhanklik is van die roete wat gevolg word.*

(2)

9.2

Option 1/ Opsie 1

$W_{nc} = \Delta E_k + \Delta E_p$
$W_A + W_f = (\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2) + (mgh_f - mgh_i)$ Any one ✓ / Enige

$W_A + (-5{,}85 \times 10^6) = (0) + (1750)(9{,}8)(55)$ ✓
$W_A = 943250 + 5{,}84 \times 10^6$
$W_A = 6\ 783\ 250$ J

$W_A = F_A \Delta x \cos\theta$ ✓
$6\ 783\ 250 = F_A(570)\cos(0)$ ✓
$F_A = 11\ 900{,}44$ N ✓

Accept range: between (11 900,42 N - 11 900,45 N)

Option 2

$W_f = f \Delta x \cos\theta$ ✓
$-5{,}84 \times 10^6 = f(570)\cos(180)$ ✓
$f = 10245{,}61$ J

$F_{net} = ma$
$F_{net} = 0$
$-f - F_{g\parallel} + F_A = 0$ Any one ✓/Enige een

$-f - (1750)(9{,}8)\sin\theta + FA = 0$
$-(10245{,}61) - (1750)(9{,}8)(\frac{55}{570}) + F_A = 0$ ✓
$F_A = 11\ 900{,}43$ N ✓

Accept range: between (11 900,42 N - 11 900,45 N)

(5)

9.3 $F_{net} = 0$ N ✓ (1)

9.4 **OPTION 1 / OPSIE 1**

$W_{nc} = \Delta E_k + \Delta E_p$
$W_A + W_f = (\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2) + (mgh_f - mgh_i)$ } Any one ✓

$W_A + \underline{(6{,}44 \times 10^3)(570)\cos(180)}$ ✓ = $\underline{\frac{1}{2}(1\,100)(25^2 - 20^2)}$ ✓ +
$\underline{(1\,100)(9{,}8)(0 - 55)}$ ✓
$W_A = 3\,670\,800 - 592\,900 + 123\,750$
$W_A = 3\,201\,650$ J ✓

OPTION 2 / OPSIE 2

$W_{net} = \Delta E_k$
$W_A + W_f + W_{Fg\perp} = (\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2)$
$W_A + f\,\Delta x \cos\theta + mg \sin\theta\, \Delta x \cos\theta = (\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2)$ } Any one ✓

$W_A + \underline{(6{,}44 \times 10^3)(570)\cos(180)}$ ✓ + $\underline{(1\,100)(9{,}8)\left(\frac{55}{570}\right)570\cos(0)}$ ✓ =
$\underline{\frac{1}{2}(1\,100)(25^2 - 20^2)}$ ✓
$W_A - 3\,660\,451{,}95 + 592\,900 = 123\,750$
$W_A = 3\,201\,650$ J ✓

(5)
[13]

QUESTION 10 /*VRAAG 10*

10.1 Doppler effect. ✓/*Doppler effek* (1)

10.2 $f_L = \frac{v \pm v_L}{v \pm v_S} f_S$ ✓ (4)

$= \frac{340}{340-30}$ ✓ (458) ✓

f_L = 502,32 Hz ✓

10.3 Decrease ✓/ *Afneem* (1)

10.4 Equal to ✓/*Gelyk aan*

- The velocity of the fire engine driver relative to the fire engine siren is zero.✓ **OR** /*Die snelheid van de brandweerman relatief tot die brandweerwa is nul*
- The fire engine driver has the same velocity as the fire engine. ✓ **OR**/ *Die brandweerman beweeg teen dieselfde snelheid as die brandweerwa.*
- There is no relative motion between the fire engine driver and the fire engine. ✓/ *Daar is geen relatiewe beweging tussen die brandweerwa en die brandweerman nie.* (2)

10.5

- Use of ultrasound for measuring the rate of blood flow. ✓/*Gebruik ultraklank om bloedvloei te meet*
- Use of ultrasound to measure the heartbeat of a foetus.✓/*Gebruik ultrank om die hartklop van die fetus te meet*
- To detect weather by analysing doppler shift of radar waves. ✓/*Weervoorspelling deur die annalise van die dopplerskuif van radargolwe.* (3)

(Any other correct answers).

10.6 When light from a distant star or galaxy is observed to have shifted towards the red end of the spectrum. ✓ ✓/ Wanneer lig van 'n verafgeleë *ster of sterrestelsel waargeneem word en daar vind rooiverskuiwing van die spektrum plaas.* (2)

[13]

TOTAL/ TOTAAL: 150