SENIOR SECONDARY INTERVENTION PROGRAMME 2013

GRADE 12

PHYSICAL SCIENCES

LEARNER HOMEWORK SOLUTIONS

The SSIP is supported by

TABLE OF CONTENTS

TOPIC 1: MECHANICS – PROJECTILE MOTION

SOLUTIONS TO HOMEWORK

QUESTION 1

1.1 $0\ m{\cdot}s^{-2}$ ✓ (1)

1.2 $9,8\ m{\cdot}s^{-2}$ ✓downwards ✓ ✓✓ (2)

1.2

$\Delta y = ?$
$v_i = 5\ m{\cdot}s^{-1}$
$V_f = 0\ m{\cdot}s^{-1}$
$g = -9,8\ m.s^{-2}$

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

$0^2 = (5)^2 + 2(-9,8)\Delta y$ ✓

$y = 1,28\ m$ ✓

$\therefore y = 1,28\ m$ upwards

$\therefore$ Maximum height (P) is 101,28 m ✓ (3)

1.3

$t = ?$
$v_i = 5\ m{\cdot}s^{-1}$
$V_f = 0\ m{\cdot}s^{-1}$
$g = -9,8\ m{\cdot}s^{-2}$

$v_f = v_i + g\Delta t$ ✓

$0 = 5 + (-9,8)\Delta t$ ✓

$\therefore t = 0,51\ s$ ✓

(3)

1.4

$\Delta x = 101,28\ m$
$t = ?$
$v_i = 0\ m{\cdot}s^{-1}$
$g = 9,8\ m{\cdot}s^{-2}$

$\Delta x = v_i\Delta t + \frac{1}{2}g\Delta t^2$ ✓

$101,28 = (0)\Delta t + \frac{1}{2}(9,8)(\Delta t)^2$ ✓

$101,28 = 4,9t^2$

$t^2 = 20,67$

$t = 4,55\ s$ ✓

$\therefore$ total time $= 0,51 + 4,55 = 5,06\ s$ ✓ (4)

1.5 Velocity increases ✓✓

$F_R = 0$; so F_A = - weight, but weight decreases, but F_A is constant ; so there is an upwards F_R; and an upwards acceleration ✓✓
etc.

(4)
[17]

TOPIC 2: CONSERVATION OF MOMENTUM

SOLUTIONS TO HOMEWORK

QUESTION 1

1.1 Consider to the left as positive

$\Sigma m_i v_i = \Sigma m_f v_f$

$p_{before} = p_{after}$ OR $m_A v_{iA} + m_B v_{iB} = m_A v_{fA} + m_B v_{fB}$✓

$(1\ 000)(0) + (1\ 200)(18)$ ✓ $= (1000)(12) + (1\ 200)v_{fB}$✓

$9\ 600 = (1\ 200)v_{fB}$

$v_{fB} = 8\ m{\cdot}s^{-1}$ ✓ (4)

1.2 Not an isolated system / external forces present / frictional forces present / driver in front car has his foot on the brake. ✓✓ (2)

1.3 During the collision, both cars experience a force of equal magnitude✓
This net force on the car with larger mass causes it to experience a smaller acceleration,✓therefore, the passenger will experience a smaller change in velocity and will be less injured. ✓

For a specific Fnet Δt: Δp(heavy car) = Δp(light car) ✓

$m_H(v_f - vi)_H = m_L(v_f - v_i)_L$ but $m_H > m_L$ and $(v_f - v_i)_H < (v_f - v_i)_L$ ✓

Therefore a passenger will experience a smaller change in velocity ✓ and gets less injured. (3)

[9]

2.1 **Choose the direction to the right as positive**

Total p before collision = Total p after collision ✓

$mv_{i(Franck)} + mv_{i(Mandla)} + mv_{i(trolley)} = mv_{f(Franck)} + mv_{f(Mandla)} + mv_{f(trolley)}$

$(50)(0) + (80)(0) + (180)(0) = (50)(-3)$✓ $+ (80)(3)$✓ $+ (180).v_f$

✓ ✓ $0 = -150 + 240 + 180v_f$

$-90 = 180v_f$

$v_f = -\ 0,5\ m.s^{-1}$

$= 0,5\ m.s^{-1}$ to the left ✓

(in the same as Franck) (6)

OR

Choose the direction to the left as positive

Total p before collision = Total p after collision ✓

$mv_{i(Franck)} + mv_{i(Mandla)} + mv_{i(trolley)} = mv_{f(Franck)} + mv_{f(Mandla)} + mv_{f(trolley)}$

$(50)(0) + (80)(0) + (180)(0) = (50)(3)$✓ $+ (80)(-3)$ ✓ $+ (180).v_f$

✓ ✓ $0 = 150 + -240 + 180v_f$

$90 = 180v_f$

$v_f = 0,5\ m.s^{-1}$ to the left ✓

(in the same as Franck

2.2 There is friction ✓ between the ground and ✓ the wheels (2)

2.3 Mandla has a larger change in momentum ✓ than Franck (because Mandla has a bigger mass) and will therefore exert a bigger force ✓ on the trolley than Franck in the same time (0,2s). This means that there is a resultant force (net force) ✓ on the trolley towards Franck (or away from Mandla) and the ✓ acceleration of the trolley is towards Franck (or away from Mandla). ✓ (4)

2.4 **Direction to the right as positive** ✓

$F_{(Trolley\ on\ Mandla)} . \Delta t = m_{(Mandla)} \Delta v_{(Mandla)}$

$F(0,2) = (80)(3 - 0)$ ✓

$F = 1200N$ to the right ✓

The magnitude of the force = 1200N

OR

Direction to the left as positive

$F_{(\ Mandla\ on\ trolley\&\ Franck)} . \Delta t = m_{(trolley)} \Delta v + m_{(Franck)} \Delta v$ ✓

$F(0,2) = (180)(0,5 - 0) + (50)(3 - 0)$ ✓

$F = 1200N$ to the left ✓

(3)

2.5 The two forces act on different objects✓ and cannot cancel ✓each other out

OR

They are action-reaction forces ✓according to Newton's third Law and thus do not cancel each other out✓ (2)

[17]

WORK, ENERGY AND POWER

SOLUTIONS TO HOMEWORK

QUESTION 1

Mechanical Energy = $E_p + E_k$ = mgh + ½ mv^2 ✓

=(1200)(9,8)(10) ✓+ ½ $(1200)(15)^2$✓

= 252 600 J✓

P = W/t✓

P = 252 600/60✓

= 4210 W✓

[7]

QUESTION 2

W = FΔx·cosα ✓= (50)(3)cos48º ✓= 100,37 J✓ **[3]**

QUESTION 3

3.1. E_p=mgh ✓= (88)(9,8)(7) ✓= 6036,8 J✓ (3)

3.2. W = FΔx·cosα ✓= (108)(7) ✓= 756 J✓ (3)

3.3. $v_f^2 = v_i^2 + 2g\Delta x$✓

0 ✓= v_i^2 + 2(-9,8)(7) ✓

v_i = 11,71 $m \cdot s^{-1}$✓ (4)

3.4. E_p = mgh✓ = (2)(9,8)(7) ✓= 137,2 J✓ (3)

3.5. 12 bricks in a minute – each brick takes 5 s✓

P = W/t ✓= 137,2/5 ✓= 27,44 W✓ (4)

QUESTION 4

4.1 8m.s^{-1} ✓✓
(2)

4.2 Direction up is positive

$v_f^2 = v_i^2 + 2a\Delta y$ ✓

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

$0 = 64 - 19,6\ \Delta y$

$\Delta y = 3,27$m ✓ (4)

4.3.1 When the ball lands in the gutter, the gutter exerts an upward force on the ball. The system is not isolated ✓ any more. Work is done by the upward force and some of the mechanical energy of the ball is converted ✓ into heat and sound. (2)

4.3.2 Energy is converted into other forms (like heat and sound) ✓ (1)

4.4 $E_{mech\ at\ start} = mgh + ½mv^2$

$= (0,01)(9,8)(0) + ½(0,01)(8)^2$ ✓

$= 0,32$J

$E_{mech\ at\ start} = mgh + ½mv^2$

$= (0,01)(9,8)(0) + ½(0,01)(7)^2$ ✓

$= 0,245$J

$W_{gutter} = \Delta E_{mech} = E_{end} - E_{start}$ ✓

$= 0,245 - 0,32$

$= -0,075$J ✓

OR

$E_{mech\ at\ max\ height} = mgh + ½mv^2$ ✓

$= (0,01)(9,8)(3,27) + ½(0,01)(0)^2$ ✓

$= 0,32$J

$E_{mech\ in\ gutter} = mgh + ½mv^2$ ✓

$= (0,01)(9,8)(2,5) + ½(0,01)(0)^2$

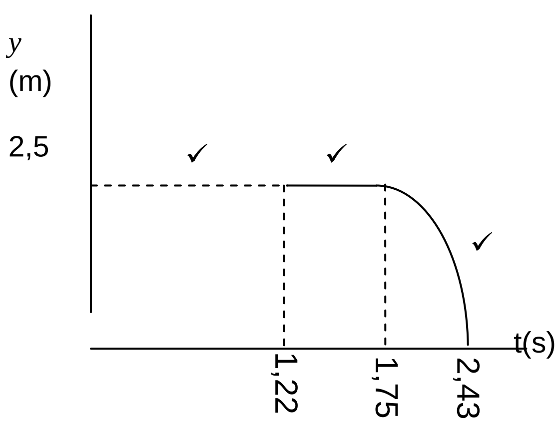
$= 0,245$J ✓

$W_{gutter} = \Delta E_{mech} = E_{gutter} - E_{max\ height}$ ✓

$= 0,245 - 0,32 = -0,075$J

(5)

4.5



- Both Axes correctly labelled
- Intercepts on axes correct ✓
- No graph up to 1,22s
- Constant line between 1,22s and 1,75s
- Curve with negative gradient from 1,75s to 2,43s

(4)

[18]

QUESTION 5

5.1 $W_{net} = \Delta K$ ✓

$W_f + W_N + W_{Fg} = \Delta K$

$f\Delta x\cos\theta + 0 + 0 = ½mv_f^2 - ½mv_i^2$ ✓

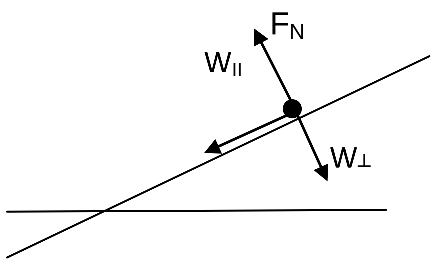
$(30)(2)(\cos 180°)$ ✓ $= ½(3)v_f^2 - ½(3)(7)^2$ ✓

$-60 = ½(3)v_f^2 - 73,5$

$v_f = 3\ m\cdot s^{-1}$ ✓ (5)

5.2

F_N = normal force
W_{II} =parallel component of weight
$W_{\perp}$= perpendicular component of weight



✓ for all 3 forces correctly drawn
✓ for all 3 forces correctly labelled (2)

5.3 $W_{net} = \Delta K$

$W_{WII} + W_N + W_{\perp} = \Delta K$

$W_{II}\,\Delta x\cos\theta + 0 + 0 = ½mv_f^2 - ½mv_i^2$ ✓

$mg\sin 20°\ \Delta x\cos 180°$ ✓ $= 0 - ½(3)(3)^2$ ✓

$(3)(9,8)\ \sin 20°\ d\ (-1)$ ✓ $= 0 - ½(3)(3)^2$

d = 1,34 m ✓ (5)

[12]

QUESTION 6:

6.1 E_p=mgh ü= (88)(9,8)(7) ü= 6036,8 Jü (3)

6.2. W = FΔx·cosα ü= (108)(7) ü= 756 Jü (3)

6.3. $v_f^2 = v_i^2 + 2g\Delta x$ü
0 ü= $v_i^2 + 2(-9,8)(7)$ ü
$v_i = 11,71\ m\cdot s^{-1}$ü (4)

6.4. E_p = mghü = (2)(9,8)(7) ü= 137,2 Jü (3)

6.5. 12 bricks in a minute – each brick takes 5 sü
P = W/t ü= 137,2/5 ü= 27,44 Wü (4)

TOPIC 1: PHOTOELECTRIC EFFECT

SOLUTIONS TO HOMEWORK

QUESTION 1

1.1 Minimum energy needed to eject electrons from a certain material/metal. ✓✓ (2)

1.2 $E = hc/\lambda$ ✓

$\therefore 6,9 \times 10^{-19}$ ✓ $= (6,63 \times 10^{-34})(3 \times 10^{8})/\lambda$ ✓

$\therefore \lambda = 288,26 \times 10^{-9}$ m ✓ $= 288,26$ nm (4)

1.3 $E_k = \frac{hc}{\lambda} - W$ ✓

$= \frac{(6,63 \times 10^{-34})(3 \times 10^{8})}{260 \times 10^{-9}}$ ✓ $- 6,9 \times 10^{-19}$ ✓

$= 7,65 \times 10^{-19} - 6,9 \times 10^{-19}$

$= 7,5 \times 10^{-20}$ J ✓ (4)

1.4 The positively charged zinc plate will attract electrons ✓preventing them from being emitted. ✓ (2)

[12]

QUESTION 2

2.1 Photo-electric effect ✓ (1)

2.2 $c = f\lambda$ ✓

$\therefore 3 \times 10^{8} = f(200 \times 10^{-9})$ ✓

$\therefore f = 1,5 \times 10^{15}$ Hz

$f_0 = W_o/h$ ✓

$= \frac{7,57 \times 10^{-19}}{6,63 \times 10^{-34}}$ ✓ $= 1,14 \times 10^{15}$ Hz ✓

Frequency ($1,5 \times 10^{15}$ Hz) greater than threshold frequency ($1,14 \times 10^{15}$ Hz) ✓ (6)

2.3.1 The energy of the photo-electrons remains unchanged ✓ as the frequency / wavelength of the photons did not change. ✓ (2)

2.3.2 Number of photo-electrons (per second) is increased ✓. When the intensity is increased the number of photons will increase, releasing an increased number of electrons. ✓

(2)

[10]

TOPIC 2: ELECTROMAGNETIC RADIATION AND SPECTRA

SOLUTIONS TO HOMEWORK

QUESTION 1

Emission lines are evidence of light (energy) being given off ✓as electrons fall through energy levels✓. Absorption spectra lines are evidence of certain frequencies of energy being taken in ✓by the atom as the electrons go to higher energy levels. ✓ Since the energy levels of a particular element have the same energy level spacings✓, the energy emitted (shown as a colour) will correspond exactly with the energy absorbed (shown by a black line) ✓ **[6]**

QUESTION 2

$E = hf$ ✓
$1,89 \times 10^{-24}$ ✓ = $(6,6 \times 10^{-34})$ ✓ f

$f = 2,9 \times 10^{9}$ Hz✓

This frequency corresponds to the radio wave region of the electromagnetic spectrum. ✓

[5]

QUESTION 3

3.1 $v = \lambda f$✓

3×10^{8} ✓= $\lambda\ (405 \times 10^{6})$ ✓

$\lambda = 0,74$m✓ (4)

3.2 radio✓ (1)

3.3 $E = hf$ ✓= $(6,6 \times 10^{-34})$ ✓ (405×10^{6}) ✓

$= 2,67 \times 10^{-25}$ J✓ (4)

[9]

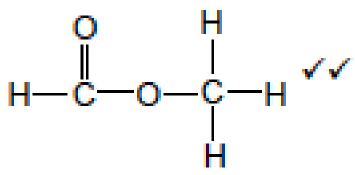
TOPIC 1: ORGANIC MOLECULES: STRUCTURES AND PHYSICAL PROPERTIES

SOLUTIONS TO HOMEWORK

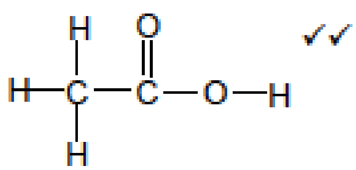
QUESTION 1

1.1 Compounds that have the same molecular formula but different structural formulae. ✓✓ (2)

1.2



methylmethanoate ✓
metielmetanoaat



ethanoic acid ✓
etanoësuur

(6)

1.3.1 Ethanoic acid. ✓ The hydrogen bonds/intermolecular forces between ethanoic acid molecules are stronger than the Van der Waals forces/intermolecular forces between the ester molecules ✓
More energy needed to break bonds between ethanoic acidmolecules. (3)

1.3.2 Methylmethanoate ✓ The Van der Waals forces/intermolecular forces between the ester molecules are weaker than the hydrogen bonds/intermolecular forces between ethanoic acid molecules. ✓
Less energy needed to break bonds between the ester molecules. (3)

1.4 Decrease ✓ Van der Waals forces increase with molecular size ✓ (3)
[17]

TOPIC 2: ORGANIC MOLECULES: REACTIONS

QUESTION 1

1.1 Dichlorodifluoromethane ✓✓ (2)

1.2 Low boiling point ✓ (1)

OR

High volatility/high vapour pressure ✓

1.3.1 Damages the ozone layer ✓ (1)

1.3.2 Increase in (dangerous) UV rays that reaches earth ✓

Higher occurrence of skin cancer/cataracts ✓ (2)

1.4

$CH_3CH_3 + C\ell_2$ ✓ → $CH_3CH_2C\ell + HC\ell$ ✓ bal ✓ (3)

1.5 Heat ✓

OR

Ultraviolet light

OR

Sunlight (1)

1.6 $CH_3CH_3CH_3CH_4$✓✓ (2)

1.7 No harm to the ozone layer ✓

Less potent greenhouse gas – contributes less to global warming ✓ (2)

[14]

QUESTION 2

2.1 Elimination✓ (1)

2.2 Alkenes ✓ (1)

2.3 Addition/hydrohalogenation/hydrobromination ✓ (1)

2.4 $CH_3CH_2CH(OH)CH_3$ ✓→ $CH_3CHCHCH_3$ ✓✓+ H_2O ✓ (4)

2.5 Q ✓

The major product is the one in which the H-atom is removed from the least substituted C-atom (the C-atom with the least number of hydrogen atoms✓ (2)

2.6 $CH_3CH_2CHBrCH_3$ ✓✓

2-bromobutane ✓ (3)

No hyphen in the name: -1 mark

2.7 Substitution✓ (1)

[13]

TOPIC: CONSOLIDATION EXERCISES

SOLUTIONS TO SECTION A

QUESTION 1

1.1 $p_{before} = p_{after}$

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

$(3000 \times 27{,}28)$ ✓ $+ 500 \times 0$ ✓ $= (3000 + 500)\ v_f$

$v_f = 23{,}81\ m{\cdot}s^{-1}$ ✓ (5)

1.2 $\Delta p = m(v_f – v_i)$ ✓

$= 3000\ (23{,}81 – 27{,}78)$ ✓

$= -\ 11\ 910\ kg{\cdot}m{\cdot}s^{-1}$

$= 11\ 910\ kg{\cdot}m{\cdot}s^{-1}$ in the opposite direction of the motion✓ (3)

1.3 Drivers are distracted when using a cell phone while driving. This can lead to accidents which can result in injury and death. ✓✓ (2)

[10]

QUESTION 2

2.1 The **frequency is** ✓**inversely proportional** ✓to the **wavelength**. (2)

2.2 $c = f\lambda$ ✓

$3\times10^8 = (6{,}67\times10^{14})\ \lambda$

$\lambda = 4{,}5 \times 10^{-7}$ m ✓UNITS (2)

2.3 (a) At hospital for X-rays/ cancer treatment ✓

(b) A radio/ TV/ radar ✓

(c) Infra red at the physiotherapist/ night vision/ stealth/ heater/ stove ✓ (3)

2.4 (a) $E = hf$✓ (1)

(b) The energy associated with this frequency is very high ✓and is dangerous to all living matter. ✓**damage** (2)

(c) Gamma ✓ (1)

(d) Hiroshima / Nagasaki ✓/ Japan in the 2nd World War. ✓ (2)

[13]

QUESTION 3

3.1
For complete motion of stone
Upward motion negative

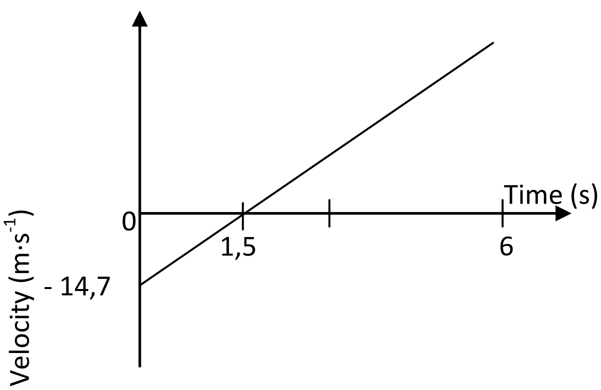
$\Delta y = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓ ∴ 88 ✓ = $v_i(6)$ ✓ + $\frac{1}{2}(9{,}8)(6)^2$ ✓

v_i = - 14,7 m·s^{-1} ∴ 14,7 m·s^{-1} upwards ✓

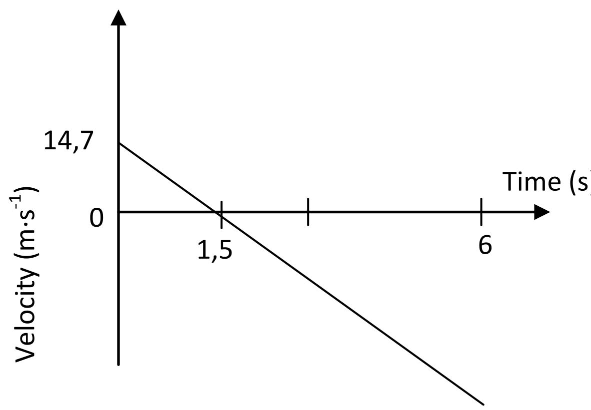
$v_{balloon} = v_{stone}$ ✓ = 14,7 m·s^{-1} (6)

3.2

Upward motion as negative:



Downward motion as negative:



Criteria for graph	Marks
Graph is a straight line that intercepts x-axis at 1,5 s	✓
Maximum velocity after 6 s	✓
Initial velocity indicated as 14,7 m·s^{-1}	✓

(3)
[9]

QUESTION 4

4.1 Ep = mgh✓
=4x9,8✓x0,2✓
=7,84J✓ (4)

4.2 By conservation of Mechanical E

Mechanical E top = Mechanical E bottom

$[mgh + ½mv^2]_{top} = [mgh + ½mv^2]_{bottom}$ ✓

4 x 9,8 x 0,2 ✓+ ½ x 4 x 0^2✓ =½ x 4 x v^2 ✓+ 4 x 9,8 x 0✓

7,84 = $2v^2$

v= 1,97 ms^{-1} to the right ✓ (6)

4.3 The total linear momentum of an isolated system ✓remains constant ✓in both magnitude and direction. ✓ (3)

4.4

$p_{before} = p_{after}$ ✓

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

(0,1)(v_{i1}) ✓+ (3,9)(0) ✓ = (0,1 + 3,9) (1,97)✓

0,1 v_{i1} = 7,88

v_f = 78,8 $m{\cdot}s^{-1}$ to the right✓ (5)

4.5 $E_k = F{\cdot}x\cos\theta$✓

$½mv^2$ ✓ = F x 0,1✓ cos 0°✓

$½(0,1)(78,8)^2$ ✓ = F x (0,1)

F= 3104,72N in direction of arrow ✓ (6)

[24]

TOPIC 1 : SOUND AND DOPPLER EFFECT

SOLUTIONS TO HOMEWORK

QUESTION 1

1.1 v = fλ
340 = 500 x λ ✓
λ = 0,68 m ✓ (2)

1.2 If the pitch is higher, then it is moving towards you. ✓ If the pitch is lower, it is moving away from you. ✓ (2)

1.3 Doppler effect ✓ (1)

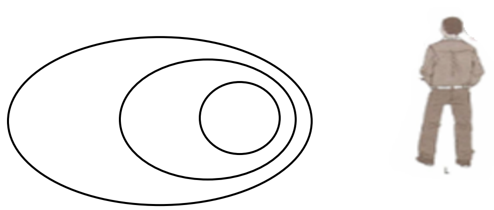
1.4 $f_L = \left(\frac{v \pm v_L}{v \pm v_s}\right) f_s = \left(\frac{340}{340 + v_s}\right) 500 = 495$ ✓

✓ ✓ ✓

v_s = 343 m·s^{-1} away from observer ✓ (5)

[10]

QUESTION 2



2.1 Diagram shows waves compressed in front and stretched out at back ✓✓ (2)

2.2 Formula One car goes much **faster**✓ and results in **greater compressions**✓**OR**
The engine **revs are higher**✓ making the vibrations take place with greater frequency (2)

2.3 $f_L = \left(\frac{v \pm v_L}{v \pm v_s}\right) f_s = \left(\frac{340}{340 - 55.56}\right) 250 = 298{,}83 Hz$

✓ formula

✓substitutions

✓ convert km·h^{-1} to m·s^{-1}

✓ answer (4)

[8]

TOPIC 2: LIGHT, ELECTROMAGNETIC WAVES, 2D AND 3D WAVEFRONTS

SOLUTIONS TO HOMEWORK

QUESTION 1

1.1 A broad central band of bright red light flanked by alternating narrower black and not so bright red bands ✓✓ (2)

1.2 All the bands will have equal width✓ and
All the bands will be equally bright ✓ (2)

1.3

$$\sin\theta = \frac{m\lambda}{d} ✓ = \frac{1(700\times10^{-9})✓}{5\times10^{-6}✓} = 0.14$$

$$\theta = 8.05°$$

$$✓ \tan 8.05° = \frac{\frac{1}{2}\text{width}}{\text{distance}} = \frac{\frac{1}{2}\text{width}}{2} ✓$$

$$\text{width} = 0.028\times 2 = 0.056\text{ m}$$

✓ (6)

QUESTION 2

2.1

$$\sin\theta = \frac{m\lambda}{d} ✓$$

$$\sin 8^0 ✓ = \frac{1.\lambda}{4{,}59\times10^{-6}} ✓ ✓$$

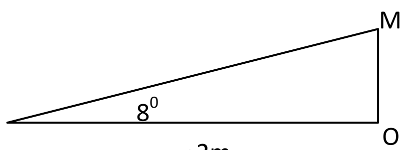
$$\lambda = \sin 8^0 . 4{,}59\times10^{-6}$$

$$= 6{,}38804\times10^{-7}\text{ m} ✓$$

= 638,80nm ✓

(6)

2.2



$\tan\theta = \frac{MN}{d}$ ✓

$\tan 8^0 = \frac{MN}{2}$ ✓

$MN = 2.\tan 8^0$

$= 0{,}281$ m ✓

Distance MN = 2 x MO✓✓✓ = 0,28 x 2 = 0,56m (6)

[12]

TOPIC 1: ENERGY CHANGES & RATES OF REACTION

SOLUTIONS TO HOMEWORK

QUESTION 1

1.1. Heat of reaction - is the difference between the energy of the products and the energy of the reactants. ✓✓ (2)

1.2. Endothermic reaction – a reaction that takes in energy, products have more energy than the reactants ✓✓ (2)

1.3. Activation energy - the 'energy hill' which must be 'overcome' by the addition of this amount of energy before a reaction can take place. ✓✓ (2)

[6]

QUESTION 2

2.1. Exothermic ✓✓ (2)

2.2. Endothermic ✓✓ (2)

2.3. Exothermic ✓✓ (2)

[6]

QUESTION 3

3.1. The sun ✓✓ (2)

3.2. Flame ✓✓ (2)

3.3. Flame ✓✓ (2)

[6]

QUESTION 4

4.1. X-axis – course of reaction ✓
Y-axis – potential energy ✓ (2)

4.2. Eproducts < Ereactants ✓✓ (2)

4.3. Activated complex - temporary, unstable, high-energy composition of atoms, which represents a transition state between reactants and the products. ✓✓ (2)

4.4. Negative ✓ (1)

4.5. Exothermic ✓ (1)

[8]

QUESTION 5

1.1 A larger mass of metal will produce more gas etc ✓✓ (2)

! The relationship between the dependent and independent variables must be given.

5.2 Temperature ✓✓ and concentration✓✓ (4)

5.3 Any mass bigger than 1,6 g will not influence the volume of the gas produced. ✓✓(2)

5.4 160 cm^3 ✓✓ (2)

[10]

QUESTION 6

As the temperature increases✓, the number of molecules with the minimum kinetic energy required for a reaction to occur, increases✓. The molecules will be moving faster✓, the number of effective collisions will increase ✓and thus the rate of the reaction will increase✓. Thus, the sugar dissolves faster in hot water. **[5]**

QUESTION 7

7.1 It will be easier to form products from the reactants ✓ because the activation energy is less ✓ than the activation energy required to form the reactants from the products. (2)

7.2 Carbon monoxide is toxic and can lead to atmospheric pollution and global warming. ✓✓ (2)

7.3.1 It will lower the amount of CO produced and this will lead to less CO poisoning. ✓✓ (2)

[6]

TOPIC 2: CHEMICAL EQUILIBRIUM

SOLUTIONS TO HOMEWORK

QUESTION 1

1.1 The forward reaction is exothermic. ✓Thus, lowering the temperature favours the forward, exothermic reaction and the ammonia will now have a higher yield. ✓ However, the rate of reaction will be lowered and this will lead to the ammonia production being unprofitable. ✓ (3)

1.2.1

	NH_3	O_2	NO	H_2O
Initial concentration ($mol·dm^{-3}$)	1	1	0	0
Change in concentration ($mol·dm^{-3}$)	0,25	0,3125	0,25	0,375
Equilibrium concentration ($mol·dm^{-3}$)	0,75✓	0,6875✓	0,25✓	0,375✓

$$K_c = \frac{[NO]^4[H_2O]^6}{[NH_3]^4[O_2]^5} \checkmark$$

$$= \frac{(0{,}25)^4(0{,}375)^6 \checkmark}{(0{,}75)^4(0{,}6875)^5 \checkmark}$$

$$= 2{,}2 \times 10^{-4} \quad \checkmark\checkmark$$ (9)

1.2.2 Low. ✓ The small equilibrium constant value indicates that the equilibrium lies towards the reactants side ✓ and that there are more reactant molecules in the reaction mixture at equilibrium, thus NO will have a low yield. ✓ (3)

[15]

QUESTION 2

	N_2	O_2	NO
Initial number of mole (mol)	7	2	0
Number of moles used/formed (mol)	0,2	0,2	0,4
Number of moles at equilibrium (mol)	6,8	1,8	0,4
Equilbrium concentration ($mol \cdot dm^{-3}$) c = n/V	3,4✓	0,9✓	0,2✓

$K_c = \frac{[NO]^2}{[N_2][O_2]}$ ✓

$= \frac{(0,2)^2}{(3,4)(0,9)}$ ✓

= 0,013 ✓ **[6]**