education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

GERT SIBANDE DISTRICT

ERMELO SUB DISTRICT

GRADE 10

PHYSICAL SCIENCES
CONTROLLED TEST
15 SEPTEMBER 2022

MARKS: 100

TIME: 2:00 HOURS

This question paper consists of 11 pages including the data sheets

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SEVEN questions. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. You are advised to use the attached DATA SHEETS.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your final numerical answers to a minimum of TWO decimal places.
10. Give brief motivations, discussions et cetera where required.
11. Write neatly and legibly.

QUESTION 1

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A – D) next to the question number (1.1 – 1.8) in the ANSWER BOOK, for example 1.11 D.

1.1 The gravitational potential energy of an object relative to the ground is dependent on the object's …

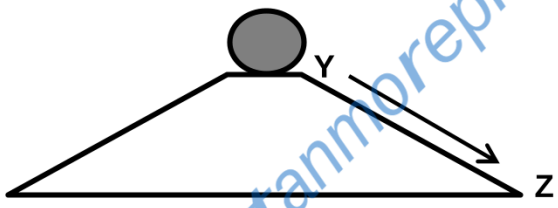
A speed.

B position.

C velocity.

D change in velocity. (2)

1.2 An object is released from the top of the platform, and moves down ward along a frictionless inclined plane **Y- Z** as shown in the diagram below.



Which one of the following statements regarding the energy of the ball is correct?

A Total mechanical energy at **Y** is greater than total mechanical energy at **Z**.

B Total mechanical energy at **Y** is less than total mechanical energy at **Z**.

C Total mechanical energy at **Y** is equal to total mechanical energy at **Z**.

D Total mechanical energy at **Y** is not equal to total mechanical energy at **Z**. (2)

1.3 The number of wave pulses per second is called ….

A Wave length

B Amplitude

C Frequency

D Period (2)

1.4 Which one of the combinations below concerning longitudinal waves is correct?

	Compression	Rarefaction
A	Is region of high pressure	Is region of low pressure
B	Is region of low pressure	Is region of high pressure
C	Is minimum displacement of particles	Is maximum displacement of particles
D	Is maximum displacement of particles	Is minimum displacement of particles

(2)

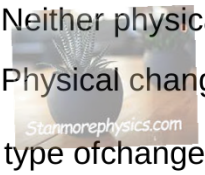
1.5 A mixture of Salt and water can be separated by boiling the mixture. The change which take place during the separation of this mixture components is……..

A Chemical change only.

B Physical change and chemical change.

C Neither physical change nor chemical change.

D Physical change only. (2)



1.6 Which type ofchanges obey the Law of conservation of mass?

A Only physical change

B Only chemical change

C Only phase changes

D physical change and chemical change (2)

1.7 Consider the following incomplete equation for a chemical reaction:

$$\underline{\mathbf{f}}\ Na(s) + H_2SO_4\ (aq) \rightarrow Na_2SO_4\ (aq) + \underline{\mathbf{Q}}$$

Letter **Q** represents one of the products and letter **f** represents a numerical value which make the chemical equation correctly balanced.

Which one of the combinations below concerning the above chemical equation is CORRECT?

	Value of f	Formula of Q
A	1	H
B	0	H_2O
C	2	H_2
D	1	H_2

(2)

1.8 The number of atoms in ONE formula unit of copper(II)nitrate $Cu(NO_3)_2$ is……

A 9

B 3

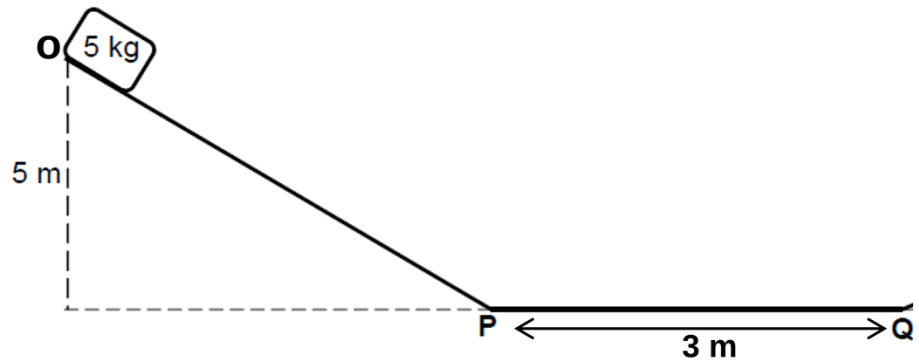
C 8

D 5 (2)

[16]

QUESTION 2

A 5 kg block is released from rest at a height of 5 m and slides down a frictionless incline **O-P** as shown in the diagram below. It then moves along horizontal portion **PQ** where it experiences friction and stops at point **Q**. Point **P** is 3 m from point **Q**.



2.1 State the principle of conservation of mechanical energy in words. (2)

2.2 Calculate the:

2.2.1 Gravitational potential energy of the block just before it is released. (3)

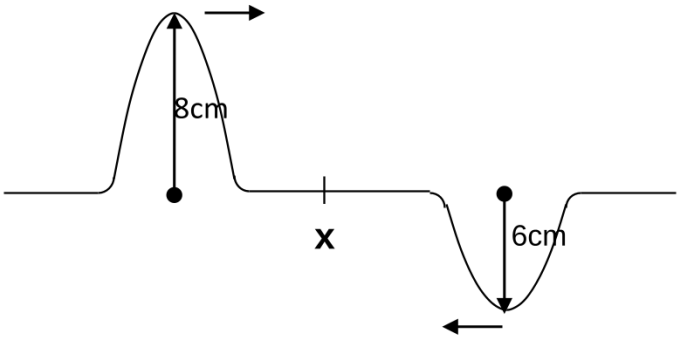
2.2.2 Magnitude of the velocity of the block at point **p,** use the principle of conservation of mechanical energy. (4)

2.2.3 Acceleration that the block experiences as it moves from point **P** to **Q**. (4)

2.3 Write down the energy conversion which takes place as the block moves from point **P** to **Q**. (1)
[14]

QUESTION 3

Two pulses are travelling towards each other along a spring, as shown in the diagram below.The centres of the two pulses meet and cross at point **X**.



3.1 Which wave property do the two pulses illustrate at point X? (1)

3.2 Name and define the principle used to answer QUESTION 3.1 (3)

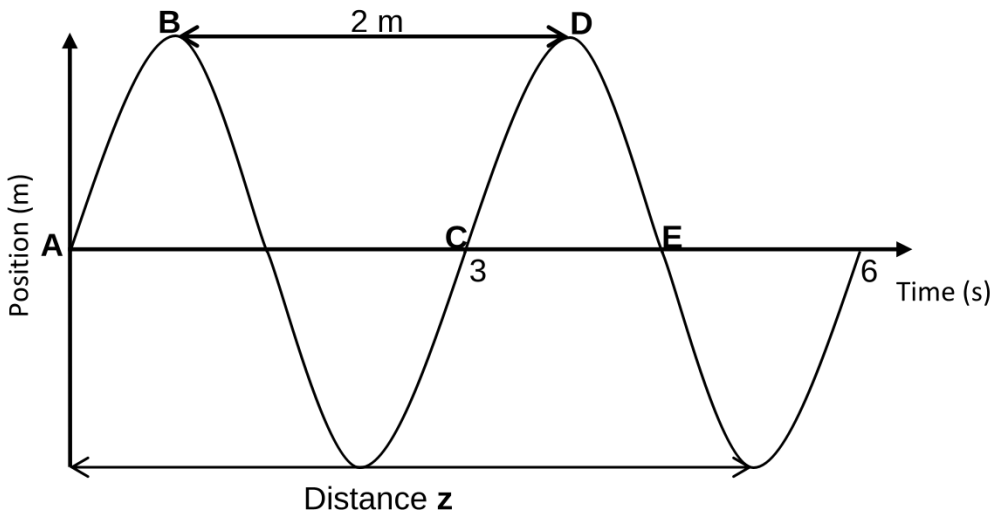
3.3 When the pulses cross at point **X**, the resulting amplitude is different from the amplitudes of the individual pulses

3.3.1 Define the term amplitude. (2)

3.3.2 Calculate the magnitude of the resulting amplitude. (2)
[8]

QUESTION 4

The sketch below shows a transverse wave in a medium.



4.1 Use the diagram above to write down:

4.1.1 The name of the physical quantity represented by the distance of 2 m. (1)

4.1.2 Two points that are in phase. (1)

4.1.3 One point that represents a crest. (1)

4.1.4 One point that represents the rest position. (1)

4.2 Write down the number of waves represented in the diagram above. (1)

4.3 Determine distance Z in the diagram. (2)

4.4 Define the term *frequency* of the wave in words. (2)

4.5 Calculate:

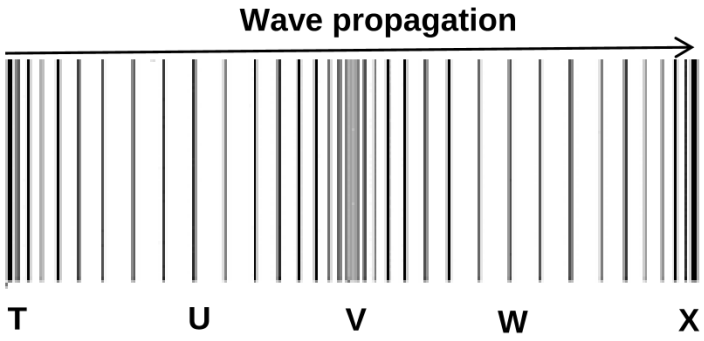
4.5.1 The frequency of the wave. (3)

4.5.2 The speed of the wave. (3)

[15]

QUESTION 5

The diagram below shows a longitudinal wave produced by a musical instrument.



5.1 Define the term a longitudinal wave. (2)

5.2 Write down the name of the parts marked:

5.2.1 **U** (1)

5.2.2 **V** (1)

5.3 Describe the motion of the particle at points **U**, as the wave propagates to the right. (2)

5.4 Write down the number of wave lengths shown in the diagram. (1)

5.5 State whether the following points are IN PHASE or OUT OF PHASE.

5.5.1 **T** and **W** (1)

5.5.2 **V** and **X** (1)

5.6 Give a reason for the answer in question 5.5.2 (2)

5.7 Wave particles at point **U** make 410 oscillations in 2 seconds. Calculate the frequency of the wave. (2)

[13]

QUESTION 6

6.1 Ice melts when there is a change in temperature of the environment

6.1.1 State whether the melting of ice is a PHYSICAL CHANGE or CHEMICAL CHANGE (1)

6.1.2 Describe the rearrangement of molecules during the melting of ice. (2)

6.2 The word equation (i) and the unbalanced equation (ii) for two chemical reactions are shown below.

(i) Calcium carbonate + hydrochloric acid → Calcium chloride + carbon dioxide + water

(ii) $2H_2O_2$ (aq) → O_2 (g) + $2H_2O$ (l)

6.2.1 Give a reason why both reactions (i) and (ii) above represent a chemical change. (1)

6.2.2 Write down a balanced chemical equation for the word equation **(i)**. Show the phases of ALL reactants and products. (4)

6.2.3 Use a calculation to show that the Law of Conservation of Mass is valid during reaction **(ii).** (3)

6.3 Which ONE of the above equations **(i)** or **(ii)** represents:

6.3.1 Decomposition reaction? (1)

6.3.2 Synthesis reaction? (1)

[13]

QUESTION 7

Grade 10 learners demonstrated the reaction of a metal with an acid by adding 1,4 g of Zinc to excess hydrochloric acid in the conical flask. **X** volume of hydrogen gas was produced at STP. The reaction which took place is represented by the balanced chemical equation below.

$$Zn(s) + 2HC\ell(aq) \rightarrow ZnC\ell_2(aq) + H_2(g)$$

7.1 Calculate:

7.1.1 The value of **X** (in dm^3), which is the volume of hydrogen gas produced at STP. (4)

7.1.2 .The mass (in gram) of $ZnC\ell_2$ (theoretical yield) produced. (3)

7.1.3 The percentage yield of $ZnC\ell_2$, If the actual mass of $ZnC\ell_2$ formed is 2,69 g. (3)

7.2 The formula of the hydrated sodium carbonate is $Na_2CO_3.xH_2O$.

The molar mass of hydrated sodium carbonate is found to be 268 $g \cdot mol^{-1}$. Calculate the number of moles water of crystallisation (x) in the compound. (3)

7.3 A sample of compound **Q** contains 24,27% C, 4,07% H and 71,65% Cℓ.

7.3.1 Define the term empirical formula. (2)

7.3.2 Use a calculation to determine the empirical formula of compound **Q**. (6)

[21]

TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 10

TABLE 1: PHYSICAL CONSTANTS

NAME	SYMBOL	VALUE
Molar gas volume at STP	V_m	22,4 $dm^3 \cdot mol^{-1}$
Electron Mass	m_e	9,11 x 10^{-31} kg
Charge on electron	e	-1,6 x 10^{-19}C
Avogadro's constant	N_A	6,02 x 10^{23} mol^{-1}

TABLE 2: MOTION

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$
$v_f^2 = v_i^2 + 2a\Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$

TABLE 3: WEIGHT AND MECHANICAL ENERGY

$F_g = mg$	$U = E_p = mgh$
$K = E_k = \frac{1}{2}mv^2$	

TABLE 4: WAVES, LIGHT AND SOUND

$v = f\lambda$ or $v = \nu\lambda$	$T = \frac{1}{f}$ or $T = \frac{1}{\nu}$
$n_i \sin\theta_i = n_r \sin\theta_r$	$n = \frac{c}{v}$

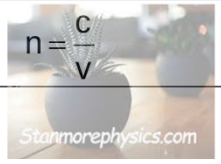
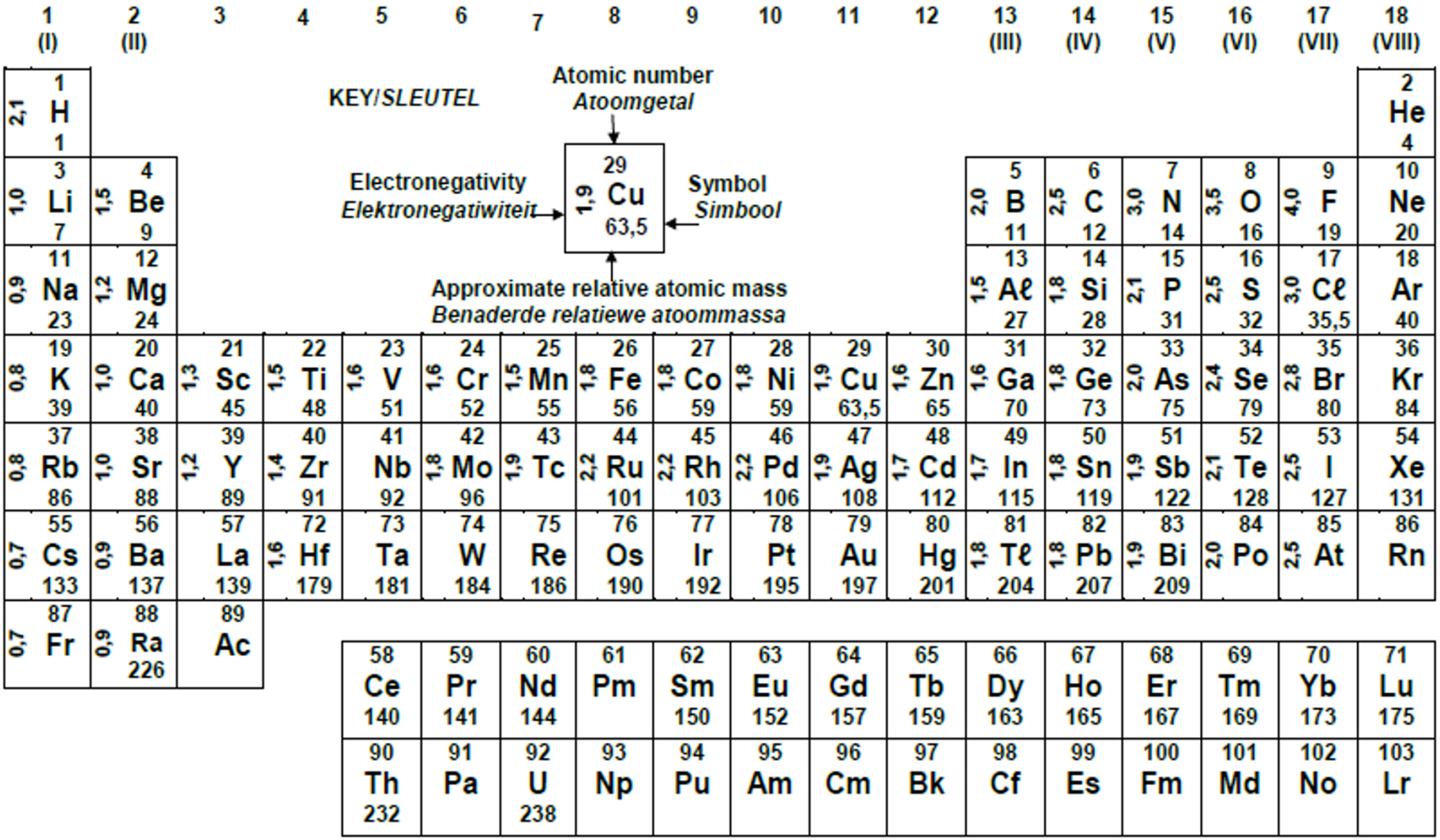


TABLE 5: FORMULAE

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ ***OR / OF*** $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*



1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
2,1 H 1																	2 He 4
1,0 Li 7	1,5 Be 9											2,0 B 11	2,5 C 12	3,0 N 14	3,5 O 16	4,0 F 19	Ne 20
0,9 Na 23	1,2 Mg 24											1,5 Aℓ 27	1,8 Si 28	2,1 P 31	2,5 S 32	3,0 Cℓ 35,5	Ar 40
0,8 K 39	1,0 Ca 40	1,3 Sc 45	1,5 Ti 48	1,6 V 51	1,6 Cr 52	1,5 Mn 55	1,8 Fe 56	1,8 Co 59	1,8 Ni 59	1,9 Cu 63,5	1,6 Zn 65	1,6 Ga 70	1,8 Ge 73	2,0 As 75	2,4 Se 79	2,8 Br 80	Kr 84
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	Nb 92	1,8 Mo 96	1,9 Tc	2,2 Ru 101	2,2 Rh 103	2,2 Pd 106	1,9 Ag 108	1,7 Cd 112	1,7 In 115	1,8 Sn 119	1,9 Sb 122	2,1 Te 128	2,5 I 127	Xe 131
0,7 Cs 133	0,9 Ba 137	La 139	1,6 Hf 179	Ta 181	W 184	Re 186	Os 190	Ir 192	Pt 195	Au 197	Hg 201	1,8 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	Rn
0,7 Fr	0,9 Ra 226	Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

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GRADE 10

PHYSICAL SCIENCES

SEPTEMBER 2022

MARKING GUIDELINES

MARKS: 100

This marking guidelines consists of 6 pages

QUESTION 1

1.1 B✓✓ (2)

1.1 C✓✓ (2)

1.3 C✓✓ (2)

1.4 A✓✓ (2)

1.5 D✓✓ (2)

1.6 B✓✓ (2)

1.7 C✓✓ (2)

1.8 A✓✓ (2)

[18]

QUESTION 2

2.1 The total energy of an isolated system remains constant.✓✓
[2 or 0 mk] (2)

2.2.1 $Ep = mgh$ ✓
$= (5)(9,8)(5)$ ✓
$= 24,5\ J$ ✓ (3)

2.2.2 $EM_{(O)} = EM_{(P)}$ /✓ $(Ep + Ek)O = (Ep + Ek)P$
OR: $mgh_{(O)} + ½mv^2_{(O)} = mgh_{(P)} + ½mv^2_{(P)}$
$(5)(9,8)(5) + 0 =$✓ $0 + ½(5)\ V_2$✓
$V = 9,90\ m.s^{-1}$✓ (4)

2.2.3 **POSITIVE MARKING FROM Q 2.2.2**
$vf^2 = vi^2 + 2a\Delta x$✓
$(0)^2 =$✓ $(9,90)^2 + 2a(3)$✓
$a = -16,34\ m{\cdot}s^{-2}$
$a = 16,34 m{\cdot}s{-}2$ in opposite to direction of motion✓ (4)

2.3 Mechanical/kinetic energy converted to heat/sound/internal energy.✓ (1)

[14]

QUESTION 3

3.1 (Destructive) interference.✓ (1)

3.2 Principle of superposition.
The algebraic sum of the amplitudes of two pulses that occupy the same space at the same time.✓✓ **[2 or 0 mk]** (3)

3.3.1 The maximum disturbance of the particle from its rest (equilibrium) position.✓✓ **[2 or 0 mk]** (2)

3.3.2 8-6✓ = 2cm✓ (2)
[8]

QUESTION 4

4.1.1 Wave length.✓ (1)

4.1.2 A and C✓ (1)

4.1.3 B✓/D (1)

4.1.4 A✓/C/E (1)

4.2 2✓ (1)

4.3 3,5 m✓✓ (2)

4.4 The number of wave pulses per second.✓✓ (2)

4.5.1 $f = \frac{1}{T}$✓

$f = \frac{1}{3}$✓

f = 0,333 Hz✓ (3)

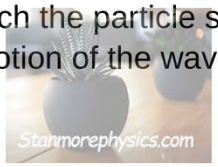
4.5.2

OPTION 1	OPTION 2
V = fλ ✓	Δx = VΔt✓
V = 0.333x2✓	2 = VX3✓
V = 0,67 $m.s^{-1}$✓	V = 0,67 $m.s^{-1}$✓

(3)
[15]

QUESTION 5

5.1 A wave in which the particle sof the medium vibrate parallel to the direction of motion of the wave.✓✓ (2)



5.2.1 Rarefaction✓ (1)

5.2.2 compression✓ (1)

5.3 The particle moves to the left and right✓✓
OR; The particle moves backwards and forwards (then return to its original position). (2)

5.4 2✓ (1)

5.5.1 OUT OF PHASE✓ (1)

5.5.2 IN PHASE✓ (1)

5.6 They are separated by a whole number of (complete) wavelengths.✓✓ (2)

5.7 f = number of oscillations per second
f = 410 ÷ 2✓
f = 205 Hz✓ (2)
[13]

QUESTION 6

6.1.1 PHYSICAL CHANGE✓ (1)

6.1.2 Molecules become disorderly arranged ✓due to breaking of intermolecular forces.✓ (2)

6.2.1 New chemical substances are formed.✓
OR: Mass and atoms are conserved , but the number of molecules is not. (1)

6.2.2 $CaCO_3$ (s) + 2HCl (aq) → $CaCl_2$ (aq) + CO_2 (g) + H_2O (l)

Criteria for marking Q 6.2.2	
Correct reactants	✓
Correct product	✓
Balancing	✓
All states are correct	✓

(4)

6.2.3 $2H_2O_2$ (aq) → O_2 (g) + $2H_2O$ (l)
2(1x2+16x2)✓ = (16x2) + 2(1x2 +16)✓
68 = 68✓ (3)

6.3.1 (ii)✓ (1)

6.3.2 (i)✓ (1)
[13]

QUESTION 7

7.1.1 $n(Zn) = \frac{m}{M}$✓
$n(Zn) = \frac{1,4}{65}$✓ = 0,022 mol
$n(Zn) = nH_2 = 1:1$
nH_2 = 0,022 mol
$n(H_2) = \frac{v}{Vm}$
$0,022 = \frac{v}{22,4}$✓

$V(H_2)$ = 0,493 dm^3✓ (4)

7.1.2 $n(Zn) = nZnCl_2 = 1:1$
$nZnCl_2$ = 0,022 mol✓
$m(ZnCl_2) = nM$
$m(ZnCl_2)$ = 0,022 X 136✓
$m(ZnCl_2)$ = 2,99 g✓ (3)

7.1.3 % yield = $\frac{\text{actual yield}}{\text{theoretical yield}} x\ 100$✓
% yield = $\frac{2,69}{2,99}$x100✓

% yield = 89,97 %✓ (3)

7.2 $Na_2CO_3.xH_2O$ = 268
23x2+12+16x3 + 18x✓ = 268✓
106 + 18X = 268
X = 9✓ (3)

7.3.1 The simplest whole-number ratio of atoms in a compound.✓✓ (2)

7.3.2

Element	C	H	Cl
$n = \frac{m}{M}$ ✓	$\frac{24,27}{12}$ = 2,0225	$\frac{4,07}{1}$ = 4,07	$\frac{71,65}{35,5}$ ✓ = 2,0183 ✓
Divide by smallest	$\frac{2,0225}{2,0185}$ = 1	$\frac{4,07}{2,0183}$ = 2	$\frac{2,0183}{2,0183}$ ✓ = 1 ✓
Empirical formula:		CH_2Cl ✓	

(6)
[21]

TOTAL: 100