HILLCREST HIGH SCHOOL

PHYSICAL SCIENCE P1

JUNE 2023

Grade 10

MARKS: 140

TIME: 2 Hours

EXAMINER: Mrs M. Smith

MODERATOR: Mrs J Knox-Whitehead

Ms N Badenhorst

INSTRUCTIONS

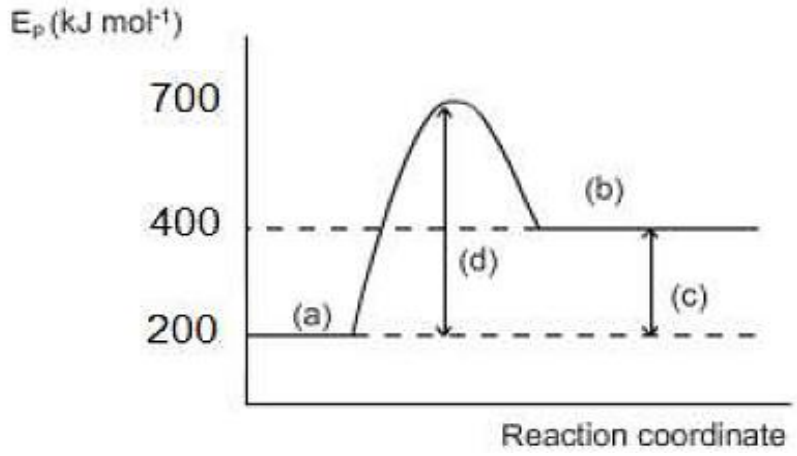
1. This question paper consists of 12 pages and 2 SECTIONS:
   SECTION A (99) SECTION B (41)
2. Answer all the questions from SECTIONS A and SECTION B in the ANSWER BOOK provided.
3. Non-programmable calculators may be used.
4. Number the answers correctly according to the numbering system used in this question paper
6. Give brief motivations, discussions, et cetera where required.
7. Final answers to calculations must be rounded off to **two decimal** places where appropriate.
8. Data sheets and a periodic table are attached for your use.
9. Rule off after each question 1 - 13.
10. Write neatly and clearly.
11. Leave a line between each answer.

SECTION A : CHEMISTRY 90

QUESTION 1: (2 x 6 = 12)

Four options are provided as possible answers to the following questions.
Each question has only one correct answer.
Write only the letter (A-D) next to the question number (1.1 – 1.6) in the answer book.

1.1 Study the graph below. The enthalpy change for the reaction is given by the letter



A. (a)

B. (b)

C. (c)

D. (d)

1.2 Metal X forms a nitrate with the formula $X(NO_3)_3$.
Which one of the following is the correct formula for the sulphate of X?

A. $X(SO_3)_2$

B. $X_2(SO_4)_3$

C. XSO_4

D. $X(SO_3)_3$

1.3 Which one of the following is described as a chemical change?

A. steam coming from a kettle

B. evaporation of alcohol on the surface of the skin

C. snow melting into water

D. decomposition of hydrogen peroxide into water

1.4 The process of separating the components of a liquid mixture, based on their boiling points is called

A. distillation

B. chromatography

C. magnetism

D. filtration

1.5 Which statement is true?

As you move up and to the right of the Period Table

A. atomic radius increases and electronegativity increases

B. electronegativity decreases and atomic radius decreases

C. atomic radius decreases and electronegativity increases

D. electronegativity decreases and atomic radius increases

1.6 The intermolecular forces found between the molecules of hydrogen chloride (HCl) holding the liquid together are called..

A. ion – ion forces

B. Hydrogen bonds

C. Van der Waals / London forces

D. dipole – dipole forces

QUESTION 2 (6)

Magnesium has three naturally occurring isotopes as shown in the table:

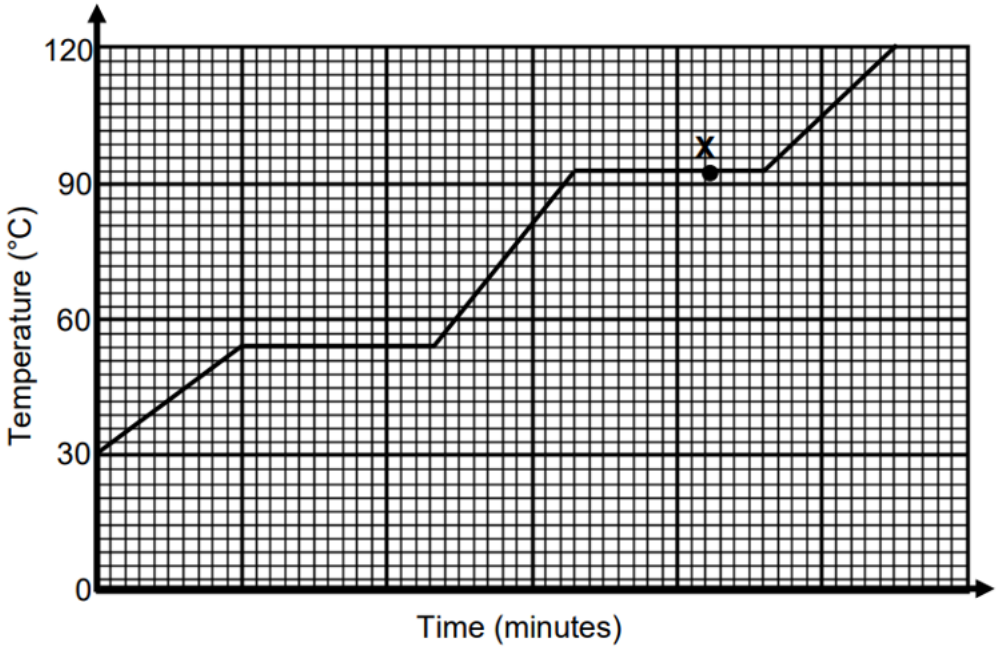
	% OCCURANCE	RELATIVE ISOTOPE MASS
$^{24}Mg_{12}$	78.99	23.985
$^{25}Mg_{12}$	10.00	24.986
$^{26}Mg_{12}$	11.01	25.985

2.1 Show by using a calculation how many neutrons an atom of ^{26}Mg contains. (2)

2.2 Use the information in the table to calculate the relative atomic mass of magnesium. (4)

QUESTION 3 (10)

The heating curve for a pure substance at atmospheric pressure is shown in the graph below.



3.1 Write down the following for this pure substance :

3.1.1 melting point (1)

3.1.2 boiling point (1)

3.2 Is this substance pure water? Give a reason for your answer. (2)

3.3 Describe what is happening to the substance at point X on the graph. (1)

3.4 In what phase is the substance at room temperature? (2)

3.5 What happens to the temperature of the substance as it melts? Explain this observation. (3)

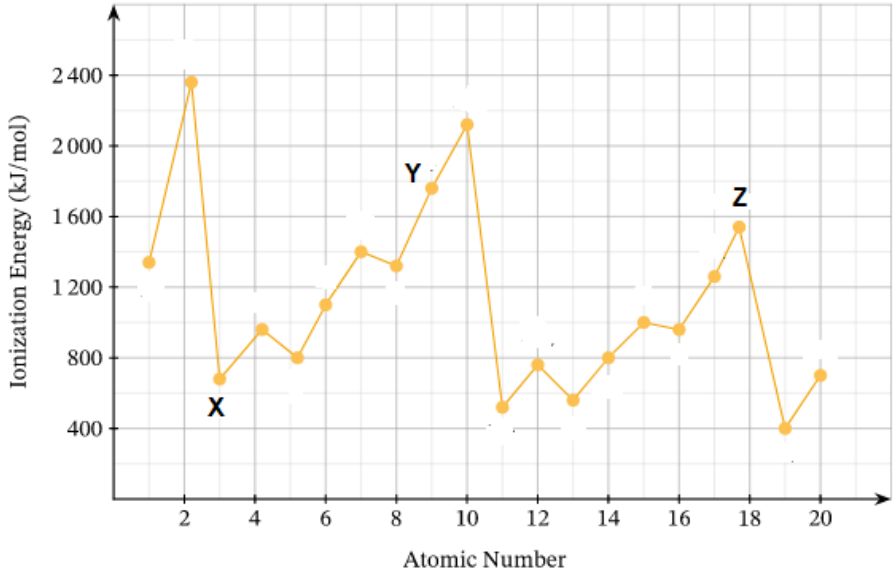
QUESTION 4 (14)

4.1 Define the following terms :

4.1.1 ionization energy (2)

4.1.2 electron affinity (2)

4.2 The graph below shows the first ionisation energies of the first 20 elements of the periodic table.



4.2.1 Which element X or Y is the metal, and how can you tell by looking at the ionisation energies only? (2)

4.2.2 Element Z has a relatively high ionization energy. Why do you suppose this is, and what does this tell you about the reactivity of this element? (3)

4.2.3 Describe the trend from element X to element Y with respect to the following **(choose from increase/decrease/stays the same)**

4.2.3.1 atomic radius (1)

4.2.3.2 electron affinity (1)

4.2.4 Explain why there is a sudden decrease in ionization energy from element number 4 to element number 5. (3)

QUESTION 5 (24)

5.1 Write down the chemical formulae for the following substances.

5.1.1 potassium sulphite (2)

5.1.2 calcium nitrate (2)

5.1.3 dinitrogen tetroxide (2)

5.2 Write down the names of the following compounds, using Stock Notation where necessary

5.2.1 $(NH_4)_2CO_3$ (2)

5.2.2 PbO_2 (2)

5.2.3 HNO_3 (2)

5.2.4 $CuCl_2$ (2)

5.3 Rewrite and balance the following equations:

5.3.1 $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$ (2)

5.3.2 $KClO_3 \rightarrow KCl + O_2$ (2)

5.4 To prevent iron from rusting in air, it is often mixed with other elements, e.g it is mixed with chromium and nickel to make stainless steel.

5.4.1 Is stainless steel a HOMOGENEOUS or a HETEROGENEOUS mixture? Give a reason for your answer . (2)

5.4 2 Iron rusting in air forms a compound called iron (III) oxide. Write a balanced equation for this reaction. (4)

QUESTION 6 (18)

Consider ONLY the following substances.

P	HF	N_2	H_2O	NH_3	KCl	MgF_2	O_2	Ca

6.1 What type of bond exists between the atoms of the water molecule. (1)

6.2 Draw a molecule of NH_3 molecule using Couper Notation. (2)

6.3 What type of bonding is found in Ca. (1)

6.4 Name the intermolecular force that holds molecules of HF together. (1)

6.5 Identify any substance that forms a crystal lattice in the solid phase. (1)

6.6 Show the formation of MgF_2 using Lewis Structure. (4)

6.7 Which molecule has a <u>double</u> covalent bond between the atoms. (1)

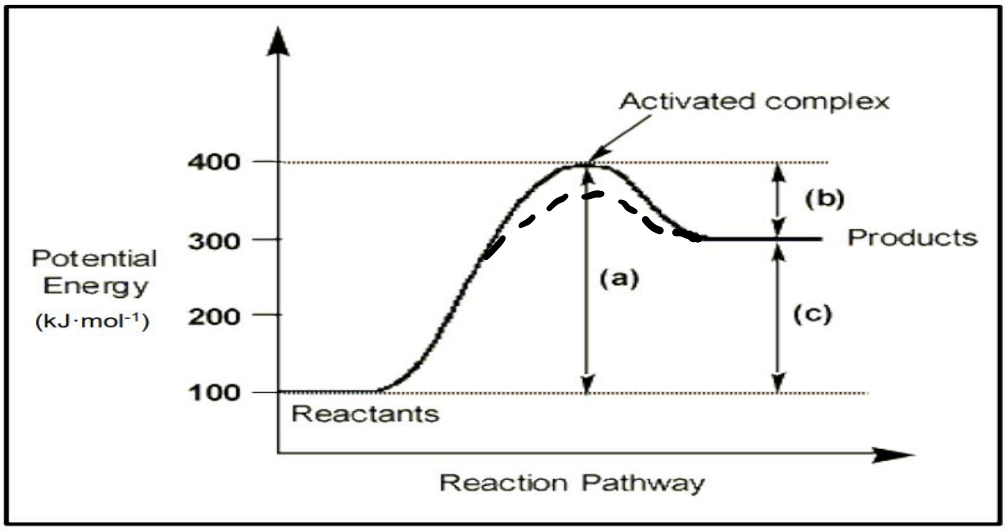
6.8 Draw an Aufbau (Energy Level) Diagram for an atom of P. (3)

6.9 Write the electron configuration (s,p notation) for an **ion** of Ca. (2)

6.10 Write the formula for the molecule that forms when Ca combines with P. (2)

QUESTION 7 (6)

Consider the following potential energy diagram for a chemical reaction.



7.1 Calculate the heat of the reaction (ΔH) for the forward reaction, and state whether the forward reaction is endothermic or exothermic . (4)

7.2 What is the value of the activation energy for the reverse reaction? (1)

7.3 What change was made to the reaction for the activation energy to decrease, as shown by the dotted line? (1)

Question 8 [9]

8.1 Calculate the mass of 2,5 moles of Nitrogen gas. (3)

8.2 Calculate the total number of atoms in 72 g of methane (CH_4) gas (6)

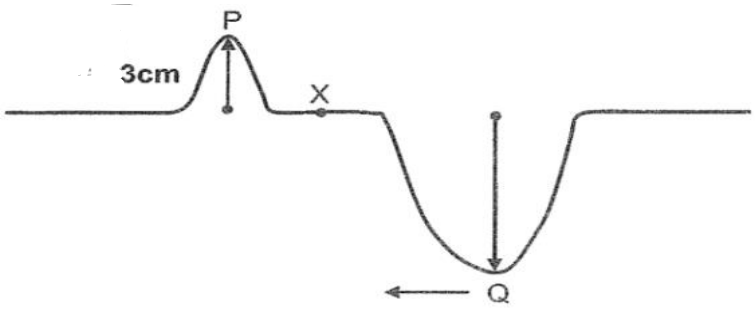
SUB TOTAL (99)

SECTION B : PHYSICS (50)

QUESTION 9 (4 X 2 = 8)

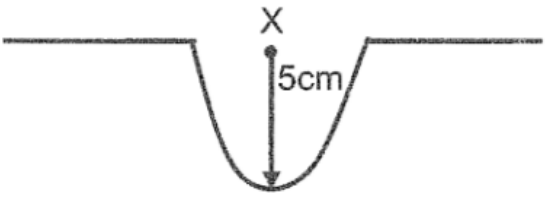
Four options are provided as possible answers to the following questions. Each question has only one correct answer.
Write only the letter (A-D) next to the question number (8.1 – 8.4) in the answer book.

9.1 The diagram below shows two pulses P and Q travelling in opposite directions in the same medium. Pulse Q is travelling to the left.



The amplitude of P is 3cm while the amplitude of Q is unknown.

The two pulses meet at point X and the resultant amplitude is shown below.



The amplitude of Q is :

A. 3 cm

B. 5 cm

C. 8 cm

D. 10 cm

9.2 Which one of the following is correct concerning sound waves?

A. as the frequency decreases so the pitch decreases

B. as the pitch increases so the amplitude increases

C. as the loudness increase so the pitch decreases

D. as the amplitude increases so the frequency decreases

9.3 Consider the following three statements concerning ultraviolet radiation

(i) it cannot travel through a vacuum

(ii) it has a longer wavelength than gamma radiation

(iii) it has a higher energy than visible light and may be harmful to humans

Which one of the following combinations is CORRECT?

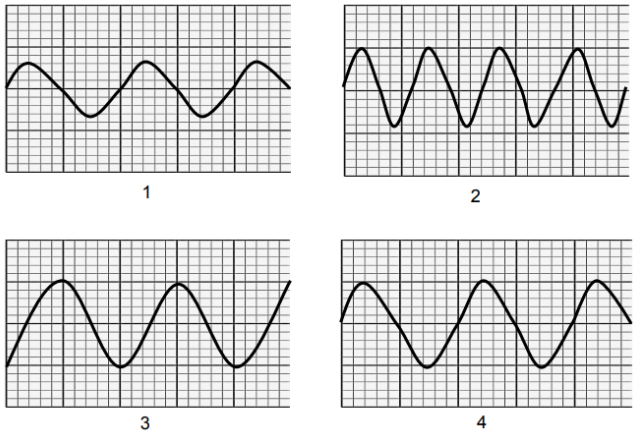
A. (i) and (ii) only

B. (ii) and (iii) only

C. (i) and (iii) only

D. (i) , (ii) and (iii)

9.4 Study the wave patterns.



Which combination is the correct representation of the wave patterns with the same pitch?

A. 1 and 2

B. 1 and 3

C. 2 and 3

D. 2 and 4

QUESTION 10 (3)

Convert the following

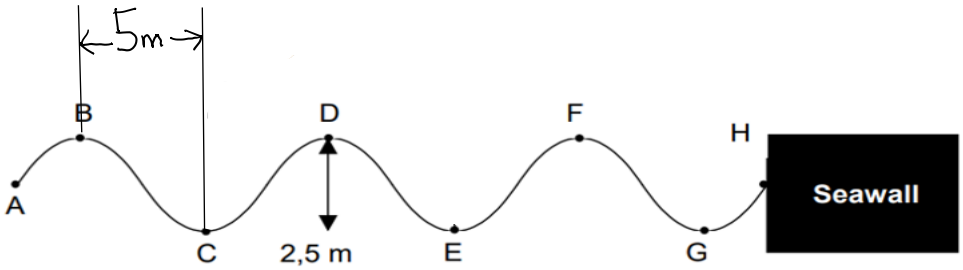
10.1 30 cm^3 → litres

10.2 5,5 x10^6 mm^2 → m^2

10.3 100 $km.h^{-1}$ → $m.s^{-1}$

QUESTION 11 (11)

The diagram below represents water waves crashing against a seawall at a harbour.
Five waves hit the sea wall every 3 seconds. The distance between a successive trough and crest is 5m. The height of the wave from crest to trough is 2,5 m.



11.1 How many complete waves are indicated in the sketch? (1)

11.2 Identify any TWO points that are in phase.
(Choose from BC or DF or DG) (1)

11.3 Show that the period of the waves is 0,6 s (2)

11.4 Calculate the

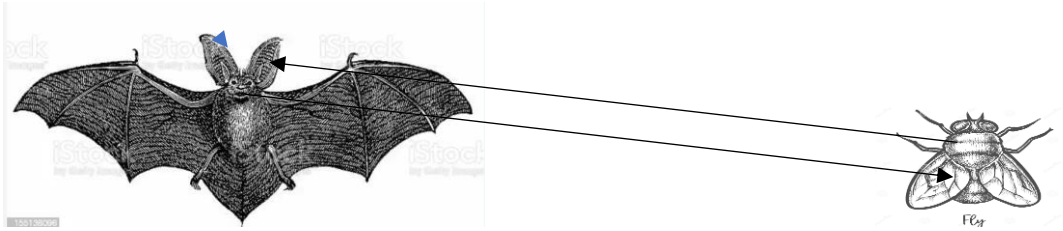
11.4.1 amplitude, (2)

11.4.2 frequency, (2)

11.4.3 velocity of the waves (3)

QUESTION 12 (9)

Bats use echo - location to navigate in the dark. They emit *ultrasonic* sound waves from their mouth which is received at their ears a short time later. This also alerts them as to how far away a food source is.



12.1 What are 'ultrasonic' waves? (2)

12.2 The ultrasonic waves transmitted by the bat have a frequency of 34 kHz. Calculate the wavelength of these waves, if the speed of sound in air is Given as 340 $m.s^{-1}$. (3)

12.3 If it takes 1,5 $x10^{-3}$ s for the sound waves to be transmitted and received by the bat, calculate how far the bat is away from the fly. (4)

QUESTION 13 (10)

13.1 How are electromagnetic waves created? (2)

Consider the two electromagnetic waves A and B below:

electromagnetic wave		frequency (Hz)	wavelength (m)
A	ultraviolet radiation	7×10^{16}	
B	radio waves		$2,5 \times 10^{-2}$

13.2 Calculate the frequency of wave B. (3)

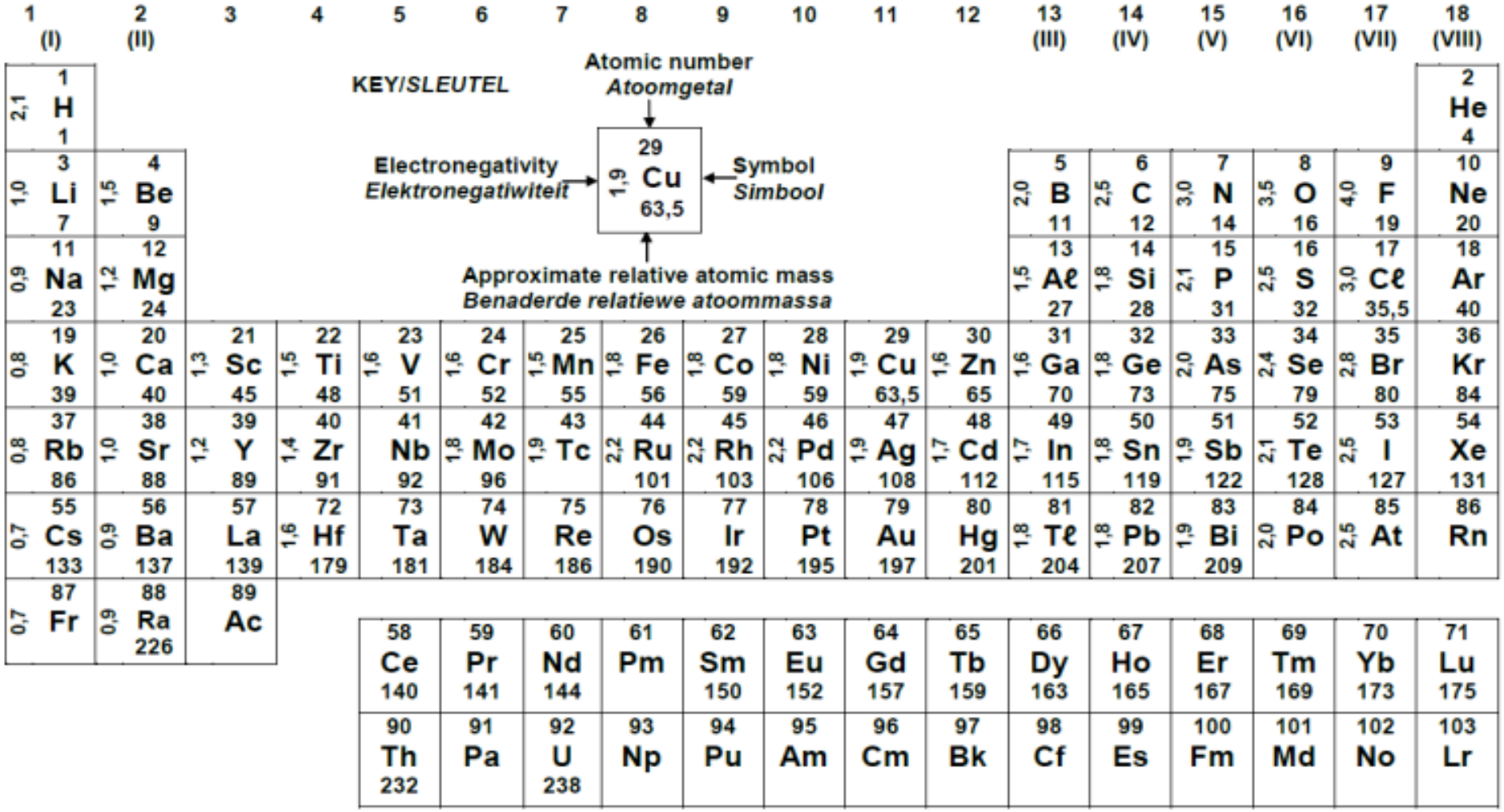
13.3 Which wave has a higher penetrating ability? Give a reason for your answer. (2)

13.4 Calculate the energy of a photon of ultraviolet radiation. (3)

SUB TOTAL (41)

TOTAL (140)

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

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	g	$9,8\ m{\cdot}s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vacuum*	c	$3,0 \times 10^{8}\ m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}\ J{\cdot}s$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*

$v = f\lambda$	$T = \frac{1}{f}$
$v = \frac{\Delta x}{\Delta t}$	$E = hf$
$c = f\lambda$	$E = h\frac{c}{\lambda}$

$n = \frac{m}{M}$	
$n = \frac{No}{NA}$	$N_A = 6.02 \times 10^{23}$
$n = \frac{V}{Vm}$	$V_o = 22.4\ dm^3$
$C = \frac{n}{V}$	