UNAM
UNIVERSITY OF NAMIBIA

SCHOOL	EDUCATION
DEPARTMENT	INTERMEDIATE AND VOCATIONAL EDUCATION
SUBJECT	NATURAL SCIENCE AND HEALTH EDUCATION 2A
MODULE CODE	E3621IN
DATE	JUNE/JULY 2026
DURATION	3 Hours
MARKS	100

SECOND OPPORTUNITY EXAMINATIONS

EXAMINER: Ms. K.K Kapikara

Moderator: Dr Motlhale Judicial Sebatana

INSTRUCTIONS TO CANDIDATE:

1. Work in an orderly way and present your work as neatly as possible.
2. Number your questions correctly and clearly.
3. This question paper consists of **13** pages, including this cover.
4. Answer **all** the questions.
5. Show all calculations clearly.
6. Use $g = 9.81\ m/s^2$ or 9.81 N/kg
7. A scientific calculator may be used.
8. Round off your final numerical answers to a minimum of TWO decimal places.
9. A periodic table is attached at the back of this paper.

Name + Surname: _____

Student No: _____

QUESTION 1 /10/

1.1 Substances can be classified as acids, bases, or neutral according to different acid–base theories.

1.1.1 Explain the difference between Arrhenius and Brønsted–Lowry theories. [4]

1.1.2 State one substance that functions as an acid and one that functions as a base under both the Arrhenius acid–base theory and the Brønsted–Lowry acid–base theory. [2]

1.2 A student states that "All strong acids are concentrated." Evaluate this statement, explaining whether it is correct or incorrect. [4]

QUESTION 2 /12/

2.1 Calcium carbonate reacts with hydrochloric acid to produce a salt and other products.

2.1.1 Write a balanced chemical equation, including state symbols, for the reaction between calcium carbonate and hydrochloric acid. [6]

2.1.2 Describe the steps you will take to obtain a pure dry sample of the salt produced. [6]

QUESTION 3 /13/

3 A student in Ms Kapikara's laboratory is required to prepare a potassium hydroxide (KOH) solution with a concentration of 1.5×10^{-4} mol/L.

3.1 Calculate the following for this solution.

3.1.1 Hydroxide ion concentration [2]

3.1.2 Hydronium ion concentration [3]

3.1.3 pH [3]

3.1.4 pOH [3]

3.2 Explain how the pH of the potassium hydroxide solution would change if the concentration of KOH is increased to 3.0×10^{-4} mol/L. [2]

QUESTION 4 /18/

4.1 Figure 1 below represents the displacement against the position of a water wave at a particular time.

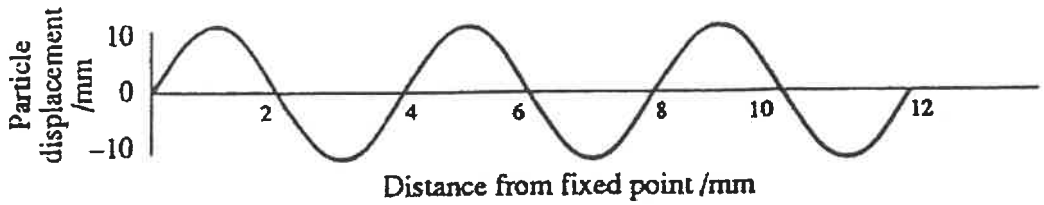

Figure 1

4.1.1 Find the amplitude [1]

4.1.2 Find the wavelength [1]

4.2 Figure 2 below represents the same water wave as in **Figure 1.**

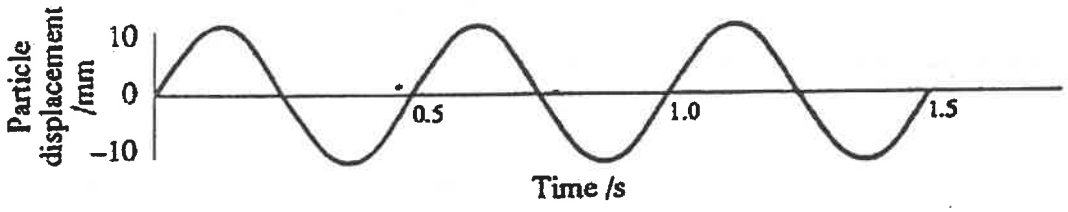

Figure 2

4.2.1 Find the amplitude [1]

4.2.2 Find the time period [1]

4.2.3 Find the frequency [3]

4.3 Figure 3 below shows a student investigating a wave on a rope. The wave has a wavelength of 2.0 m and a frequency of 4.0 Hz.

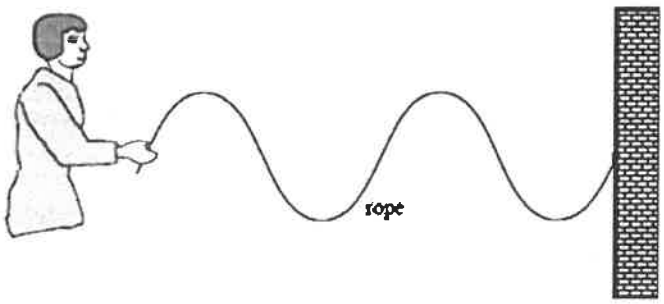

Figure 3

4.3.1 State the relationship between wave speed, frequency, and wavelength. [1]

4.3.2 Calculate the speed of the wave. [3]

4.3.3 Explain how the speed of a wave is affected if its frequency is doubled while its wavelength remains unchanged. [2]

4.3.4 Name the type of wave produced on the rope and describe the movement of the rope's particles as the wave travels along it. [3]

4.4 A student claims that sound waves can travel through space. Is this claim correct? Justify your answer. [2]

QUESTION 5 /17/

5.1 A narrow beam of white light is directed at a glass prism as shown below. The light is refracted and splits into different colours.

5.1.1 Name the property responsible for the splitting of white light in the prism. [1]

_____

_____

5.1.2 List the colours of the visible spectrum in order of increasing wavelength. [3]

_____

_____

5.2 The table below gives the wavelength of an ultraviolet wave and three other electromagnetic waves.

	Ultraviolet	Wave E	Wave F	Wave G
Wavelength in nanometres	300	0.1	600	100 000

Table 1

5.2.1 Draw one line from each wave to the name of the wave in **Figure 4.** [3]

Wave	Name
Wave E	Infrared
Wave F	Visible light
Wave G	X-rays

Figure 4

5.3 Figure 5 shows an object near a convex lens.

5.3.1 Complete the ray diagram to show how the image is formed. Use an arrow to represent the image. [6]

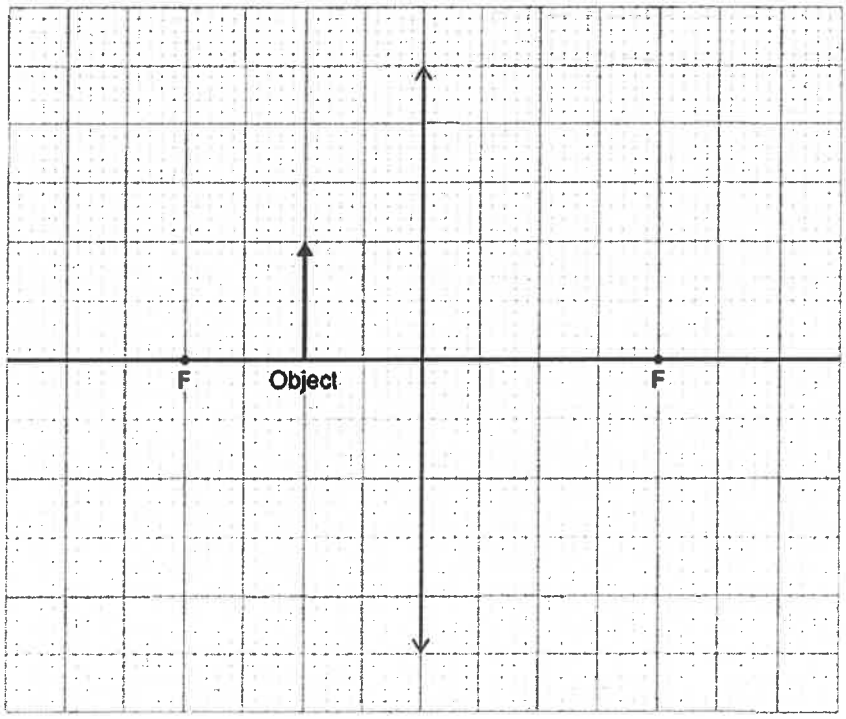

Figure 5

5.3.2 State any four properties of the image formed by this lens. [4]

QUESTION 6 /10/

6.1 State Hess's Law [2]

6.2 Describe, in terms of energy changes, why bond breaking is considered endothermic and bond making is considered exothermic. [4]

6.3 Draw and label energy profile diagrams for both an endothermic reaction, clearly showing the activation energy and overall energy change. [4]

QUESTION 7 /10/

7.1 The collision theory explains why chemical reactions occur and why they take place at different rates. Some of the terms used in collision theory and reaction rate are given below:

surface area; catalyst; effective collision; activated complex; products; concentration; temperature; heat of reaction; activation energy; reactants

Give ONE term for each of the following descriptions by choosing a term from the list above.

7.1.1 A chemical substance that speeds up the rate of a chemical reaction by lowering the activation energy. [1]

7.1.2 A collision in which the reacting particles have sufficient kinetic energy to react and the correct orientation. [1]

7.1.3 The factor responsible for increasing the rate of a reaction when a solid is broken up into smaller pieces. [1]

7.1.4 The temporary unstable state that is formed during the course of a chemical reaction. [1]

7.2 Outline how light can provide the energy needed for certain chemical reactions to occur and give an example of a reaction where this is the case. [3]

7.3 Discuss how a catalyst can impact the rate of a chemical reaction according to the collision theory. [3]

QUESTION 8 /10]

8.1 Define the term pressure and state its formula. [2]

8.2 Rank the following from highest pressure to lowest pressure upon the ground: [4]

- The atmosphere at sea level
- A 7000-kg elephant with total area 0.5 m^2 in contact with the ground
- A 65-kg lady in high heels with total area 0.005 m^2 in contact with the ground
- A 1600-kg car with a total tire contact area of 0.2 m^2

8.3 A fisherman with a mass of 75 kg sits on a four-legged chair with a mass of 5 kg. Each leg of the chair has a contact area of $2.5\times10^{-4}\ m^2$ with the ground. Calculate the pressure exerted on the ground by the fisherman and the chair combined. [4]

-END-

DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35,5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	88 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Telurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Cesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thellium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

*58-71 Lanthanoid series
90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60
Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63
157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66
165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69
173 Yb Ytterbium 70	175 Lu Lutetium 71	
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92
Np Neptunium 93	Pu Plutonium 94	Am Americium 95
Cm Curium 96	Bk Berkelium 97	Cf Californium 98
Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101
No Nobelium 102	Lr Lawrencium 103	

Key: a / X / b
a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).