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COMBINED SCIENCE

PAPER 3 3102/3

Tuesday **6 JUNE 2023** 9:00 A.M.–10:30 A.M.

Additional materials:
Graph paper

MINISTRY OF EDUCATION NATIONAL EXAMINATIONS

BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

INSTRUCTIONS AND INFORMATION FOR CANDIDATES

Do not open this booklet until you are told to do so.

Write your school number, candidate number, surname and initials in the spaces provided on this question booklet.

Answer **ALL** questions in **Section A** (1 – 4) in the spaces provided.

Answer **ANY** two (2) out of the three [3] questions from **Section B** on the lined pages provided in this booklet.

Candidates are advised to spend no more than 35 minutes on **Section A**.

The number of marks is given in brackets [] at the end of each question or part question.

A copy of the Periodic Table is printed on page 2.

Calculators are permitted, however, **NO** graphing calculators are allowed.

For Examiner's Use	
SECTION A	
1	
2	
3	
4	
SECTION B	
5	
6	
7	
TOTAL	

This question paper consists of **15** printed pages, **4** lined pages and **1** blank page.



The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
1 H Hydrogen 1																	
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	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	96 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 Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 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 Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86
87 Fr Francium	226 Ra Radium 88	227 Ac Actinium 89															

a

X

b

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

*58-71 Lanthanoid series
†90-103 Actinoid series

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71	103 Lr Lawrencium	102 No Nobelium	100 Fm Fermium	101 Md Mendelevium	85 At Astatine	86 Rn Radon
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SECTION A

Answer **ALL** questions in this Section.

1. The diagrams shows a type of white blood cell defending the human body against an infection.

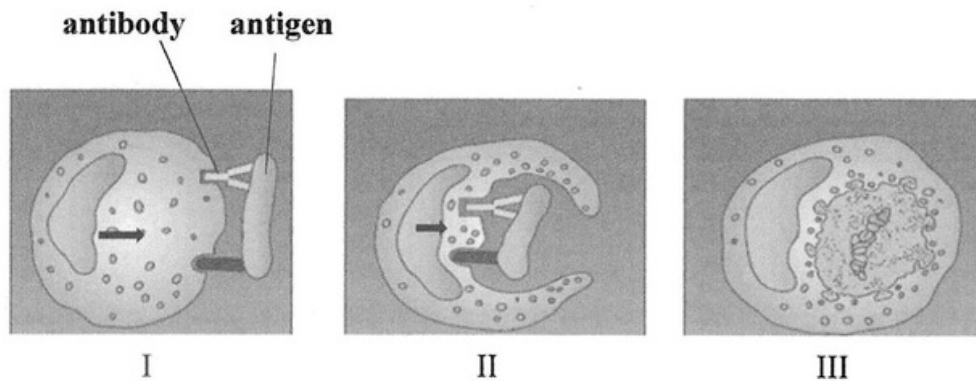


Fig. 1.1

- (a) Name the type of white blood cell shown in the diagrams.

_____ [1]

- (b) The diagrams show an **antigen** interacting with an **antibody**.

Define the terms **antigen** and **antibody**.

antigen _____

_____ [1]

antibody _____

_____ [1]



- (c) Describe the process occurring in each diagram.

I _____

II _____

III _____

[3]

- (d) Describe how the production of antibodies results in immunity.

[2]

- (e) Explain why patients who have had an organ transplant, need to be continuously treated with immunosuppressant drugs.

[2]

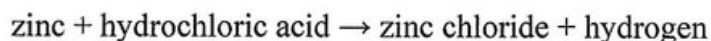
TOTAL MARKS [10]



2. A student investigates the reaction between excess zinc powder and dilute hydrochloric acid. The volume of the gas produced is measured at intervals and recorded in the table shown.

Time/s	0	10	20	30	40	50	60
Volume of hydrogen gas/cm³	0	18	38	60	74	80	80

- (a) (i) The word equation for this reaction is:



Write the balanced symbol equation for this reaction.

_____ [2]

- (ii) Describe the test and the positive result that show that the gas produced is hydrogen.

Test: _____

Positive result: _____

_____ [2]

- (iii) Explain why it is better to use zinc powder and not lumps of zinc in the experiment.

_____ [2]

- (iv) Explain why the last two gas readings remain constant.

_____ [1]



- (b) The student also investigates the effect of concentration on the rate of reaction. Different concentrations of acid are used and the time taken for the reaction to complete is recorded. The results obtained are plotted in the graph.

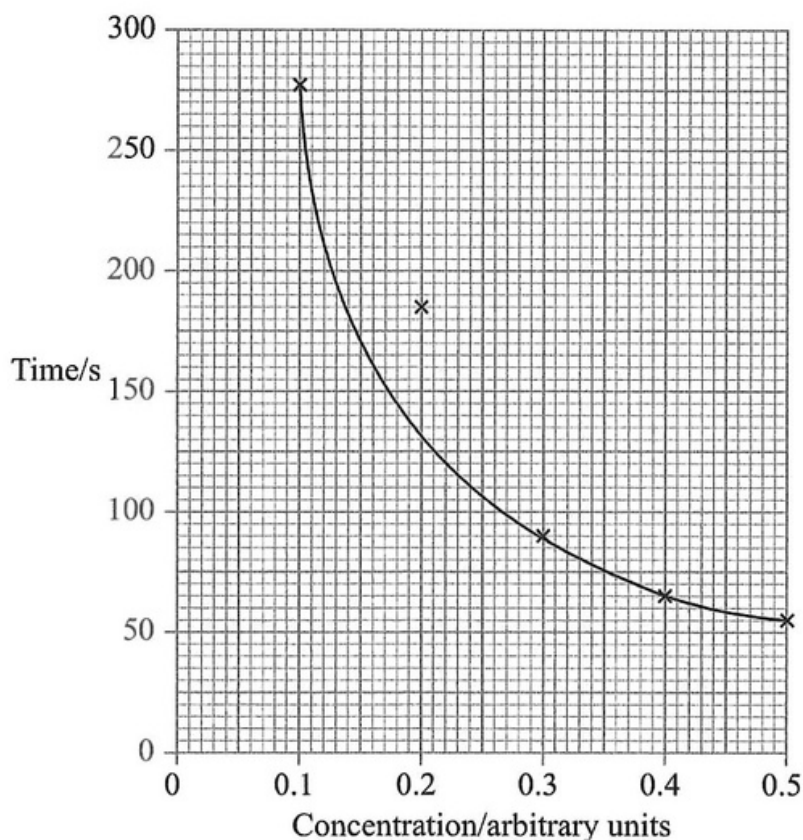


Fig. 2.1

- (i) One of the times obtained is an anomalous result. The acid is in excess in this reaction. The temperature and the size and mass of zinc remain constant in the investigation.

Suggest **one** possible error that the student may have made to produce this anomalous result.

[1]

- (ii) Describe the effect of increasing acid concentration on the rate of this reaction.

[2]

TOTAL MARKS [10]

[Turn over]



3. The diagram shows an electrical circuit.

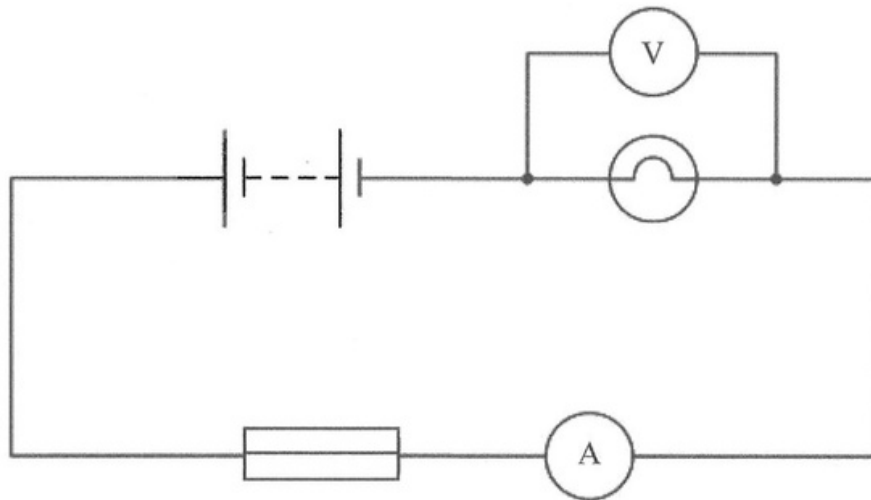
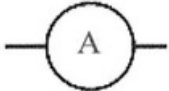


Fig. 3.1

- (a) Give the name and function of the electrical symbols shown in the table.

component	name	function
		
		
		
		

[4]



The diagram shows an electrical circuit.

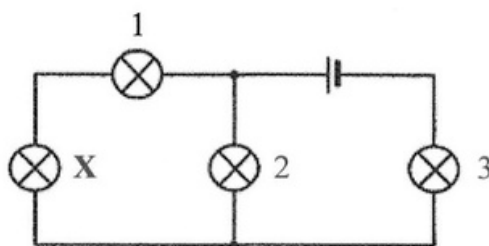


Fig. 3.2

- (b) (i) Name the type of circuit shown.

_____ [1]

- (ii) Lamp X blows and breaks the circuit.

Describe what happens to lamps 1, 2 and 3.

Lamp 1 _____

Lamp 2 _____

Lamp 3 _____ [3]

- (c) Calculate the current flowing through a 10Ω resistor when 5V is applied across it.
Show your working.

[2]

TOTAL MARKS [10]

[Turn over]

4. The diagram shows a section through a flower.

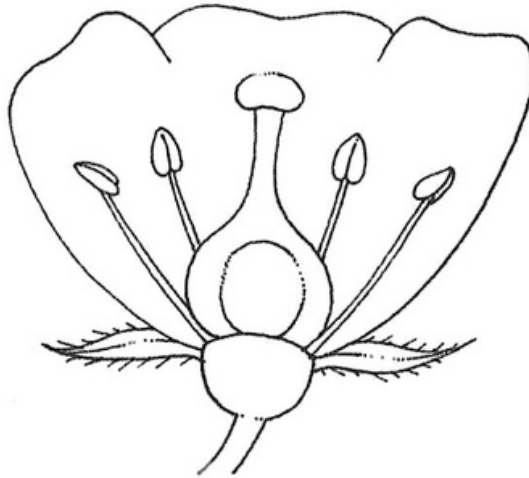


Fig. 4.1

- (a) Define the term pollination.

_____ [1]

- (b) (i) On the diagram draw a line to show where pollination takes place and label the line **Y**. [1]

- (ii) Describe the difference between cross-pollination and self-pollination.

_____ [2]

- (iii) Name the structure in the flower that produces the male gametes.

_____ [1]



- (c) (i) List **two** agents of pollination.

1 _____

2 _____

[2]

- (ii) State the most likely agent of pollination for this flower in **Fig. 4.1**.

_____ [1]

- (iii) Using the diagram, state **two** features that indicate the agent of pollination for the flower in **Fig. 4.1**.

1 _____

2 _____

[2]

TOTAL MARKS [10]

SECTION B

Answer any **TWO** questions in this section.

5. This question is about the Earth's crust, extraction and use of metals.

The table shows the percentage abundance of some elements in the Earth's crust.

Name of Element	Symbol of Element	Percentage abundance (%)
Oxygen	O	46.1
Silicon	Si	28.2
Aluminium	Al	8.0
Iron	Fe	5.0
Calcium	Ca	3.6
Sodium	Na	3.0
Magnesium	Mg	2.1
Potassium	K	2.0
Titanium	Ti	0.5
Hydrogen	H	0.5
Other elements		_____

- (a) Using the information given in the table:
- determine the percentage abundance of the **other elements** present in the Earth's crust. (Show working.) [2]
 - construct a bar chart of the percent composition of elements in the earth's crust. [4]
- (b) Brass is an alloy of copper and zinc. Suggest **two** reasons why brass is used in preference to copper. [2]
- (c) Aluminium is extracted from its ore using electrolysis.
- Suggest why electrolysis is used for the extraction of aluminium from its ore and not the blast furnace. [1]
- (d) State **two** reasons why aluminium is used in the manufacture of airplanes. [2]



- (e) Iron is extracted from iron ore using the blast furnace.

Chemical reactions occurring in the blast furnace result in the formation of carbon dioxide, carbon monoxide and iron.

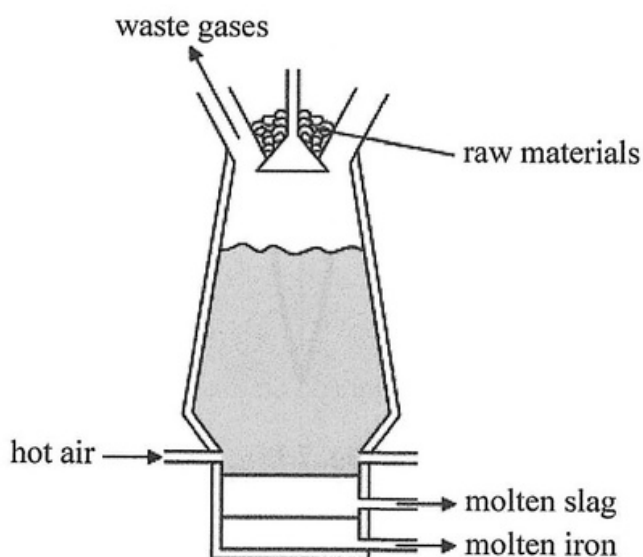


Fig. 6.1

- (i) State the chemical name of the iron ore. [1]
- (ii) Name **two** other raw materials needed for the extraction process. [2]
- (iii) Suggest why hot air is blown into the furnace. [1]
- (iv) Identify the impurity in the extraction process. [1]
- (v) Use the diagram to:
- explain how carbon monoxide forms in the extraction process. [2]
 - describe how iron forms from the iron ore in the extraction process. [2]

TOTAL MARKS [20]

[Turn over

6. (a) **Fig. 7.1** shows the lens, the object and the two principal focuses F_1 and F_2

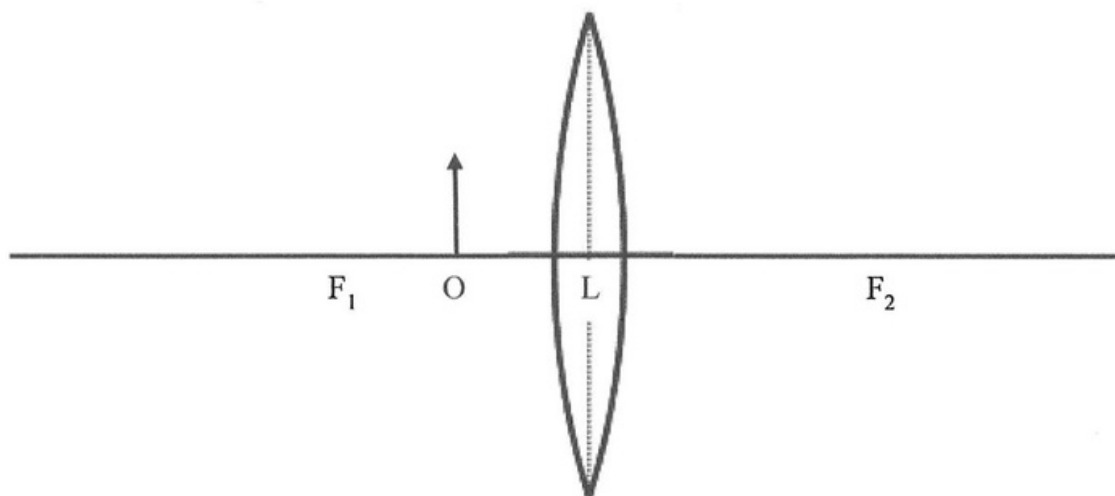
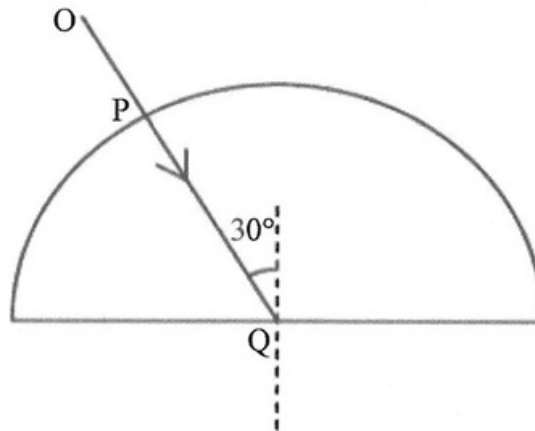


Fig. 7.1

- (i) Identify the type of lens shown in the diagram. [1]
- (ii) Name the line drawn on the diagram that includes points F_1 , F_2 , O and L. [1]
- (iii) On the diagram, use a ruler to accurately construct the position of the image.
Show how you construct your ray diagram and how light appears to come from this image to produce a refracted ray. [5]
- (iv) The image is virtual. Describe a virtual image. [1]
- (v) Name the optical instrument that produces this kind of refracted ray. [1]
- (vi) Give **two** characteristics of the image that is formed by the lens in the human eye. [2]
- (vii) Describe how the object and the lens are positioned to produce a real image which is smaller than the object. [2]



- (b) The diagram shows a light ray **OPQ** passing through a semi-circular glass block.



- (i) Explain why there is no change in the direction of the ray at **P**. [1]
- (ii) Describe the changes, if any that occur to the **speed, wavelength** and **frequency** of the light as it enters the glass block. [3]
- (c) A person has an eye defect called short-sightedness.
- (i) Explain what happens in the eye when a person is shortsighted. [1]
- (ii) Identify the lens used to correct for this defect and briefly describe how the lens works to correct the defect. [2]

TOTAL MARKS [20]



7. The diagram represents a type of wetland ecosystem found in The Bahamas.

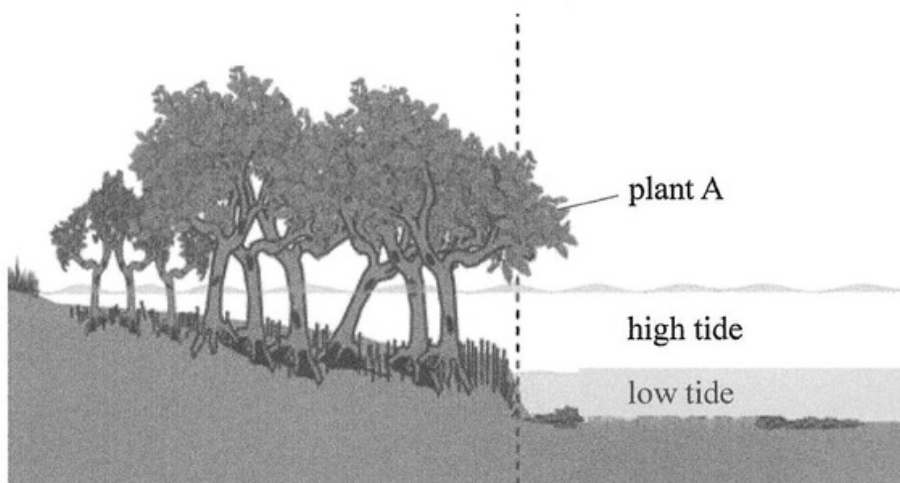


Fig. 5.1

- (a) Define the term ecosystem. [2]
- (b) (i) Name the ecosystem shown in the diagram and describe **three** ways in which this ecosystem is important to the Bahamian environment. [4]
- (ii) Describe **three** activities of man which can damage and destroy this ecosystem. [3]
- (c) (i) Name plant A. [1]
- (ii) Describe the roots of this plant and explain how they adapt the plant to this ecosystem. [2]
- (iii) Name **two** other plants that are found in this ecosystem. Describe **two** adaptations for **each** plant. [6]
- (iv) State **two** abiotic environmental conditions that affect organisms living in this ecosystem. [2]

TOTAL MARKS [20]



Question

Write on both sides of the paper

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