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COMBINED SCIENCE

PAPER 3 3102/3

Wednesday **5 JUNE 2024** 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.

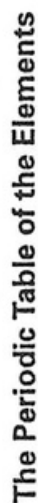
The number of marks is given in brackets [] at the end of each question or part question.

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 16 printed pages and 4 lined pages.



Group

I	II	III	IV	V	VI	VII	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
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
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
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44
133 Cs Cesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	Re Rhenium 75	190 Os Osmium 76
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89					

*58-71 Lanthanoid series

†90-103 Actinoid series

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

Key

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

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

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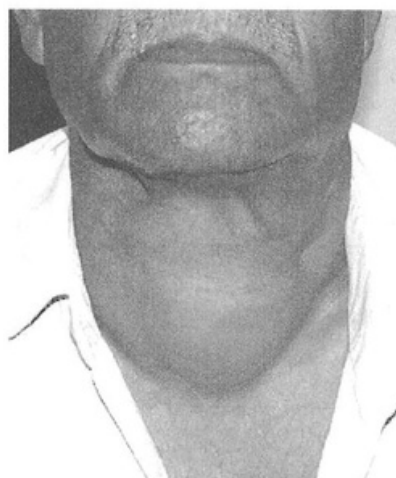
SECTION A

Answer **ALL** questions in this Section.

1. The pictures show two symptoms of deficiency diseases.



Picture A



Picture B

- (a) In Table 1.1, write the name of the deficiency disease shown in pictures A and B and the nutrient that is lacking.

Table 1.1

	Picture A	Picture B
Deficiency disease		
Nutrient lacking		

[2]

- (b) Scurvy is another deficiency disease. State the cause and give one symptom of this disease.

Cause _____

Symptom _____

[2]

- (c) Define the term balanced diet.

[2]

[Turn over



- (d) Suggest the name of the condition caused when a person is overweight and eats more food than required for normal activities.

_____ [1]

- (e) About two thirds of the world's population suffers from malnutrition.

Define malnutrition and suggest **one** solution on how to get rid of food shortage.

Definition: _____

Solution: _____

[3]

TOTAL MARKS [10]



2. A student used the apparatus set-up in Fig. 2.1 to investigate the effect of increasing the concentration on the rate of reaction.

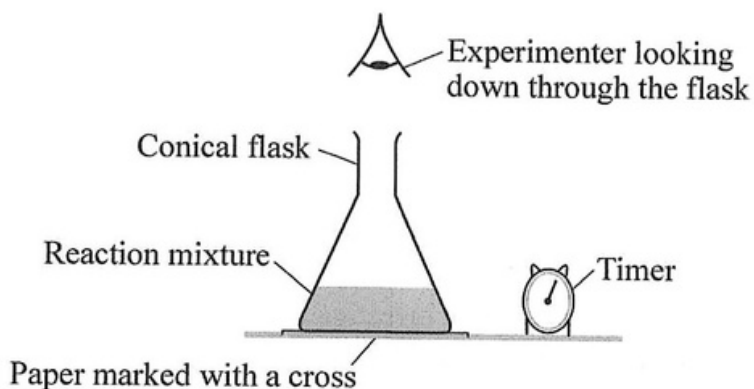


Fig. 2.1

The student uses 10 cm^3 of hydrochloric acid and the following volumes of sodium thiosulphate and distilled water.

The time taken for the sulphur precipitate to form and make the cross disappear from view is measured and recorded.

Table 2.1

Experiment	1	2	3
Volume of sodium thiosulphate/ cm^3	10	20	
Volume of water added/ cm^3	40	30	
Time taken for cross to disappear/s	56	28	

- (a) (i) In experiment 3 the student wanted the concentration of the sodium thiosulphate to be double the concentration used in experiment 2.

Complete Table 2.1 to show the **volumes** which should be used and the expected **time** taken for the cross to disappear from view in experiment 3. [2]

- (ii) In terms of particles and collisions, explain the effect of increasing the concentration of sodium thiosulphate on the rate of reaction.

[3]

- (b) In another experiment a student investigated the effect of a catalyst on the rate of reaction using the apparatus shown in Fig. 2.2

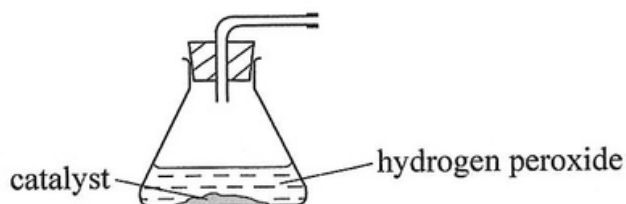
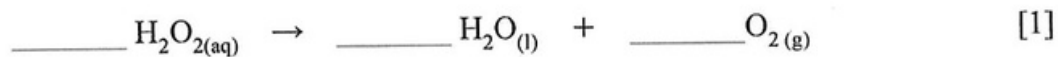


Fig. 2.2

The student uses 50 cm^3 of hydrogen peroxide and 1.0 g of the catalyst manganese(IV) oxide.

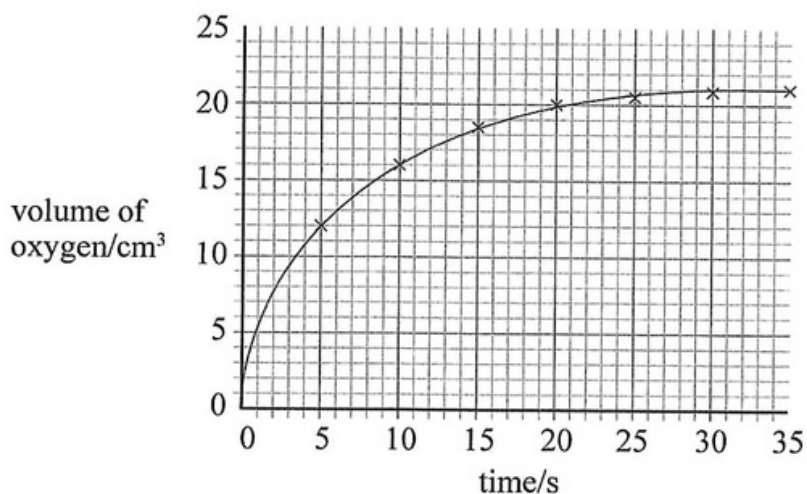
In the reaction, hydrogen peroxide decomposes to produce water and oxygen.

- (i) Place the correct numbers in the blanks to balance the chemical equation showing the decomposition of hydrogen peroxide.



The volume of oxygen given off in the reaction was measured at intervals.

The graph shows the results.



- (ii) Using information from the graph describe the changes in the rate of the reaction from 0 to 15 seconds and 20 to 35 seconds.

- Changes in the rate of the reaction from 0 to 15 seconds

- Changes in the rate of the reaction from 20 to 35 seconds

[2]

- (iii) Explain how a catalyst increases the rate of a reaction.

[2]

TOTAL MARKS [10]

3. This question is about major sources of energy and alternative energy sources.

(a) Define the term non-renewable source of energy.

_____ [1]

(b) Fossil fuels are examples of non-renewable sources of energy. The use of fossil fuels have resulted in the greenhouse effect.

Describe the greenhouse effect.

_____ [3]

(c) Natural resources can be used as alternative sources of energy.

Identify the alternative source of energy for each description:

Energy from the sun _____

Energy from the nucleus _____
of an atom

Heat energy from the earth _____

Energy due to flowing water _____

[4]



- (d) Wind energy has been proposed as an alternative source of energy for The Bahamas.

State **one** advantage and **one** disadvantage of using wind energy as a main source of energy.

- Advantage _____

- Disadvantage _____

[2]

TOTAL MARKS [10]

4. Janae spilt some hydrochloric acid on the lab desk. She looked at the possibility of neutralising it with one of five chemicals. The properties of these chemicals are summarised in Table 4.1.

Table 4.1

Chemical	pH	Reaction with acid
A	1	None
B	7	None
C	4	None
D	13	Produces a salt and water
E	8	Produces a salt, water and carbon dioxide

- (a) Explain the meaning of the term neutralise.

_____ [2]

- (b) (i) Explain why chemical A would not be suitable for neutralising the hydrochloric acid on the lab desk.

_____ [1]

- (ii) State the chemical you would recommend Janae to use to neutralise the acid spilled on the desk.

Give a reason for your answer,

Chemical _____ [1]

Reason _____

_____ [1]



- (c) State the colour of universal indicator in chemical **B**, chemical **C** and chemical **E**.

chemical **B** _____

chemical **C** _____

chemical **E** _____

[3]

- (d) Write the formula of the ion responsible for the acidic and alkaline properties of a substance.

Acidic _____

Alkaline _____

[2]

TOTAL MARKS [10]

SECTION B

Answer **any** two out of the three questions on the lined pages at the end of this booklet.

5. Fig 5.1 shows a villus.

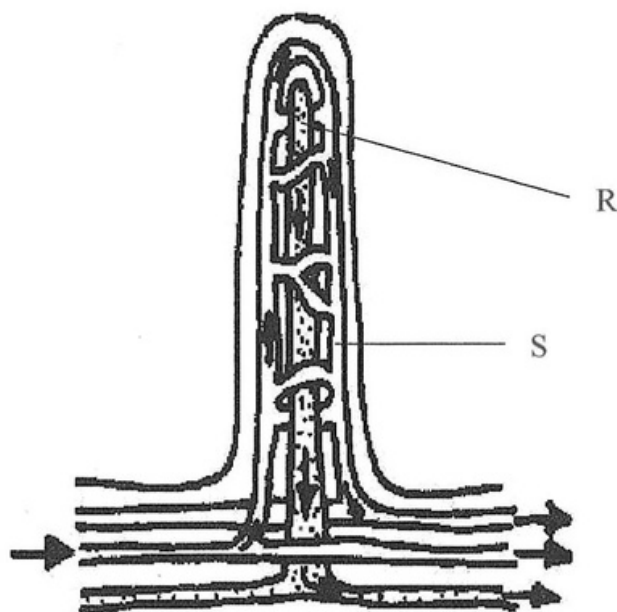


Fig 5.1

- (a) (i) Name the part of the digestive system where the villus is found. [1]
- (ii) Explain why it is important to have a large number of villi. [2]
- (b) Digested substances are absorbed into the vessels labelled R and S.
- Identify:
- two substances absorbed in vessel R.
 - two substances absorbed in vessel S.
- [4]
- (c) Chemical reactions which are vital to life could not take place quickly without the use of enzymes.
- (i) Define the term enzyme. [1]



- (ii) Complete Table 5.1 to show an enzyme associated with the digestion of protein and fat.

Table 5.1

Substance Digested	Enzyme
Protein	
Fat	

[2]

- (iii) A substance produced in the liver works along with the enzyme to aid in the digestion of fat.

Name the substance and explain why it is needed to help with the digestion of fat.

[3]

- (d) Six test-tubes containing a mixture of starch and amylase in water are kept at different temperatures. The time taken for the starch to be broken down was measured.

The results are shown in the Table 5.2.

Table 5.2

Test-tube	Temperature/°C	Time it takes for starch to be digested/minutes
1	15	32
2	20	18
3	30	7
4	35	3
5	40	10
6	50	35

- (i) Plot a line graph using the data shown in Table 5.2. [4]
- (ii) State the temperature at which starch is broken down the fastest. [1]
- (iii) Describe the relationship between temperature and the rate of starch digestion. [2]

TOTAL MARKS [20]

[Turn over]

6. This question is about the effects of forces and energy.

A student conducts the experiment illustrated in Figure 6.1. A 4 kg ball is dropped from Position P, which is 50 metres above the ground at Position Q.

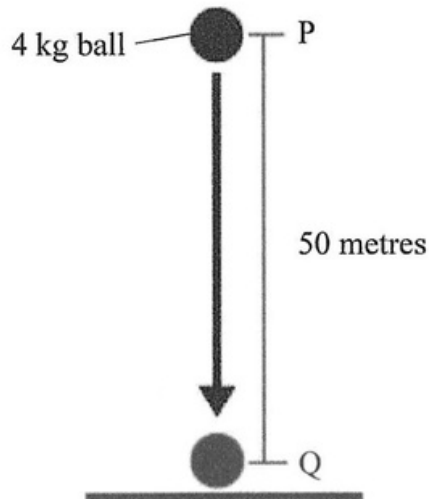


Fig. 6.1.

- (a) Define energy. [1]
- (b) State the kinetic energy of the ball when it is held at P. [1]
- (c) Ignoring air resistance,
 - (i) Name the force which acts on the ball after it is released. [1]
 - (ii) Calculate the magnitude of this force.
(Formula and working must be shown.) [2]
 - (iii) Calculate the work done by the force in (c) (ii) as the ball falls from P to Q.
(Formula and working must be shown.) [2]
- (d) Calculate the gravitational potential energy of the ball at P.
(Formula and working must be shown.) [2]
- (e) Assuming no energy losses during the fall,
 - (i) State the kinetic energy of the ball just before it hits the ground at Q. [1]
 - (ii) Calculate the speed of the ball just before it hits the ground at Q.
(Formula, working and correct units must be shown.) [4]



- (iii) In an experiment, energy losses occur.

State two ways in which energy can be lost from the ball when it is dropped.

[2]

- (f) The student conducts further experiments and determines that air resistance is significant and exerts an opposing force of 1.5 N on the ball.

- (i) Determine the acceleration of the falling ball when 1.5 N of air resistance acts on it.

(Formula, working and correct units must be shown.)

[3]

- (ii) Suggest how the presence of air resistance would affect the magnitude of the kinetic energy of the ball.

[1]

TOTAL MARKS [20]



7. A student carried out an experiment to determine the degree of softness and hardness of five different water samples. The results obtained are recorded in Table 7.1.

Table 7.1

Water Sample	Volume of soap solution needed to give a good lather/cm ³	
	Before boiling	After boiling
A	12	7.5
B	9.0	1.0
C	0.5	0.5
D	3.5	0.5
E	12.5	11.5

- (a) (i) Identify the water sample that shows the greatest degree of hardness. Give a reason for your answer. [2]
- (ii) Water can be temporarily or permanently hard. Suggest which water sample has water that is temporarily hard. Give a reason for your answer. [2]
- (iii) Discuss the impact detergent would have on hard and soft water. [1]
- (b) Describe a test that can be used to confirm the water sample is pure. State the positive result of the test for pure water. [2]
- (c) The natural sources of water hardness are dissolved mineral compounds from rocks.
- (i) Drinking hard water has health benefits. State one health benefit of drinking hard water. [1]
- (ii) Name two metal ions responsible for permanent hardness of water. [2]
- (iii) Name and describe a physical method used to remove dissolved minerals from water. [3]
- (iv) Seawater is not used for drinking. Suggest why. [1]
- (d) (i) Two processes used in the purification of water for drinking are filtration and chlorination. Explain why drinking water is filtered and treated with chlorine. [2]
- (ii) Anhydrous copper(II) sulphate can be used in a test for water. State **one** observation made when water is added to anhydrous copper(II) sulphate. [1]
- (e) Give **one** main use of water in the home. [1]
- (f) The concentration of nitrogen and oxygen in the atmosphere is stable at 78% and 20 – 21% respectively. The concentration of water vapour in the air is variable. Suggest a reason why the amount of water vapour in the air can vary. [2]

TOTAL MARKS [20]



End]

Question

Write on both sides of the paper

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