Name	Class	Index Number

ANG MO KIO SECONDARY SCHOOL
MID YEAR EXAMINATION 2017
SECONDARY TWO EXPRESS

SCIENCE

SECTION A & C

Total Mark: 10002 May 2017 / Tuesday

Setter: Mr Pang Ronnie

2 hours

Additional Materials: OTAS Paper, Writing Papers

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this paper.
You may use a soft pencil for any diagrams, graphs or rough working.
You should show the essential steps in any calculations.
No marks will be awarded for answers that are NOT clearly shown.
Do **not** use paper clips, highlighters, glue or correction fluid/tape.

Section A
Answer **all** the questions in Section A on the OTAS paper provided. Write your name, class and index number on the OTAS paper in the spaces provided. **Use only 2B pencil on the OTAS paper.**

Section B
Answer **all** the questions in Section B in the spaces provided on the question paper. **Additional papers attached will not be marked**.

Section C
Answer any **4 out of 5** questions. Begin each question on a **FRESH** page of the writing paper.

Hand in the OTAS, Section A & C, Section B and Section C answers separately.

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 19.

	For Examiner's use	
	Section A	
	Section B	
	Section C	
	TOTAL	

This document consists of **19** printed pages, including the cover page.

[Turn over]

Section A: Multiple-Choice Questions (30 marks)
For each of the questions, four suggested answers are given. You are to choose the most appropriate ONE and indicate your answer on the OTAS sheet provided.

1. Which is **not** an abiotic factor that affects the environment an organism lives in?

   A predation
   B temperature
   C soil pH
   D water availability

2. Joel grew some Kang Kong in his school's Ecogarden. He chose a plot of land which received a good amount of sunlight. To ensure that his Kang Kong grew well, he watered them daily and pulled out weeds and removed pests on a weekly basis. On a monthly basis, he added mineral salts to the soil.

   Which of the following correctly identifies the biotic and abiotic factors mentioned?

	Biotic Factors	Abiotic Factors
A	mineral salts	water
B	sunlight	pest
C	weeds	sunlight
D	water	mineral salts

3. Which of the following does **not** threaten biodiversity?

   A increase in human population
   B reforestation
   C mining for precious stones
   D acid rain

4. How can farm land be used to transfer the greatest amount of energy to humans?

   A By growing plant crops for people to eat.
   B By keeping cows to provide cheese and milk.
   C By using half the land for growing crops and the half for cattle ranching.
   D By keeping cows to provide meat.

5. Which of the following best describes ecology?

A The study of the interactions of organisms with one another and its environment.
B The study of the abiotic factors that affect the populations of the organisms.
C The study of how organisms are dependent on one another.
D The study of how to conserve our environment.

6. A special type of ants live in the hollowed-out thorns and act as a defense mechanism for the Acacia tree, protecting it against predators that may come into contact with it. In return, the tree supplies the ants with food. If the tree is under attack, the aggressive ants rush out in great numbers to swarm the enemy.

What relationship is shown in the above?

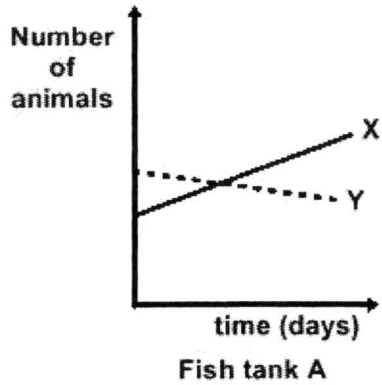
A commensalism
B mutualism
C parasitism
D predator-prey

7. Living organisms transfer their energy from one to another in a food chain through _____.

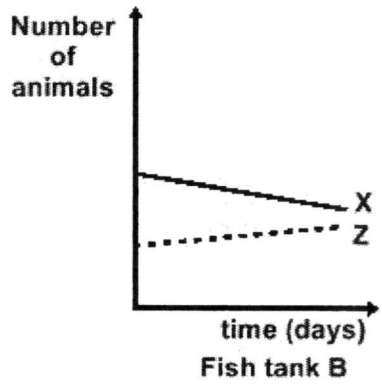
A decomposition
B feeding
C photosynthesis
D respiration

8. Sam collected three different kinds of animals, **X**, **Y** and **Z**, from a pond and put them into two fish tanks, **A** and **B**. He put animals **X** and **Y** into fish tank **A** and animals **X** and **Z** into fish tank **B**. He placed in the same amount of aquatic plants into each tank. Out of the 3 animals; **X**, **Y** and **Z**, there is one herbivore and two carnivores.

He counted the number of animals in each fish tank every day for a week and plotted his findings in the graphs below. He did not notice any dead animals in both fish tanks. The relationship between animals **X**, **Y** and **Z** are shown in the two graphs below.



Fish tank A



Fish tank B

From the information given above, which of the following food chains **most likely** shows the relationship between animals **X**, **Y** and **Z**?

A Aquatic Plant → **X**→**Y** → **Z**
B Aquatic Plant → **Y** → **X** → **Z**
C Aquatic Plant → **Z** → **X** → **Y**
D Aquatic Plant → **Z** → **Y** → **X**

9. Which of the following particles has the lowestrelative mass?

A atom
B electron
C neutron
D proton

10. An atom of element **X** contains four electrons less than that of a calcium atom. The atoms of element X are electrically neutral. Which of the following represents this element?

A oxygen
B chlorine
C sulfur
D argon

11. Which pair of elements have the same number of electrons in their outermost shells?

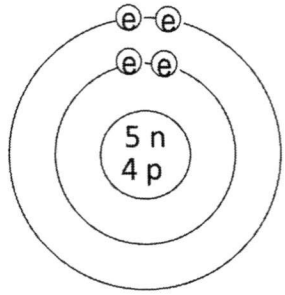
A carbon and phosphorus

B potassium and magnesium

C aluminium and tin

D oxygen and sulfur

12. The diagram below represents an atom of an element.



key
e= electron
n= neutron
p= proton

Which symbol represents this atom?

A $^{4}_{9}F$

B $^{13}_{8}O$

C $^{9}_{4}Be$

D $^{9}_{8}B$

13. The table shows the number of protons, neutrons and electrons in atoms of four elements that can be found in the Periodic Table on page 19.
Which of the following shows the correct number of protons, neutrons and electrons in each atom?

	atom	number of sub-atomic particles		
		protons	neutrons	electrons
A	B	5	6	5
B	F	9	9	9
C	P	15	16	16
D	Ca	20	40	20

14. Elements **X**, **Y** and **Z** are in the same period of the Periodic Table. **X** is a metal, **Y** is chemically unreactive and **Z** has a low boiling point.

What is the order of **X**, **Y** and **Z** in increasing proton number?

	increasing proton number →		
A	Y	Z	X
B	Z	Y	X
C	X	Z	Y
D	Y	X	Z

15. Manganese exists as two isotopes, $^{55}_{25}Mn$ and $^{57}_{25}Mn$.

A Mn-57 has 2 more protons than Mn-55.
B Mn-57 has 2 more electrons than Mn-55.
C Mn-57 has 2 more neutrons than Mn-55.
D Mn-57 has 2 more protons and neutrons than Mn-55.

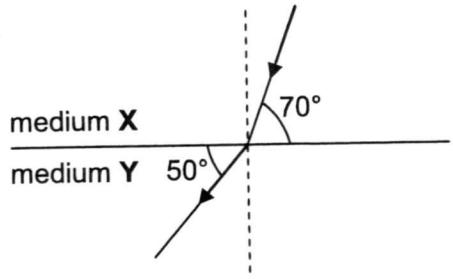
16. Which of the following statements about an atom is **incorrect**?

A The number of proton is greater than the number of electron.
B The nucleon (mass) number can be equal or greater than the proton number.
C The overall charge of an atom is zero.
D It is possible for an atom to have no neutrons.

17. Which of the following does **not** have the same electronic configuration as argon?

A Cl^- **B** K^+
C Na^+ **D** S^{2-}

18. The diagram below shows how a ray of light travels from medium **X** to medium **Y**. Refer to it and answer questions **18** and **19**.



What are the values for the angle of incidence and the angle of refraction?

	Angle of Incidence	Angle of Refraction
A	20°	40°
B	20°	50°
C	70°	40°
D	70°	50°

19. Which of the following correctly explains why the light bends when it travels from medium **X** to medium **Y**?

A The light slows down as it is going from the optically denser medium **X** to the optically less dense medium **Y**.

B The light slows down as it is going from the optically less dense medium **X** to the optically denser medium **Y**.

C The light speeds up as it is going from the optically denser medium **X** to the optically less dense medium **Y**.

D The light speeds up as it is going from the optically less dense medium **X** to the optically denser medium **Y**.

20. Which one of the following shows that light travels in straight lines?

A A black object absorbs all the light.
B An opaque object scatters light.
C An opaque object forms a shadow when light falls on it.
D In a thunderstorm, we can see the lightning first before hearing the thunder.

21. May is being tested by an optician. She sits 3 m from the mirror and looks at the image of a chart of letters, which seems to be 7 m in front of her. Where exactly is the chart located?

A 4 m behind her
B 1 m behind her
C 3 m in front of her
D 7 m in front of her

22. The table below shows how the speed of sound varies with substances of different densities at room temperature.

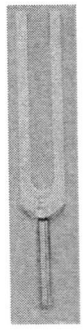
medium	speed of sound in medium (m/s)	density of medium (kg/m^3)
air	330	1.29
oxygen	320	1.43
aluminium	5 100	2 710
iron	5 000	7 870
lead	1 200	11 300

Based on the information, what can you conclude about the speed of sound?

A The speed of sound is greater in less dense mediums.
B The speed of sound is greater in metals than in gases.
C The speed of sound is greatest in the densest metal.
D The speed of sound increases as the density of the medium increases.

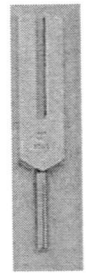
23. Which one of the following tuning forks will produce the highest pitch?

A



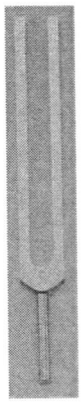
A short and thin tuning fork

B



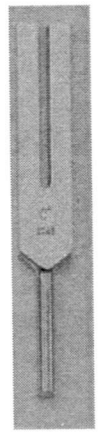
A short and thick tuning fork

C



A long and thin tuning fork

D



A long and thick tuning fork

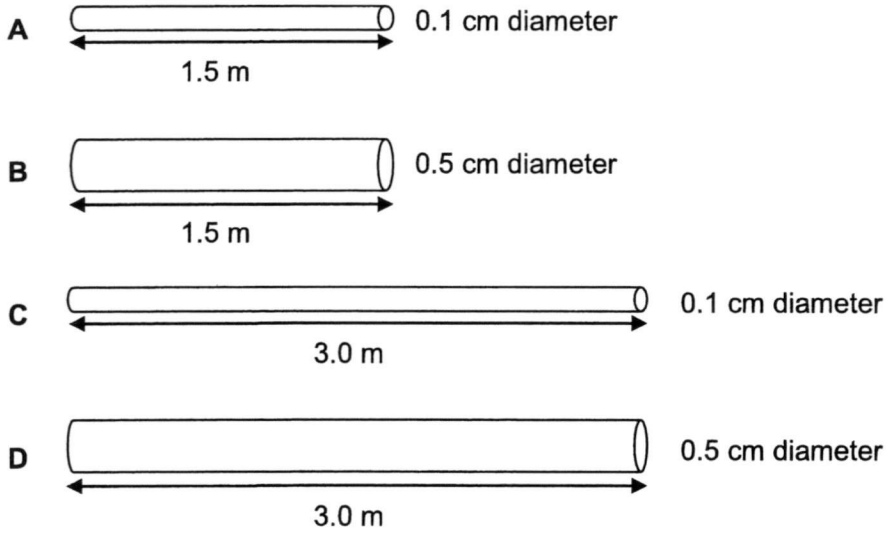
24. Joshua hears an echo when he claps his hands near a high wall.
What happens to the echo if he moves nearer to the wall?

A It has higher pitch and takes less time to reach him.
B It has lower pitch and takes longer to reach him.
C It is louder but takes longer to reach him.
D It is louder and takes less time to reach him.

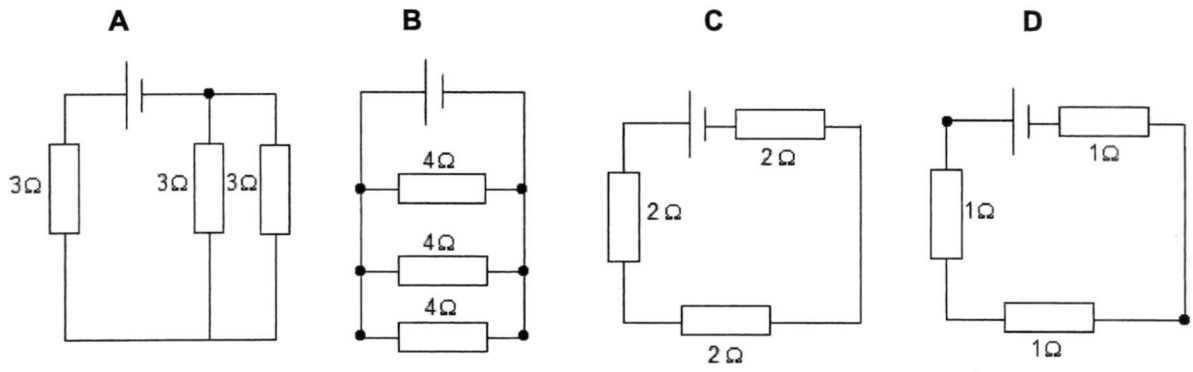
25. Which statement is **incorrect**?

A Loudness of sound is measured in decibel.
B Sound is caused by vibrations of matter.
C Sound requires a medium to be transmitted.
D Sound waves cannot travel through a solid.

26. The diagram below shows four wires of different dimensions made from the same metal. Which of the following has the **lowest** electrical resistance?

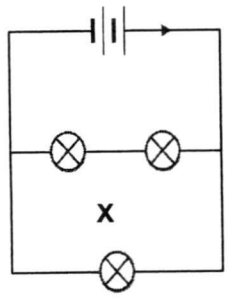


27. The diagram below shows 4 circuits. Which circuit has the **greatest** resistance?

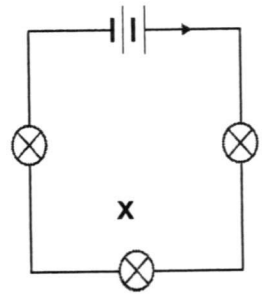


28. The diagrams below show different arrangements of light bulbs. In which circuit will at least one light bulb remain lit if light bulb **X** blows?

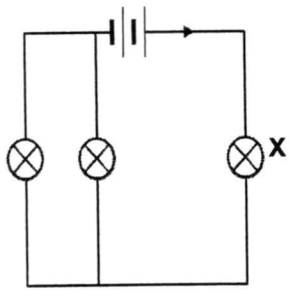
A



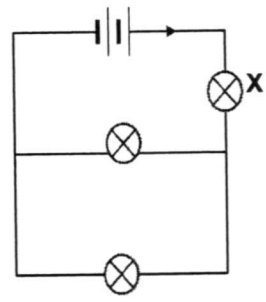
B



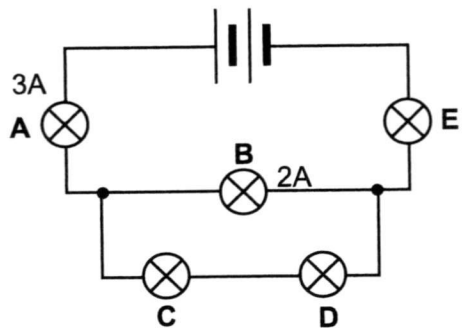
C



D



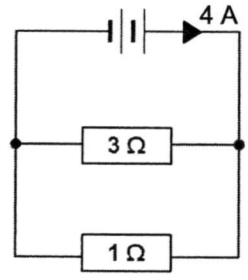
29. The figure below shows a battery connected to five lamps. The current passing through lamp **A** is 3 A and through lamp **B** is 2 A.



What is the current flowing through lamp **C** and **E**respectively?

	lamp **C**	lamp **E**
A	3 A	2 A
B	3 A	5 A
C	1 A	3 A
D	1 A	2 A

30. The diagram below shows a circuit with two dry cells connected to two resistors.



How much current will pass through 3 Ω and 1 Ω resistors?

	Current through 3 Ω resistor	Current through 1 Ω resistor
A	1 A	3 A
B	2 A	2 A
C	3 A	1 A
D	4 A	4 A

~ End of Section A ~

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 sulfur 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	– 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 Tλ thallium 81	207 Pb lead 82	209 Bi bismuth 83	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– 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 mendeleviu m 101	– No nobelium 102	– Lr lawrencium 103

Key: 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

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SECTION B

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	For Examiner's use	
	Section B	30
	TOTAL	

This document consists of **8** printed pages, including the cover page.

[Turn over]

Section B: Structured Questions (30 marks)
Answer **ALL** the questions in the space provided.

1. (a) Figure B1.1 below shows the food web in a wild fruit tree.

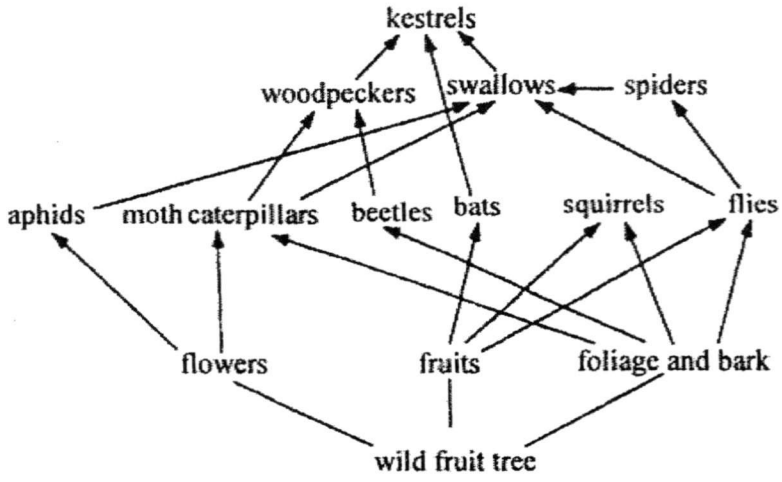


Fig B1.1

(a) State the term used to describe the different populations that live in a habitat. [1]

.....

(b) List a food chain that contains foliage and bark which provides the **least** amount of energy to the organism at the last trophic level. [1]

.....

(c) An outbreak of a certain disease caused many swallows to die. How would the populations **directly linked** to the swallow be affected? Explain your answer. [3]

.....

.....

.....

.....

2. Table B2.1 below shows the subatomic particles present in four atoms, **A** to **E**.

Table B2.1

atom	number of		
	protons	neutrons	electrons
A	11	12	11
B	9	10	9
C	3	4	3
D	15	16	15
E	20	20	20

Using the data provided above, answer the following questions.

(a) Which atom has the smallest nucleon number? [1]

.....

(b) Which of these atoms belong to the same Group? [1]

.....

(c) Which of these atoms is a non-metal? [1]

.....

(d) Give the electronic configuration of atom **E**. [1]

.....

(e) Draw the electronic structure of an atom of **B**below. [2]

3 A mirror is placed at a street corner to enable a driver to see an oncoming vehicle at point **O**. Complete the ray diagram to show how the driver sees the image of point **O**.

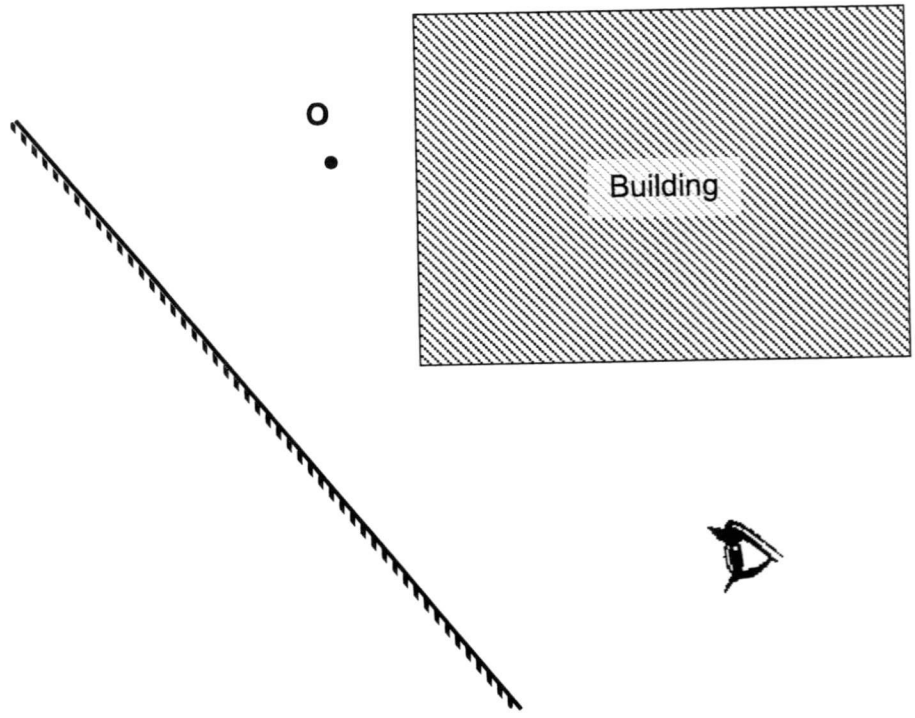


Fig B3.1

(a) On Fig B3.1 above,

(i) draw the actual position of the image of the vehicle. Label this point **I**. [1]

(ii) draw two reflected rays reaching the observer's eye from the vehicle's image. [1]

(iii) draw the two corresponding incident rays coming from the vehicle. [1]

(b) Explain why the observer is able to see a clear image of the vehicle. [1]

.....

(c) What is the distance between the vehicle and its image when the vehicle is 1 cm away from the plane mirror? [1]

.....

(d) Fig B3.2 below shows an object in front of a plane mirror. In the diagram, draw the image of the object behind the mirror. [2]

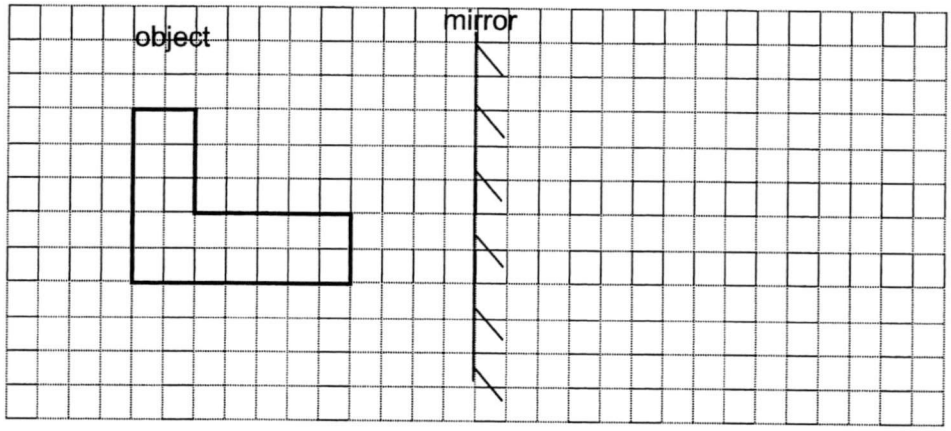


Fig B3.2

(e) State 2 properties of the image produced by a convex mirror. [2]

.....

.....

4 Jack and Jill are standing 1000 m and 485 m from a cliff as shown in Fig B4.1. Jack fires a pistol once.

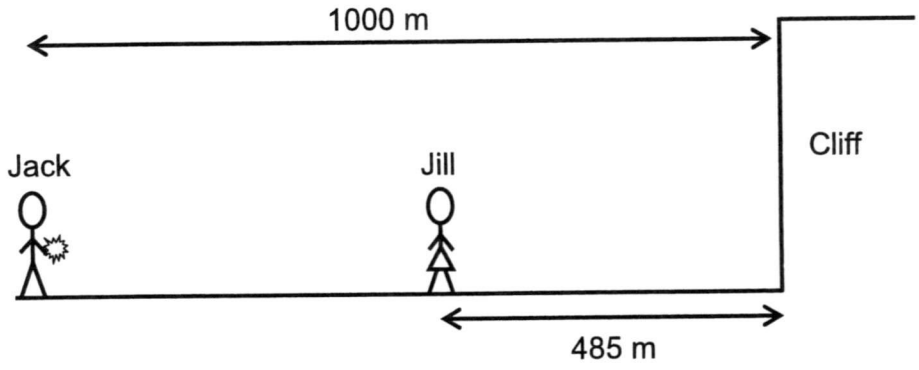


Fig B4.1

(a) Explain why Jill sees the spark from the pistol before hearing the sound from the pistol. [1]

.....

(b) Jill hears two sounds, the second sound being much softer than the first. Explain why two sounds are heard. [2]

.....

.....

.....

(c) Calculate the time taken for Jill to hear the second sound from the moment it was fired. (Speed of sound in air = 330 m/s) [2]

Time = _____

5 The following apparatus were used to form an electrical circuit.

- 2 cells of 6 V each
- 1 light bulb of 6 Ω
- 1 resistor of 2 Ω
- 1 voltmeter

(a) Draw a circuit diagram using all the above mentioned apparatus;

- the light bulb connected in parallel to the 2 Ω resistor.
- the voltmeter measuring the potential difference across the light bulb.
- label the positive and negative ends of the voltmeter. [3]

(b) Calculate the effective resistance in the circuit. [1]

effective resistance = _____

(c) Calculate the current from the battery. [1]

current =_____

~ End of Section B ~

Section C: Free Response Questions (40 marks)
Answer any four questions **on the writing papers provided.**Begin each question on a **fresh** page of the writing paper.

1. Fig C1.1 below shows a food web within a community.

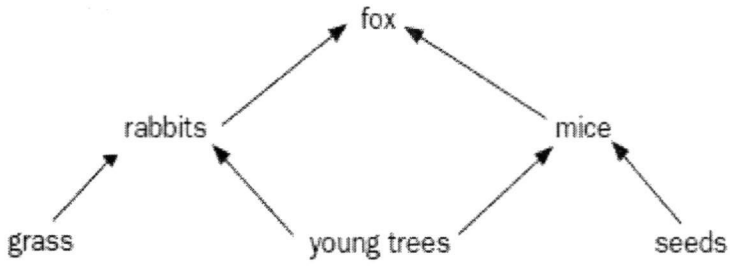


Fig C1.1

(a) (i) State the source of energy in a food web. [1]

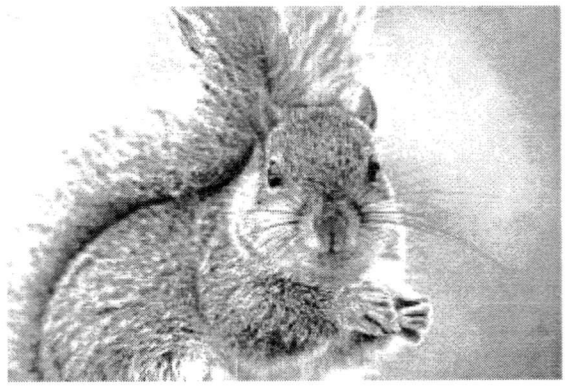
(ii) Suggest why each food chain do not usually contain more than four links. [2]

(iii) Assuming that there is 50 kJ of energy stored in the tissues of the producer and 90% of energy is lost at each trophic level, calculate how much energy is passed down from the grass to the fox. [2]

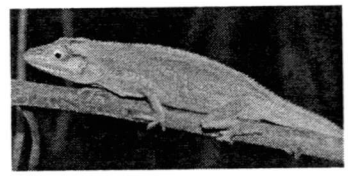
(iv) Grey squirrels which feed on seeds and grass are introduced into the community.

[2]

The introduction of the grey squirrel may cause problems for the existing wildlife. Describe **two** ways in which an introduced species may harm the existing wildlife.



(b) The photograph below shows an *Anolis carolinensis* lizard (anolis lizard). This lizard lives on a tiny island.



Scientists studied how the length of leg of the anolis lizard affected their survival. At the start of the study, the *anolis* lizards had a large range of leg lengths.

The scientists placed six *Leiocephalus carinatus* lizards (curly-tailed lizard) as an *alien species*. After one year the population of *anolis* lizards decreased by half and nearly all the remaining *anolis* lizards had long legs.

(i) Suggest what is meant by the term *alien species*. [1]

(ii) State the relationship between the anolis lizard and the curly-tailed lizard. [1]

(iii) Explain the decrease in population of anolis lizards. [1]

2. The eight elements listed below belong to the third period.

Na	Mg	Al	Si	P	S	Cl	Ar

(a) With reference to the electronic configurations of sodium and magnesium, explain why the elements listed above belong to the third period. [2]

(b) (i) Name the element from period 3 that will readily gain one electron. [1]

(ii) Explain why the element named in **(b)(i)** would readily gain one electron. [2]

(iii) Explain why elements in the same group as the element named in **(b)(i)** would form ions of the same charge. [2]

(c) Oxygen can react with both metals and non-metals to form compounds. The compounds of oxygen are known as oxides.

Oxygen reacts with lithium to form lithium oxide.By referring to the Periodic Table on page 19;

(i) Draw the electronic structure of a lithium ion. [1]

(ii) Draw the electronic structure of an oxide ion. [1]

(iii) State the chemical formula of lithium oxide. [1]

3. (a) Alfred conducts an experiment to determine the properties of an image formed by a plane mirror. He sketched the results of his experiment as shown in Fig C3.1 below.

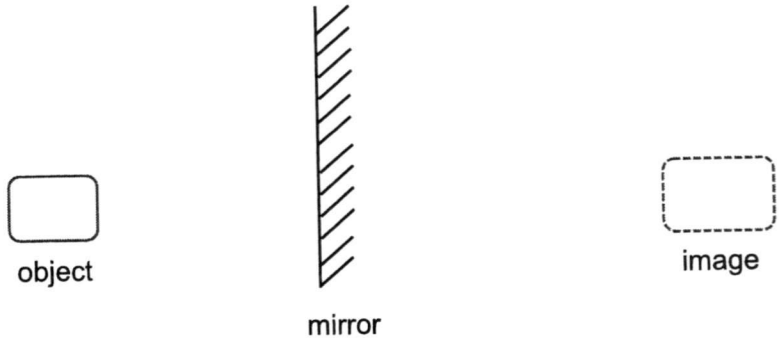


Fig C3.1

Alfred's teacher saw the diagram and commented that he has obtained the wrong result.

State two reasons to explain why Alfred's result is not correct. [2]

(b) Describe one application for each of the following types of mirrors:

(i) concave mirror

(ii) convex mirror [2]

(c) Define refraction. [2]

(d) A student uses a ray box to shine into a glass block to see how the light ray behaves. He adjusts the direction of the light ray and measures five sets of angles of incidence and angles of refractions. The results are recorded in the table below.

Angle of incidence / °	**Angle of refraction/ °**
30.0	18.0
40.0	23.4
50.0	28.2

(i) Explain why in this experiment, the angle of refraction is always less than the angle of incidence. [2]

(ii) Determine the refractive index of the glass box. [2]

4. Boat **X** sending pulses of ultrasonic waves to the bottom of the sea as it moves slowly on the water surface. The variation of time interval, **t**, between the emission of a pulse and the echo received within distances **A** to **D** are shown in Fig C4.1. The frequency of the sound is 20 000 000 Hz and it travels in the sea at a speed of 1.4 km/s.

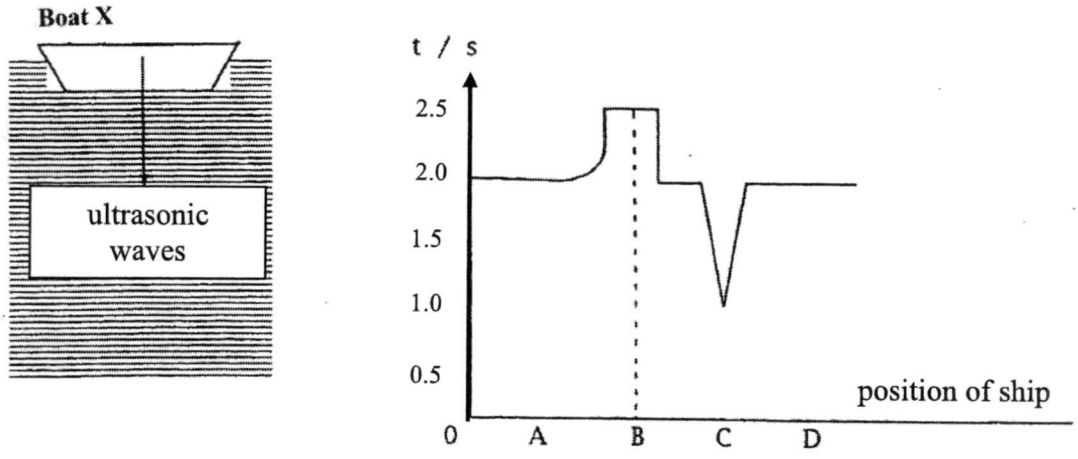


Fig C4.1

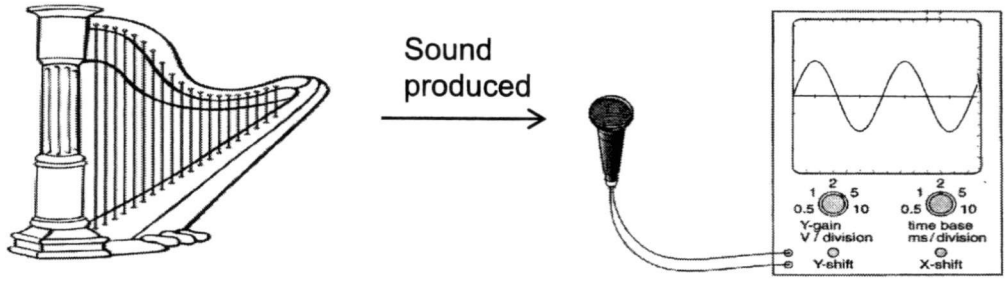
(a) Explain why the pulses of sound used by the boat **X** is an ultrasound. [2]

(b) Calculate the depth of the sea at position **B**. Express your answer in **metres**. [2]

(c) Determine which part of the sea, **A**, **B**, **C** and **D**, has the shallowest depth. Explain your answer based on the information from the graph [2]

(d) Suggest**one** use of this phenomenon that can be found in the nature. [1]

(e) Arron buys a new harp and is excited to test out the muscial instrument. He plucks the shortest string on the harp. The pressure-time graph of the sound produced is displayed on a monitor.



(i) If Arron were to pluck the same string *twice as hard* as before,state the change(s) to the sound heard. [1]

(ii) If James were to pluck a string that is *twice the length* as the one before, state the change(s) to the sound heard. [1]

(iii) What will happen to the sound produced by the harp if James were to replace the strings with thinner ones? [1]

5. Fig C5.1 shows a series circuit where a battery of 15.0 V and negligible internal resistance is connected to resistors $\mathbf{R_1}$ and $\mathbf{R_2}$ of resistance 60 Ω and 40 Ω respectively. **V** is a high resistance voltmeter and **A** is an ammeter of negligible resistance.

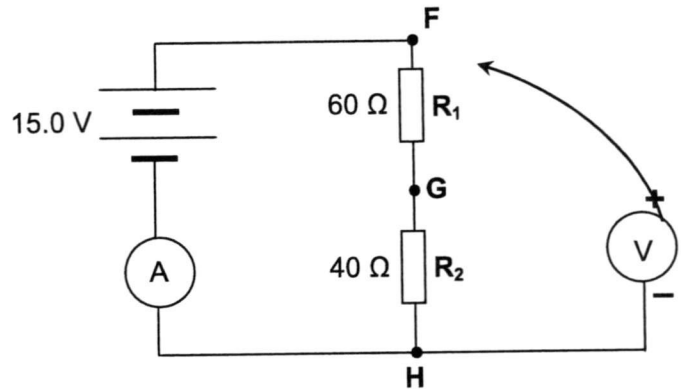


Fig C5.1

(a) The positive terminal of the voltmeter is now connected to point **G**.

(i) Find the reading on the ammeter. [2]

(ii) Find the reading on the voltmeter. [2]

(b) Without doing any calculations, state what will happen to the ammeter and voltmeter readings when the positive terminal of the voltmeter is connected to point **F** instead. [2]

(c) Define *current*. [1]

(d) State and explain an application of the following effects of current:

(i) chemical

(ii) heating

(iii) magnetic [3]

The Periodic Table of the Elements

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	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 sulfur 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	– 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	– Po polonium 84	– At astatine 85	– Rn radon 86
– Fr francium 87	– Ra radium 88	– 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 = 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

Sec 2 Express Science SA1 2017– Answers and Markers Report

Section A: Multiple-Choice Questions (40 marks)

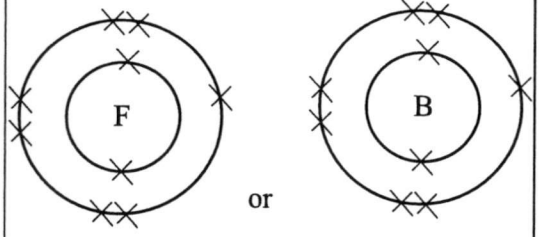
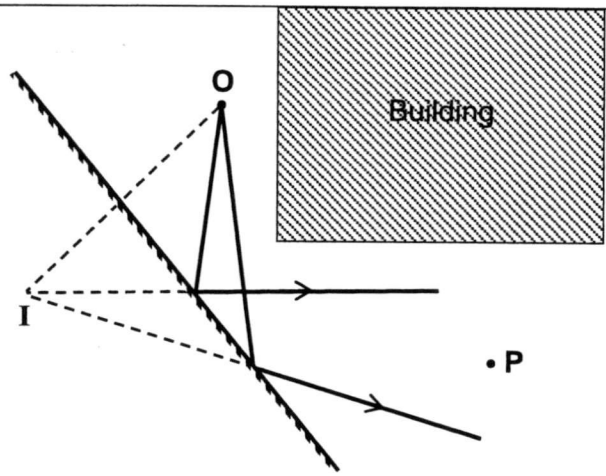
1	A
2	C
3	B
4	A
5	A
6	B
7	B
8	B
9	B
10	C

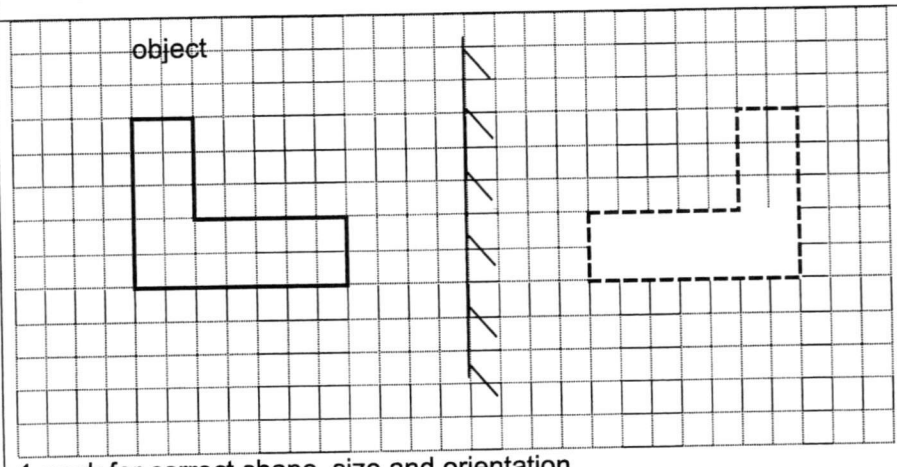
11	D
12	C
13	A
14	C
15	C
16	A
17	C
18	A
19	C
20	C

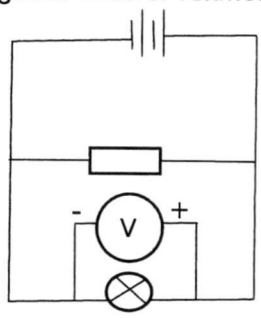
21	B
22	B
23	A
24	D
25	D
26	B
27	C
28	A
29	C
30	A

Section B

Qn	Answer	Remarks
1a	Community	- Poorly done - Many could not remember the definition.
1b	wild fruit tree →foliage & bark → flies → spiders→ swallows → kestrels	- Many left out 'wild fruit tree'. - Answers started with 'foliage & bark'.
1c	· population of aphids, moth caterpillars, flies and spiders will increase; · as there will be fewer swallows feeding on them; · population of kestrels may decrease due to fewer swallows / prey population State all correct organisms [1] State population increase/ decrease correctly [1] Give correct reasons [1]	**Reject:** - Fly decrease. because spider increases. - 'Preys of sparrows' increase. - 'Predators of sparrows' decreases. * Must list names of animals.

2a	C/ Lithium	2c: Many left out 'D' or 'B'. Well done.
2b	A and C/ sodium and lithium	
2c	B & D	
2d	2.8.8.2	
2e	 1m –chemical symbol or L or • found(no extra shell as the nucleus) 1m - identifying number of electrons per shell (1st:2, 2nd:7)	Well done. Few students drew ion' or drew wrong number of electrons.
3a	 · Labeled image, **I**, [0.5] perpendicular to mirror plane and equal distance from **O** to mirror and from **I** to mirror [0.5]. · Two rays [0.5 each] drawn from **O** towards the eye. · Rays extrapolated from image, **I**, [0.5] and reflected off mirror surface [0.5]. · Arrow heads correctly drawn [0.5] Minus 1 mark: Not drawn in pencil or ruler.	· Well done. **Common mistakes**: - Did not label "I". - No arrowheads - Wrong location of I
3b	The mirror has a <u>smooth surface</u> [1/2] rays are <u>reflected regularly</u> [1/2].	Poorly done. - Many do not have understand question. - Did not use key words.

3c	2 cm [1].	
3d	 1 mark for correct shape, size and orientation 1 mark for image being equidistant from mirror as object. Minus 1 mark: Image not drawn in dotted.	Poorly done - Many used solid line for image. 1M minus. - Many drew 5 squares from mirror. Should be 4 squares. 1M minus.
3e	Any 2 of the following is acceptable: · image is upright and but smallerthan the original object. · the image is laterally inverted · virtual. · a wider field of view.	**Common mistakes:** - Confused with concave/ plane mirror.
4a	Light travels faster than sound. [1]	
4b	First sound was direct from the pistol. [1] The second sound was reflected from the cliff / an echo from the cliff. [1]	- Many left out 'first sound was from pistol'.
4c	Time taken = Distance / Speed = 1485 / 330[1] = 4.5s [1]	Fairly done. - Many are unsure about calculations.

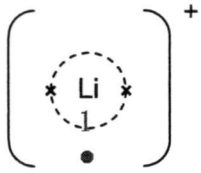
5a	**1 mark.** Correctly drawn: dry cell, resistor, light bulb, voltmeter **1 mark.** Correctly drawn: Voltmeter parallel to bulb, positive & negative ends. **1 mark.** Correctly drawn. Resistor parallel to bulb. 0.5M: each correctly drawn apparatus 1M: Positive and negative ends of voltmeter 	Poorly done. **Common mistakes:** - Position of voltmeter and positive & negative ends. - Position of resistor Mark minus: Additional item drawn.

5b	effective resistance = 1/ (1/2 + 1/6) = 1.5 Ω [1]	Deduct 1M if formula is not shown. Fairly done. - Some did not take reciprocal of $1/R_T$ - Some do not remember formula. - Gave wrong unit.
5c	current = 12 /1.5 = 8 A [1]	

Section C

Qn	Answers	Remarks
1ai	Sun [1]	Accept: Sunlight
1aii	· Energy decreases at each trophic level along the food chain due to life processes. · Not enough energy to support another consumer if the food chain exceeds four trophic levels.	Rej: if student did not write not enough energy to support another consumer/ allow for survival/ allow for the next organism to live
1aiii	Energy passed to rabbits = 50 x 0.1 = 5 kJ [1] Energy passed to fox = 5 x 0.1 = 0.5 kJ [1]	Minus 1m if answer in fractions
1aiv	Any 2: · Compete for source of food with rabbits and mice, decreasing their	Accept: population of young trees falls as

	population · Deplete food and decrease the population of producers · Carry diseases that may kill other wildlife	rabbits and mice will eat more young trees/ population of fox decreases as population of rabbits and mice decrease Rej: if student did not refer to the food chain to answer the question.
1bi	Non-native / invasive species which was being introduced to the island.	Badly done Accept: new species/ unfamiliar species introduced into the ecosystem Rej: unique/ weird/ rare species
1bii	Predator-prey relationship	Accept: Anolis lizards are the prey of the curly tail lizards
1biii	Any of the following: · Long legs of Anolis lizards can help to run away from the Curly-tailed lizards. · Short legs of Anolis lizard failed to run and escape from the Curly-tailed lizard.	Badly done
2a	Na: 2, 8, 1 and Mg: 2, 8, 2. [1]	Badly done Many students did not

	Both elements have3 electron shells [1].	read the question properly and did not write the electronic configuration of Na and Mg. Rej: both elements have same number of shells (need to include 3 as the questions states Period 3)
2bi	Chlorine	
2bii	Chlorine has 7 [1] electrons in the valence shell. Hence it needs one more electron to obtain a full valence shell. [1]	Accept: Cl has an electronic configuration of 2.8.7.
2biii	Elements in the same group have the same number of valence electrons[1]. Hence they would gain the same number of electrons[1] and form ions of similar charges.	Many students did not write the part on gaining same number of electrons.
2ci	 Correct charge of ion. Square bracket for ion. Correct number of electrons drawn.	Minus 1m if drawn in pen
2cii	 Correct charge of ion. Square bracket for ion. Correct number of electrons drawn.	Rej: if all electrons are the same symbol
2ciii	Li_2O	
3a	The image should be of the same size as the object, and not bigger.	Well done.

	[1] The distance between the image and the mirror should be the same. [1]	
3bi	dentist mirror / cosmetic mirror / telescope [1]	Rej: dental tool unless explanation is stated.
3bii	security mirror / blind corner mirror/ surveilience mirror [1]	Accept: side mirrors of vehicles
3c	Refraction is the bending of light as light passes through two media[1] of different optical density due to a change in speed. [1]	
3d i	· Glass is an optically denser media, the speed of light decreases. [1] · The refracted ray bends more towards the normal. [1]	Rej: if glass is not stated; missing the word 'optical'
3d ii	n = sin 30 / sin 18 [1] = 1.62 (3 sig fig) [1] Minus 1 mark: if unit is given in final answer. If answer is not in 3 sig fig	Accept: if there is no working but there is formula stated.
4a	· Ultrasound: sound with frequency abovethe normal hearing range, 20 000Hz [1] · sound waves used is 20 000 000Hz so it is above the range. [1]	·
4b	S = 2D/t 1.4km = 1400 m 2D = 1400 x 2.5 [1] = 3500 m D = 1750 m [1] Minus 1 mark: wrong unit	1m only given if the working is done in m.
4c	C The time interval for the sound to be emitted and received is the least, 1.0s, (must quote data, if not minus ½ m)	·
4d	Dolphin, bats uses ultrasound to locate or detect the direction they are heading	Accept: whales communicating/ echolocation Rej: sonar; ultrasound scan etc as the Qn states 'in nature'
4ei	Volume/loudness of sound increases. [1]	Accept: sound produce as a larger amplitude
4eii	Pitch of sound is lower [1]	Accept: sound deeper/ lower frequency
4eiii	Pitch of sound will be higher. [1]	Accept: sound higher/

		higher frequency
5ai	I = V / R = 15.0 V / 100 Ω [1] = 0.15 A [1]	Minus 1m if answer has no units/ wrong units
5aii	V = IR = 0.15 A x 40 Ω [1] ECF allowed = 6.0 V [1]	ECF only when current is wrong but resistance correct OR when resistance is wrong due to wrong calculations. Rej ECF if resistance is 100Ω.
5b	Ammeter reading remains the same [1]. Voltmeter reading increase [1].	
5c	Rate of flow of charges/ electrons	
5di	Electrolysis; electricity is used to break down compounds into elements. [1]	Accept: electroplating where electricity is used to coat a metallic object with a layer of metal.
5dii	Heating elements; Materials of high melting points, as electrical energy is converted to heat energy. [1]	Accept: current flowing through heating element/ high resistance wire/ metal wire which heats up to heat up water/ substances etc.
5diii	Electromagnet is produced by inserting an iron rod inside a solenoid, which current is flowing inside. [1]	Accept: current flowing through wire/ metal to create/ magnetise the material forming an electromagnet.