

Surname	Centre Number	Candidate Number
Other Names		0



GCSE – NEW

3445U20-1



S18-3445U20-1

**APPLIED SCIENCE (Double Award)
UNIT 2: Space, Health and Life**

FOUNDATION TIER

MONDAY, 11 JUNE 2018 – MORNING

1 hour 30 minutes

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
Section A	1.	10
	2.	16
	3.	8
	4.	6
	5.	10
Section B	6.(a)(b)	6
	6.(c)(d)(e)	19
Total	75	

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ADDITIONAL MATERIALS

In addition to this examination paper, you will require a separate Resource Folder, calculator, pencil and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

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

Question 4 is a quality of extended response (QER) question where your writing skills will be assessed.

You are reminded to show all your workings. Credit is given for correct workings even when the final answer given is incorrect.

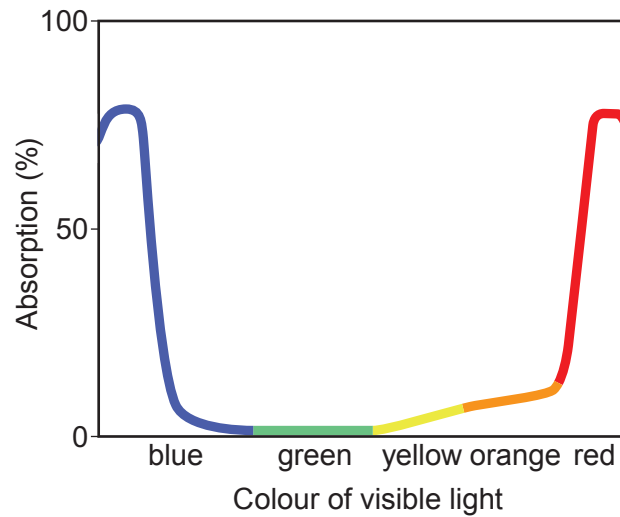
A periodic table is printed on page 20.

Section A

Answer all questions in the spaces provided.

1. Green plants produce their own food by photosynthesis.

(a) Green leaves capture a small percentage of solar energy. The graph below shows how the absorption of visible light by a green leaf depends on the colour of visible light.



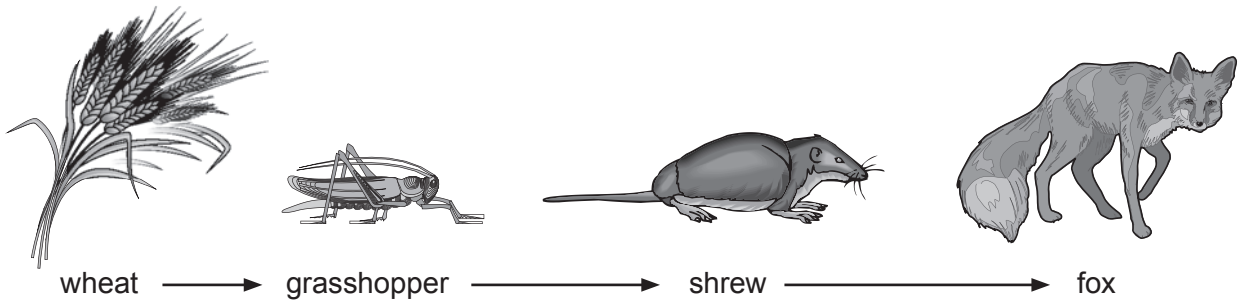
(i) State **one** colour of visible light that is absorbed very well. [1]

.....

(ii) State **one** colour of visible light that is not absorbed at all. [1]

.....

(b) The table shows what happens to the energy taken in by organisms in a food chain.



Organism	Energy per day (MJ)			
	released during respiration	used for growth	in waste products	total
wheat	10	8	6	.....
grasshopper	22	3	14	39
shrew	26	4	.....	50
fox	32	4	24	60

Use the information above to answer the following questions.

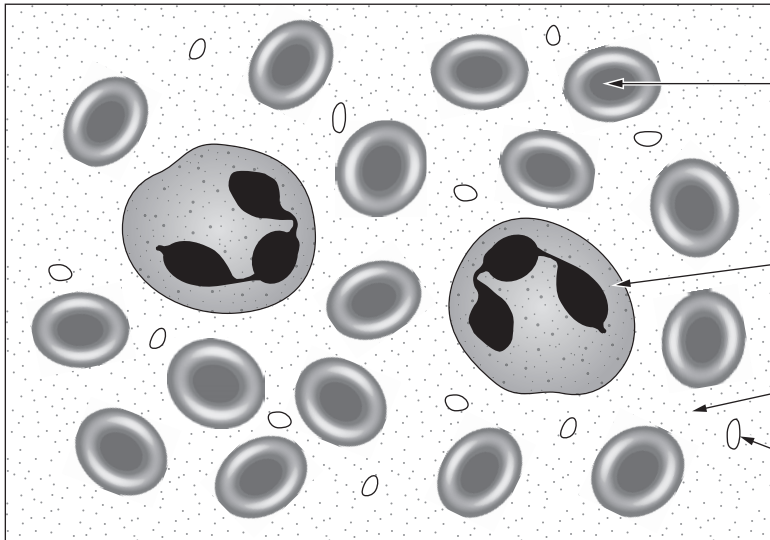
- (i) **Complete** the table. [2]
- (ii) I. State which organism releases the greatest amount of energy during respiration. [1]
.....
- II. Give **one** reason why animals respire more than plants. [1]
.....
- (iii) Name the herbivore. [1]
- (iv) Name the prey of the shrew. [1]
- (v) **Sketch** a pyramid of numbers for the food chain in the space below. [2]

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2. (a) Blood consists of plasma, red blood cells, platelets and white blood cells. Each part has a different function.

(i) Label the diagram of the blood below.

[3]



- A
- B
- C
- D

(ii) Complete the table below.

[3]

Part of the blood	Function
plasma	transports carbon dioxide, soluble food and urea
red blood cells	.....
platelets	.....
white blood cells	.....

- (b) Gareth has blood samples taken before a cycle race. His results are shown in the table below together with normal ranges.

	Red blood cell count (million/cm ³)	White blood cell count (thousand/cm ³)	Platelets (thousand/cm ³)
<i>Normal range</i>	4.4 - 5.8	3.9 - 10.8	130 - 400
Gareth	2.2	6.6	105

- (i) Describe how Gareth's blood sample results compare with the normal range. [2]

.....

.....

.....

- (ii) State **one** health problem shown by Gareth's results. [1]

.....

(c) Gareth completed a training ride around a cycle track.

- (i) Gareth accelerates from rest to a velocity of 15 m/s in 2.5 seconds.
Use the equation:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$

to calculate his acceleration.

[2]

$$\text{Acceleration} = \dots\dots\dots \text{m/s}^2$$

- (ii) Later in the ride he travels 192 m in 12 s at a constant speed.
Use the equation:

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

to calculate his speed.

[2]

$$\text{Speed} = \dots\dots\dots \text{m/s}$$

- (iii) Gareth cycles 5 laps at this constant speed. Each lap is 500 m.

- I. Calculate the distance he travels.

[1]

$$\text{Distance} = \dots\dots\dots \text{m}$$

- II. Use the equation:

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

to calculate the time taken to travel this distance.

[2]

$$\text{Time} = \dots\dots\dots \text{s}$$

3. Water quality can be monitored using invertebrates as indicators.

(a) A method for an investigation to monitor water pollution using invertebrates is described below, however the steps are in the wrong order.

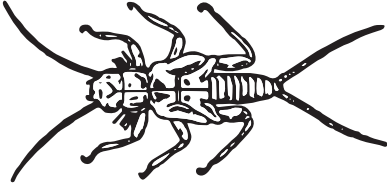
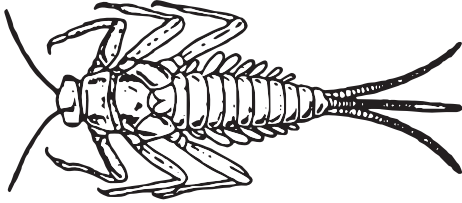
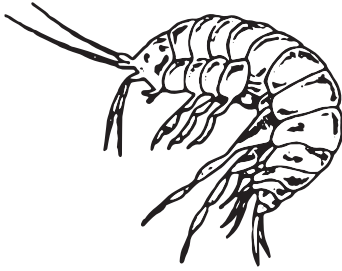

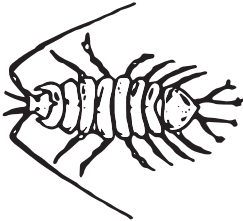

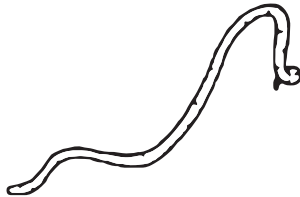
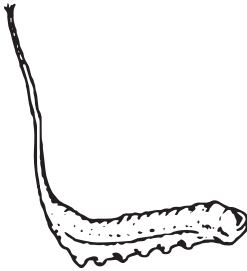
- A. Identify **two** locations to be tested e.g. two different areas in the same stream.
- B. Record the total biomass of each species of invertebrate that has been caught.
- C. Study the organisms in the tray and try to identify the invertebrates.
- D. Collect some water in a tray so it is about 2 to 3 cm deep.
- E. Collect samples of invertebrates using a net and transfer them to the tray.
- F. Pour contents gently back into the stream.

Arrange the steps in order by placing the letters **B**, **C**, **D** and **E** in the correct boxes below.

[3]

A	F
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(b) Some invertebrate species used as indicators are shown below.

Water quality	Indicator species	
Clean water	 <p data-bbox="595 719 799 757">Stonefly nymph</p>	 <p data-bbox="1098 719 1286 757">Mayfly nymph</p>
Some pollution	 <p data-bbox="576 1066 820 1104">Freshwater shrimp</p>	 <p data-bbox="1094 1066 1289 1104">Caddisfly larva</p>
Moderate pollution	 <p data-bbox="619 1413 783 1451">Water louse</p>	 <p data-bbox="1118 1413 1273 1451">Bloodworm</p>
High pollution	 <p data-bbox="616 1760 783 1798">Sludgeworm</p>	 <p data-bbox="1078 1760 1310 1798">Rat-tailed maggot</p>
Very high pollution	No life	

(Not drawn to scale.)

The results from such an investigation are shown in the table below.

	Total biomass in sample (g)	
	Stream A	Stream B
Mayfly nymph	2	0
Caddisfly larva	55	0
Freshwater shrimp	78	2
Water louse	8	6
Bloodworm	6	22
Sludgeworm	1	110

Use the information in both tables to answer the following questions.

(i) I. Name the **two** most common invertebrates found in stream **A**. [1]

..... and

II. State the water quality in stream **A**. [1]

(ii) Explain whether stream **B** has the same water quality as stream **A**. [2]

.....

(iii) State how the results would be different for a stream with very high pollution. [1]

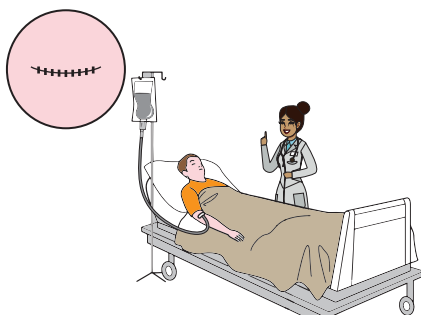
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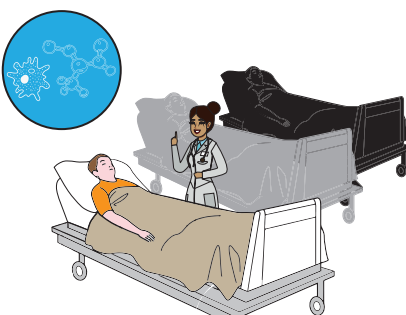
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4. Hospitals take great care to prevent patients becoming infected with bacteria such as MRSA. They often display posters such as the one shown below.


Protect patients from MRSA



Surgery allows bacteria to enter the body



Bacteria can spread when infection control measures are not taken



Antibiotics save lives but poor prescribing practices put patients at risk

Use a combination of infection control measures with every patient to prevent infections

Use the information in the poster, and your own knowledge to answer the following question.

Describe effective control measures used to prevent MRSA and explain why infections such as MRSA have become difficult to treat. [6 QER]

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5. Nuclear medicine involves the use of some radioactive isotopes, that emit gamma (γ) rays, in the diagnosis and treatment of disease.

- (a) Complete the following paragraph about gamma rays using the words from the box. [4]
Each word may be used once, more than once, or not at all.

particles	low	absorb	sound	strong
light	electromagnetic	penetrate	high	

Gamma rays are frequencywaves. They are used in nuclear medicine because they easily the human body. They have ionising power.

- (b) Information about some isotopes that emit gamma rays is given in the table below.

Isotope	Half-life
palladium-103	17.0 days
iodine-125	59.6 days
thallium-201	73.0 hours
cobalt-60	5.26 years

Use the information in the table to answer the following questions.

- (i) State which isotope takes the longest time to decay. [1]

.....

- (ii) State what happens to the activity of thallium-201 after 73 hours. [1]

.....

- (iii) In order to treat prostate cancer, palladium-103 pellets are placed directly into the prostate gland. They remain permanently in place.

I. Complete the table below.

[2]

Time (days)	0	17	34	.....	68
Activity of palladium-103	1	$\frac{1}{2}$	.....	$\frac{1}{8}$	$\frac{1}{16}$

- II. The gamma rays from the pellets are undetectable when their activity drops to $\frac{1}{32}$ of its original value. Calculate the time taken for this reduction to occur.

[2]

Time = days

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Section B

Answer all questions in the spaces provided.

Use the information in the separate Resource Folder to answer the following questions.

6. (a) Use the information in **Table 1** to answer the following question.

Tick (✓) the boxes next to the **three** correct statements.

[3]

Saturn orbits the Sun with a velocity of 5 km/s faster than Pluto

Mercury is the hottest planet

All the rocky planets have an atmosphere containing carbon dioxide

Mars and the Earth have the same day length

The Earth has the greatest density

The Moon is the smallest planet

- (b) Use the information in **Diagram 3** and your knowledge to answer the following questions.

- (i) State how the wavelength of the dark line, λ , for the very distant galaxy is different from the same line in the nearby galaxy. [1]

.....

- (ii) State how the frequency of this line for a nearby galaxy compares with the same line in a very distant galaxy. [1]

.....

- (iii) State **one** difference about the motion of the very distant galaxy compared to the nearby galaxy. [1]

.....

(c) Use the information in **Table 1** to answer the following questions.

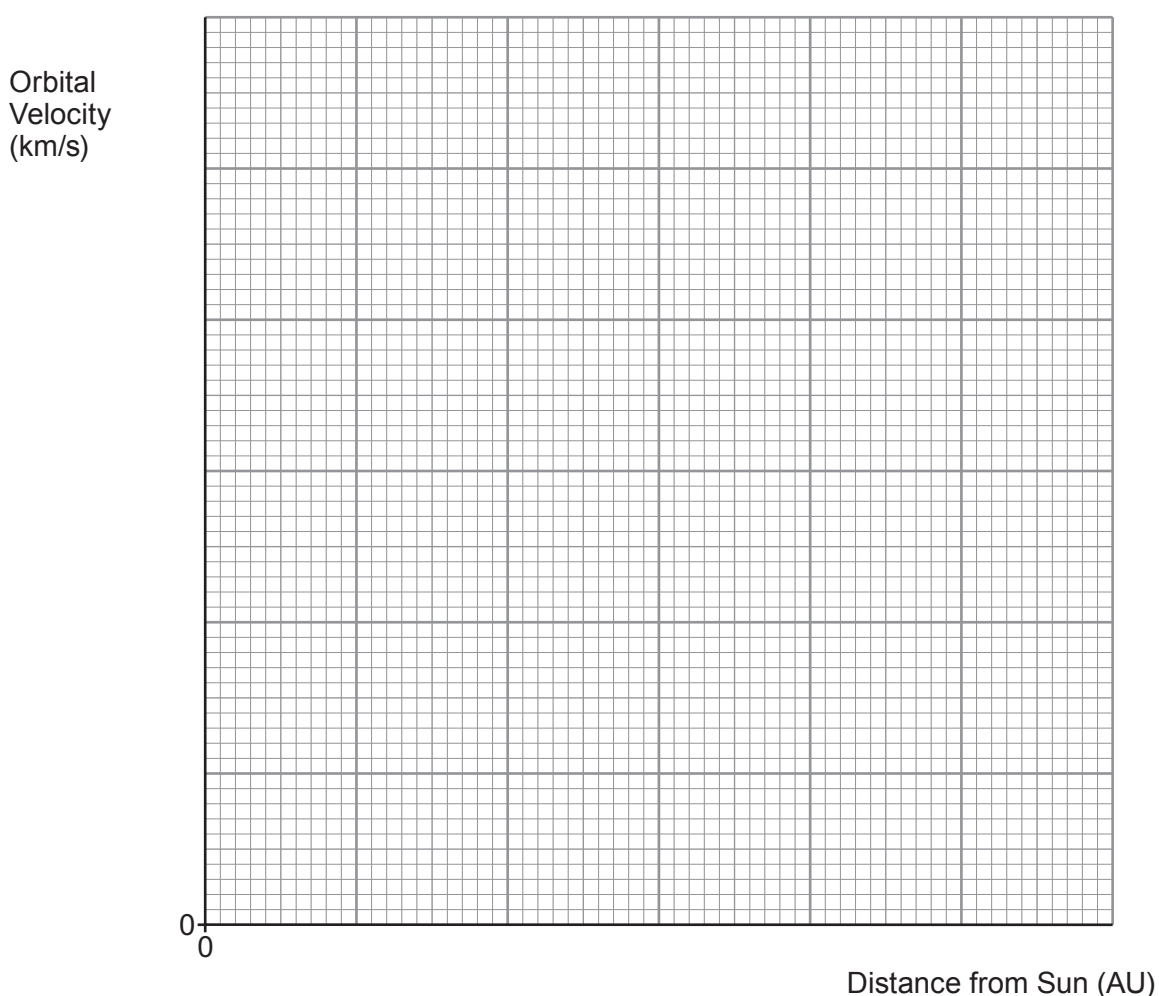
(i) Europa is an asteroid. Estimate its temperature and orbital period. [2]

Temperature = °C

Orbital period = days

(ii) Pluto is no longer classed as a planet. State **one** reason why. [1]

(iii) Plot the points on the grid below to show how the orbital velocity of the five planets Mercury, Venus, Earth, Mars and Jupiter depends on distance from the Sun. Draw a suitable line. [4]



(iv) Orbital velocity is not proportional to the distance from the Sun. Explain how your graph shows this to be true. [2]

.....

.....

(d) Use your knowledge and the information on **pages 4 and 5** to answer the following questions.

(i) Explain why sunspots appear darker than the surrounding area of the Sun. [2]

.....
.....

(ii) State **two** ways in which human activities may be affected by solar flares. [2]

1.

2.

(iii) Explain why the effect of solar flares on the Earth is not the same for each sunspot cycle. [2]

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(e) Use the information in **Diagram 1** to describe the differences between Aristotle's model of the Solar System and the 2006 model. [4]

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