

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

3445UB0-1



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

HIGHER TIER

FRIDAY, 7 JUNE 2019 – AFTERNOON

1 hour 30 minutes

	For Examiner’s use only		
	Question	Maximum Mark	Mark Awarded
Section A	1.	19	
	2.	6	
Section B	3.	8	
	4.	16	
	5.	8	
	6.	11	
	7.	7	
	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 7(b) 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

Examiner
only*Answer all questions in the spaces provided.**Use the information in the separate Resource Folder to answer the following questions.*

1. (a) Use the information in **Figure 3** to answer the following questions.

- (i) A man drinks six 175 ml glasses of wine, three pints of lager and two 25 ml glasses of spirits. Calculate the total number of units of alcohol consumed. [1]

Number of units =

- (ii) He stopped drinking at 11 pm. He is planning to drive at 1 pm the following day. Explain whether he can be **certain** that all units of alcohol will have been processed by this time so it will be safe for him to drive. Show your calculations. [2]

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- (b) Use the information in **Figures 4 and 5** to answer the following questions.

- (i) Explain why it is difficult to accurately compare the nutrition facts for the three cereals shown. [2]

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- (ii) Explain which cereal you would recommend for a 7-year-old child. [2]

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- (c) Calculate the daily personal energy requirement (PER) for a 70 kg athlete who trains for 4 hours a day. [3]

PER = units

(d) Use the information in **Figures 6, 7 and 8** to answer the following questions.

- (i) State the mass at which a person of height 1.7 m has a high risk of developing health problems. [1]

Mass = kg

- (ii) Explain whether you agree with the statement that 'BMI is proportional to body mass'. [2]

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- (iii) Calculate the BMI for a person of body mass 75 kg and height 1.6 m. [2]

BMI = kg/m²

- (e) (i) A woman suffers from maturity onset diabetes of the young (MODY). This is caused when one parent is heterozygous for the condition. Her partner is not diabetic. Complete the Punnett square, using **D** as the dominant allele, to show the possible genotypes of the children. [3]

- (ii) State the chance of a child being born with MODY. [1]

Chance =

2. (a) Use the information in **Figure 1** to explain how a person's cardiovascular system improves in the first year after they stop smoking. [3]

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- (b) Use the information in **Figure 2** to explain whether the percentage of smokers who have quit has consistently risen in the 20-year period ending 2016. [3]

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Section B*Answer all questions in the spaces provided.*Examiner
only

3. The abundance of a species in a habitat can be investigated by using quadrats for random sampling.

(a) Describe how you would use a quadrat to investigate the population of snails in a habitat. [3]

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(b) The results of an investigation into the variety of snails found in two habitats are shown below. Each quadrat measured 1 m by 1 m. The area of habitat **X** was 12 m² and the area of habitat **Y** was 15 m².

Habitat X

Quadrat	Number of snails				Total number of snails
	Species A	Species B	Species C	Species D	
1	0	2	3	1	6
2	0	0	3	2	5
3	0	1	3	1	5

Habitat Y

Quadrat	Number of snails				Total number of snails
	Species A	Species B	Species C	Species D	
1	0	0	1	2	3
2	0	0	4	3	7
3	0	0	1	3	4

(i) Use the data to compare the distribution of snail species in the two habitats. [4]

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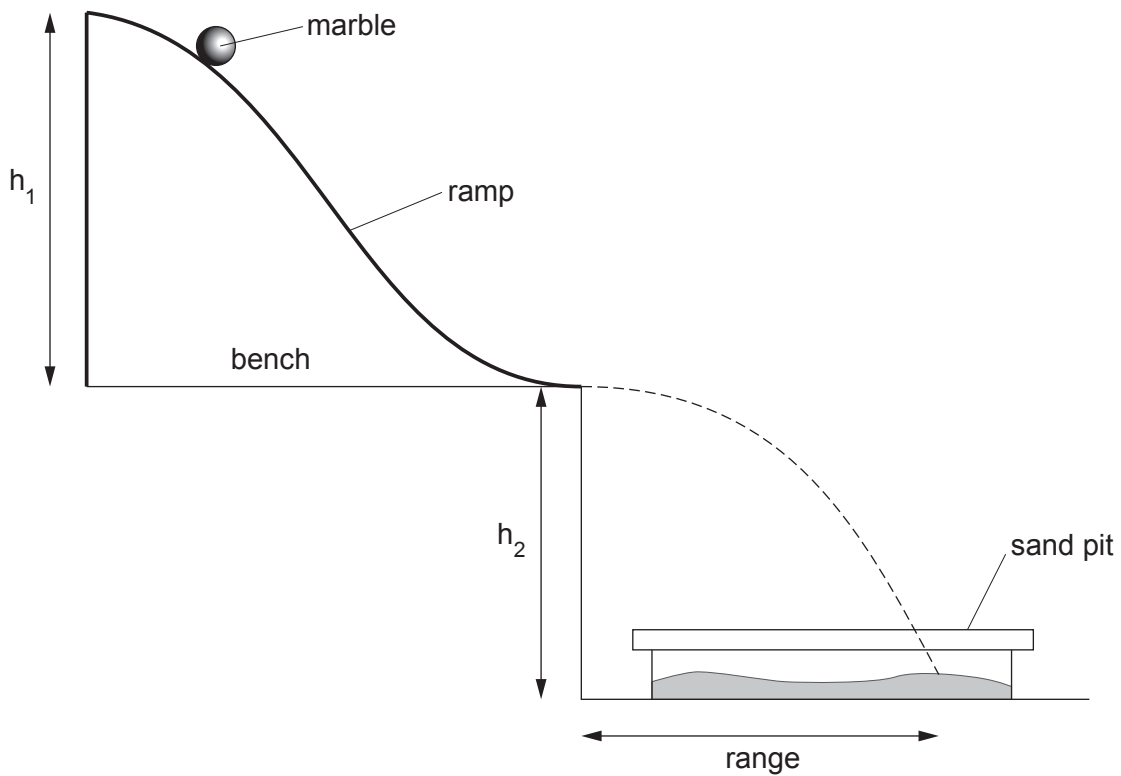
(ii) One student claims the investigation is not valid as the area of the habitats was not the same. Explain whether you agree with the claim. [1]

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4. A model ski jump can be set up on a bench as shown in the diagram below.



The marble is released from rest at the top of a ramp. It leaves the bottom of the ramp with a certain velocity. It moves through the air and lands in a sand pit. The horizontal distance travelled in the air is called the **range**.

The velocity of the marble as it leaves the ramp is calculated using the equation:

$$\text{velocity} = \frac{\text{range}}{\text{time to travel the range}}$$

The acceleration of the marble down the ramp is calculated using the equation:

$$\text{acceleration} = \frac{\text{velocity of marble as it leaves the ramp}}{\text{time to travel down the ramp}}$$

- (a) The following measurements were recorded during one trial of the experiment.

Range = 45 cm

Time to travel the range = 0.5 s

Time to travel down the ramp = 1.2 s

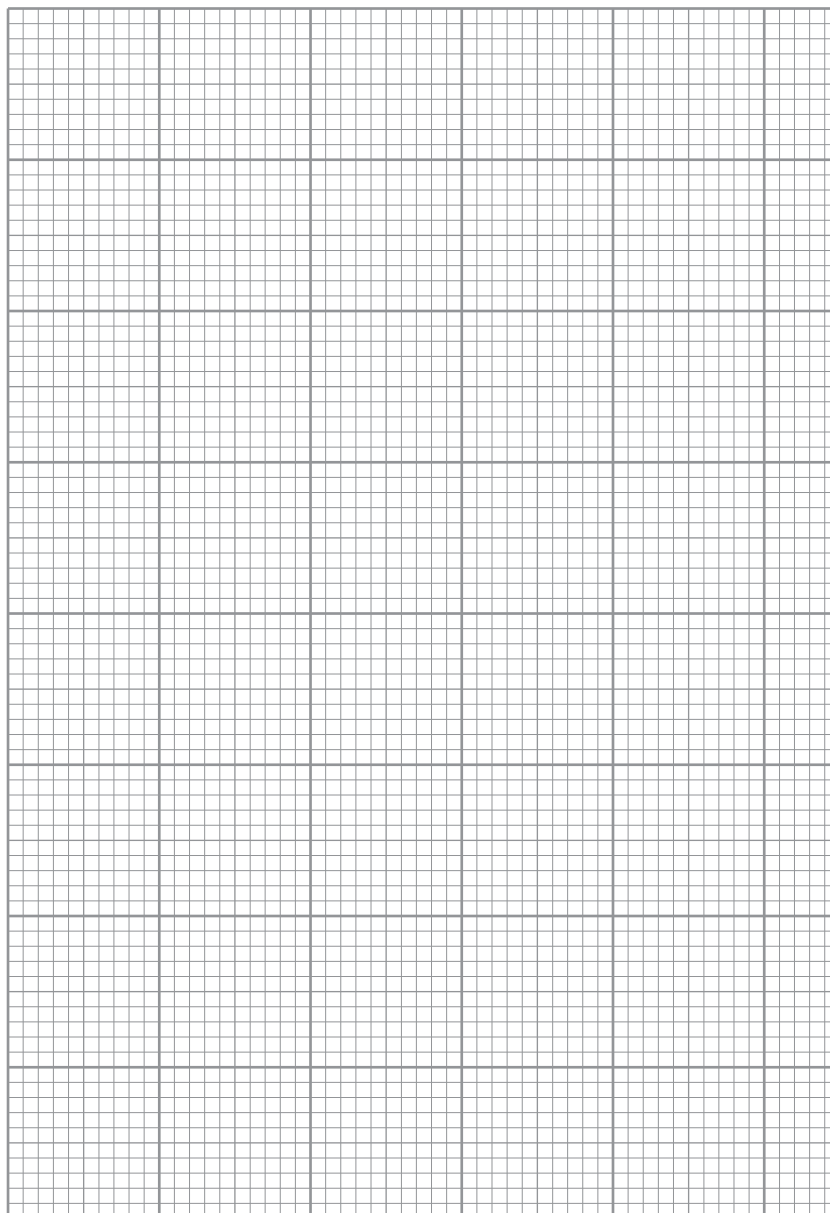
Use the equations and information above to calculate the acceleration of the marble down the ramp in m/s^2 . [4]

Acceleration = m/s^2

- (b) An experiment is then carried out to find out how the acceleration of the marble depends on the height h_1 . Throughout this experiment height h_2 is constant. The results of the experiment are shown in the table below.

Height h_1 (m)	Acceleration (m/s^2)
0	0
0.2	0.14
0.5	0.36
0.6	0.43
0.9	0.62
1.0	0.74

- (i) Use the data in the table to plot a graph on the grid below and draw a suitable line. [3]



- (ii) Use the graph to find the height required to produce an acceleration of 0.5 m/s^2 . [1]

Height =

- (iii) Describe how the experiment can be extended to determine how the range depends on the height h_2 . [2]

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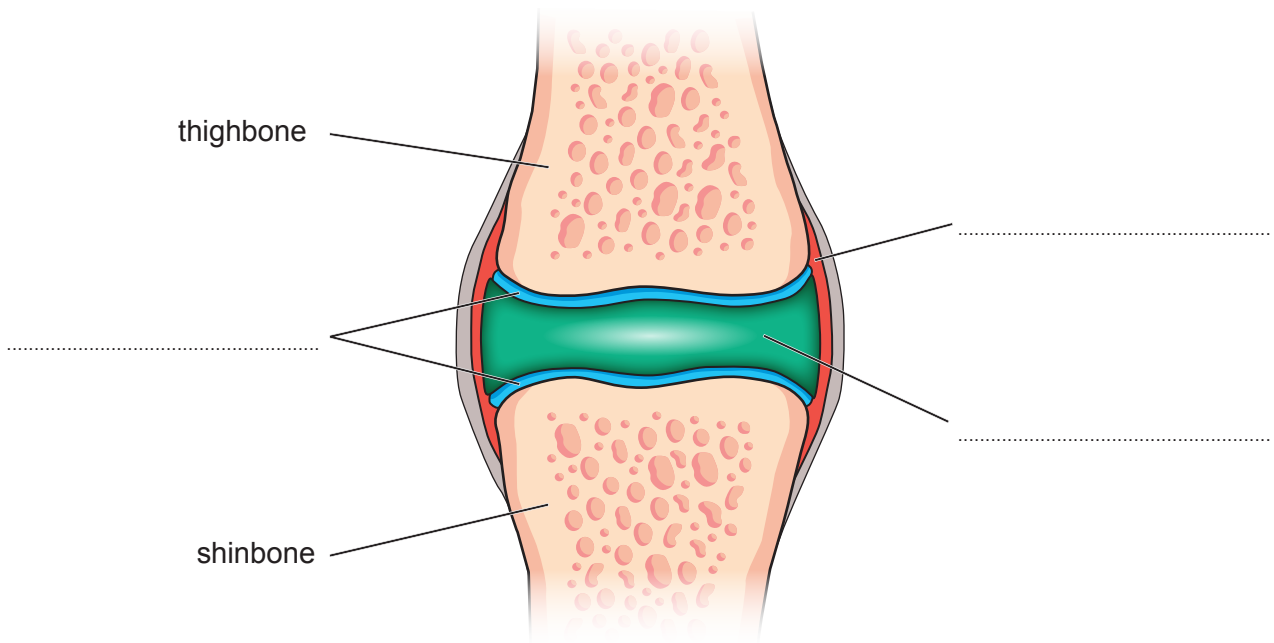
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- (c) Ski jumpers place their knee joints under considerable strain during their career. The knee is easily injured.

A simplified diagram of a knee joint is shown below.



- (i) **Complete** the labelling of the diagram above. [3]
- (ii) Explain why a ski jumper will not be able to compete if they damage the cartilage in their knee joints. [2]

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- (iii) An X-ray was taken of a ski jumper's leg following an accident.



State the name of this **type** of fracture.

[1]

16

5. In normal circumstances, nitrogen in the soil is recycled and causes no harm to aquatic organisms in nearby streams or rivers.

(a) Describe how nitrogen is recycled in the soil.

[4]

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(b) Use of artificial fertilisers increases the level of nitrogen in the soil. Explain why this becomes harmful to aquatic organisms.

[4]

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6. Humans are protected against disease by vaccination programmes and the use of antibiotics.

- (a) Measles is a highly infectious viral illness that is uncommon in the UK because of the effectiveness of vaccination. The measles vaccine provides life-long protection against the disease.

(i) Explain how vaccines work.

[2]

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- (ii) A flu vaccine is also available. Unlike the measles vaccine, it needs to be given every year and is not 100% effective. Explain why a flu vaccine does not provide life-long protection.

[4]

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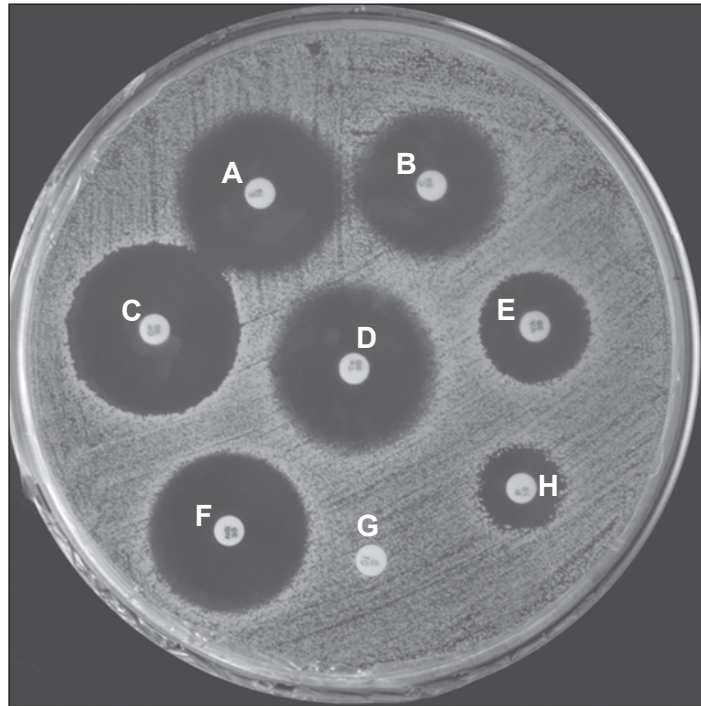
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- (b) Doctors prescribe patients antibiotics to help fight bacterial infections. There are a variety of antibiotics available.

The photograph below shows the results of an experiment to determine the effectiveness of different antibiotics against one type of bacterium.

Eight different antibiotics were tested. Each disc contains one of the antibiotics (**A** to **H**).



- (i) Evaluate the effectiveness of the antibiotics **A** to **H**.

[3]

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- (ii) A disc containing sterile water could be included to act as a control (not shown in the photograph). State the purpose of this control disc.

[2]

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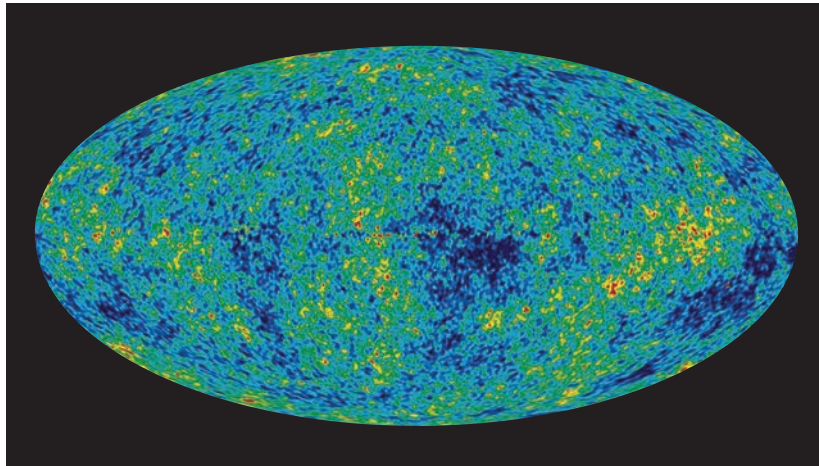
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7. In 1802, spectra from stars and galaxies were first observed.

In the 1940s the Steady State Theory of the origin of the Universe was proposed by Sir Fred Hoyle and other scientists.

In 1964, American astronomers discovered there was electromagnetic interference coming from all parts of the sky at all times. This is shown in the image below.



- (a) State the name of the region of the electromagnetic spectrum that is recorded on the image shown above. [1]

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- (b) Explain the evidence that led to an alternative, different theory of the origin of the Universe to the Steady State Theory. [6 QER]

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THE PERIODIC TABLE

1 2 3 4 5 6 7 0

Group

1 H Hydrogen 1									4 He Helium 2								
7 Li Lithium 3	9 Be Beryllium 4								19 F Fluorine 9	20 Ne Neon 10							
23 Na Sodium 11	24 Mg Magnesium 12								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	63.5 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
86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 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	127 I Iodine 53	131 Xe Xenon 54	
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 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	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

A_r	relative atomic mass
Symbol	
Name	
Z	atomic number