



BTEC Applied Science Induction Task

You will study biology, chemistry and physics topics whilst studying applied science. In this booklet are three sections of questions that cover GCSE content in biology, chemistry and physics. All questions relate to some of the first topics that you will study during your first unit in applied science.

Your task is to complete all the questions and bring your answers with you to all of your applied science lessons during the first week of term in September.

You can either print off this document and write directly on it or you can write your answers on separate paper. If you choose to write your answers on separate paper please have your answers for the different sections (biology, chemistry and physics) on separate paper so that it can be handed in to your different teachers.

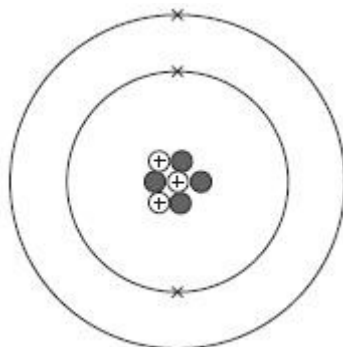
We are looking forward to meeting you all.

Chemistry Section

Q1.

This question is about atomic structure.

The figure below represents the structure of a lithium atom.



- (a) Name the particle in the atom that has a positive charge.

(1)

- (b) Name the particle in the atom that has the smallest mass.

(1)

- (c) Complete the sentences.

Choose the answers from the box.

3	4	7	10
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The mass number of the lithium atom is _____.

The number of neutrons in the lithium atom is _____.

(2)

- (d) What are lithium atoms with different numbers of neutrons called?

Tick (✓) **one** box.

Compounds

Ions

Isotopes

Molecules

(1)

(e) Name the particle in the atom discovered by James Chadwick.

_____.

(1)

(f) An element has two isotopes.

The table shows information about the isotopes.

	Mass number	Percentage (%) abundance
Isotope 1	10	20
Isotope 2	11	80

Calculate the relative atomic mass (A_r) of the element.

Use the equation:

$$A_r = \frac{(\text{mass number} \times \text{percentage}) \text{ of isotope 1} + (\text{mass number} \times \text{percentage}) \text{ of isotope 2}}{100}$$

Give your answer to 1 decimal place.

Relative atomic mass (A_r) = _____

(2)

(g) The radius of an atom is 0.2 nm

The radius of the nucleus is $\frac{1}{10000}$ the radius of the atom.

Calculate the radius of the nucleus.

Give your answer in standard form.

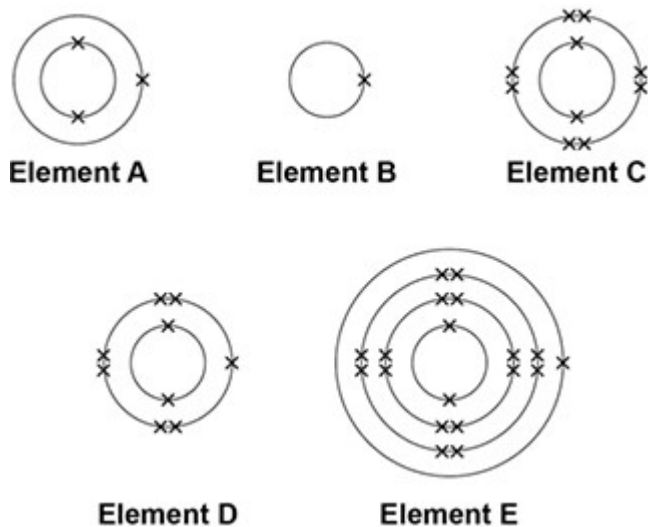
Radius = _____ nm

(2)

(Total 10 marks)

Q2. The electronic structure of the atoms of five elements are shown in the figure below.

The letters are **not** the symbols of the elements.



Choose the element to answer the question. Each element can be used once, more than once or not at all.

Use the periodic table to help you.

(a) Which element is hydrogen? Tick **one** box.

A
 B
 C
 D
 E

(1)

(b) Which element is a halogen? Tick **one** box.

A
 B
 C
 D
 E

(1)

(c) Which element is a metal in the same group of the periodic table as element **A**? Tick **one** box.

A B C D E

(1)

(d) Which element exists as single atoms? Tick **one** box.

A B C D E

(1)

(e) There are two isotopes of element **A**. Information about the two isotopes is shown in the table below.

Mass number of the isotope	6	7
Percentage abundance	92.5	7.5

Use the information in the table above to calculate the relative atomic mass of element **A**.
Give your answer to 2 decimal places.

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.....
.....
.....
.....
.....
.....

Relative atomic mass =
.....

(4)
(Total 8 marks)

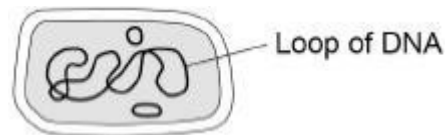
Biology Section

Q3.

This question is about cells.

(a) **Figure 1** shows a cell.

Figure 1



What type of cell is shown in **Figure 1**?

Tick (✓) **one** box.

Animal

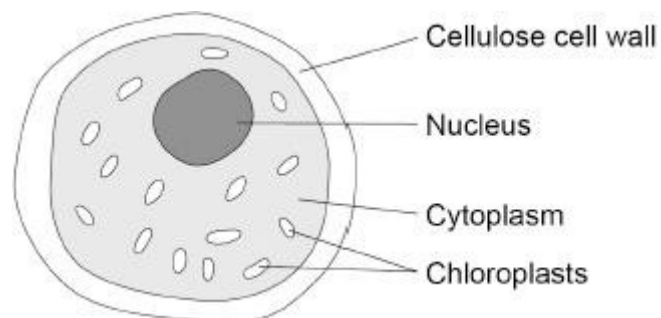
Bacterium

Plant

(1)

Figure 2 shows an algal cell.

Figure 2



(b) What is the function of the cell wall?

Tick (✓) **one** box.

To contain the genetic material

To stop the chloroplasts leaking out

To strengthen the cell

(1)

(c) The algal cell is green.

Which part of the algal cell makes it green in colour?

Tick (✓) **one** box.

Cellulose

Chloroplast

Cytoplasm

Nucleus

(1)

(d) Cells contain sub-cellular structures.

Draw **one** line from each structure to its function.

Structure	Function
Cell membrane	Controls transport of substances into the cell
Mitochondria	Where energy is released
Ribosomes	Where glucose is made
	Where photosynthesis takes place
	Where proteins are made

(3)

A student prepared a microscope slide of cheek cells.

The student looked at one cell using a microscope.

Figure 3 shows the image the student saw.

Figure 3



(e) What should the student do to get a clear image?

Tick (✓) **one** box.

Adjust the focus knob

Make the light dimmer

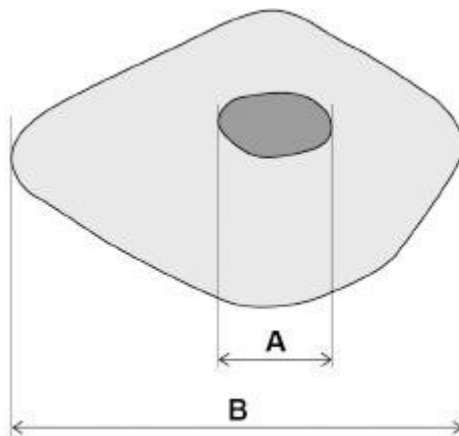
Put water on the slide

(1)

The student then obtained a clear image.

Figure 4 shows the clear image.

Figure 4



(f) Measure the length of the nucleus (**A**) and the length of the cell (**B**) in millimetres (mm).

A = _____ mm

B = _____ mm

(2)

(g) How many times longer is the cell (**B**) than the nucleus (**A**)?

Number of times longer = _____

(1)

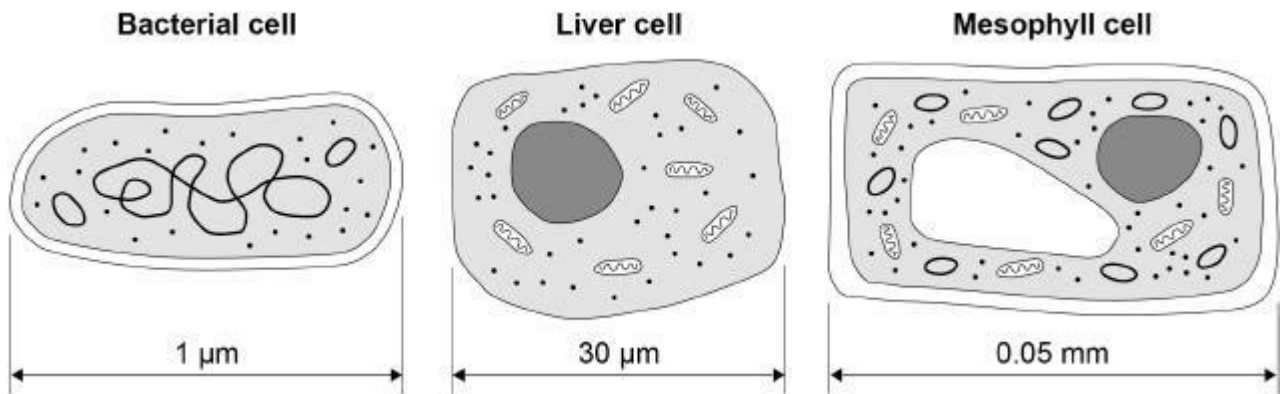
- (h) The student looked at another cell.
 The image width of the cell was 40 mm
 The real width of the cell was 0.1 mm
 Calculate the magnification of the cell.
 Use the equation:

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

Magnification = × _____ (2)
 (Total 12 marks)

Q4.

The diagram below shows three types of cell.



- (a) Give **two** similarities between the prokaryotic cell and the eukaryotic cells in the diagram above.

1 _____
 2 _____

(2)

(b) Give **three** differences between the prokaryotic cell and the eukaryotic cells in the diagram above.

1 _____

2 _____

3 _____

(3)

(c) Calculate the ratio of the size of the bacterial cell to the size of the mesophyll cell.

Ratio = 1 : _____

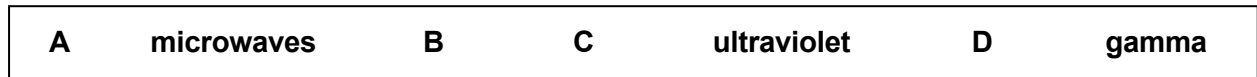
(2)

(d) Name the type of cell division that produces genetically identical body cells for growth and repair.

(1)

Physics Section

The figure below shows an incomplete electromagnetic spectrum.



- 5.** (a) What name is given to the group of waves at the position labelled **A** in the figure above?

Tick **one** box.

infrared

radio

visible light

X-ray

(1)

(b) Electromagnetic waves have many practical uses.

Draw **one** line from each type of electromagnetic wave to its use.

Electromagnetic wave	Use
Gamma rays	For fibre optic communications
Microwaves	For communicating with a satellite
Ultraviolet	To see security markings
	To sterilise surgical instruments

(3)

(c) Complete the sentence.

Use an answer from the box.

black body	ionising	nuclear
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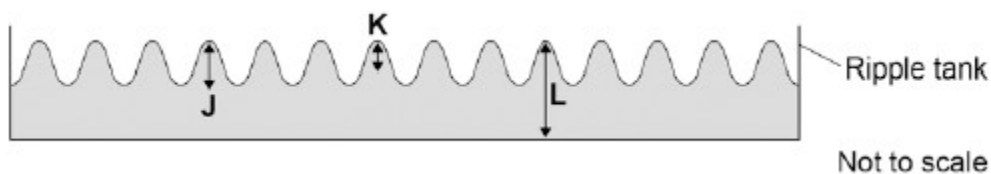
X-rays can be dangerous to people because X-rays are
_____ radiation.

(1)

(Total 5 marks)

- 6.** Small water waves are created in a ripple tank by a wooden bar. The wooden bar vibrates up and down hitting the surface of the water.

The figure below shows a cross-section of the ripple tank and water.



- (a) Which letter shows the amplitude of a water wave?

Tick **one** box.

J

K

L

(1)

- (b) The speed of the wooden bar is changed so that the bar hits the water fewer times each second.

What happens to the frequency of the waves produced?

Tick **one** box.

Increases

Does not change

Decreases

(1)

- (c) Describe how the wavelength of the water waves in a ripple tank can be measured accurately.

(2)

- (d) The speed of a wave is calculated using the following equation.

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

The water waves in a ripple tank have a wavelength of 1.2 cm and a frequency of 18.5 Hz.

How does the speed of these water waves compare to the typical speed of a person walking?

(4)

(Total 8 marks)