BTEC SCIENCE TRANSITION TASK 2023

Name: _____

There are 6 parts to this transition task

- Biology questions
- Biology research task
- Chemistry questions
- Chemistry research task
- Physics questions
- Physics research task

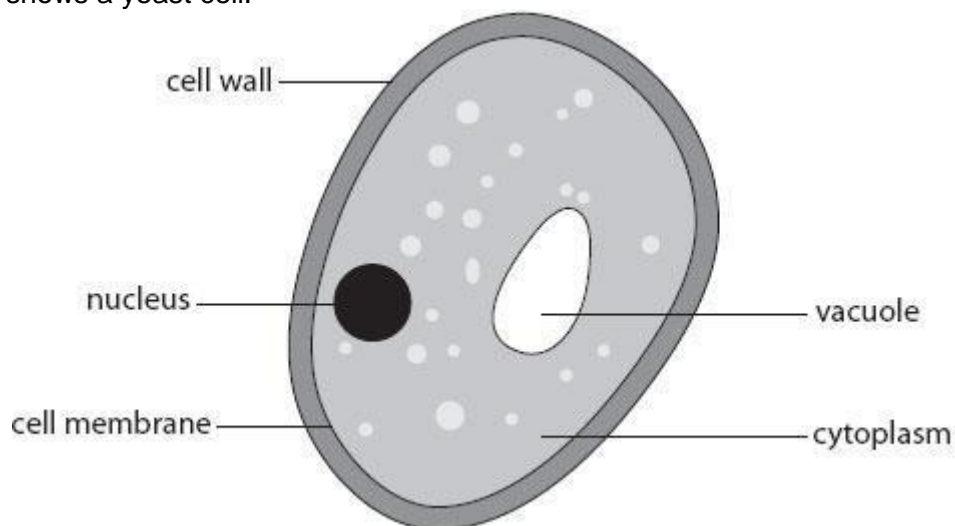Answer the questions in this booklet.

The questions are on the areas of science previously met at GCSE. These concepts will be developed further throughout the course

The research tasks should be completed separately.

Biology questions

Q1.

Yeasts are microorganisms that are used in the brewing and baking industries.
The diagram shows a yeast cell.

(a) (i) State **two** ways in which the structure of this yeast cell differs from the structure of a bacterial cell.

(ii) Plant cells can produce glucose.

Suggest why yeast cells cannot produce glucose.

(1)

(b) The table shows the number of different components found in the blood of a healthy person and the blood of two other   people.

| | number of components per dm³ of blood | | |
component of blood	healthy person	person A	person B
red blood cells	5×10^{12}	6×10^{12}	3×10^{12}
white blood cells	7×10^{9}	5×10^{10}	8×10^{10}
platelets	3×10^{11}	3×10^{11}	3×10^{11}

(i) Calculate the difference in the number of white blood cells per dm3 of blood between the healthy person and person A.

(2)

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(ii) Describe the functions of white blood cells.

White blood cells are part of the immune system, they fight infection and other diseases.They also provoke an allergy reaction. Cleans the blood of dead cells.
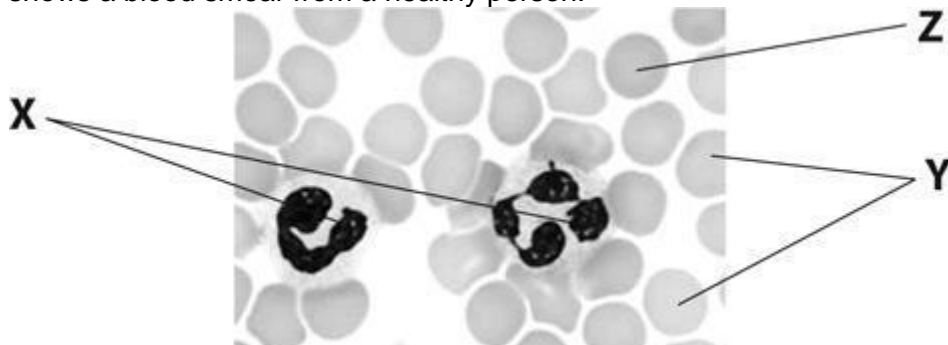
(2)

(iii) Person B has a low number of red blood cells compared to the healthy person.
    Suggest an effect this may have on person B.

(1)

Q2.
The photograph shows a blood smear from a healthy person.

(i)   Name the **two** types of blood cells, **X** and **Y**, shown in the photograph.

(2)

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The function of the cells labelled **X** is to

(1)

☒   **A** engulf bacteria
☒   **B** produce antigens
☒   **C** transport carbon dioxide
☒   **D** transport oxygen

(iii) Measure the diameter of the cell labelled **Z**.

(1)

diameter = ... mm
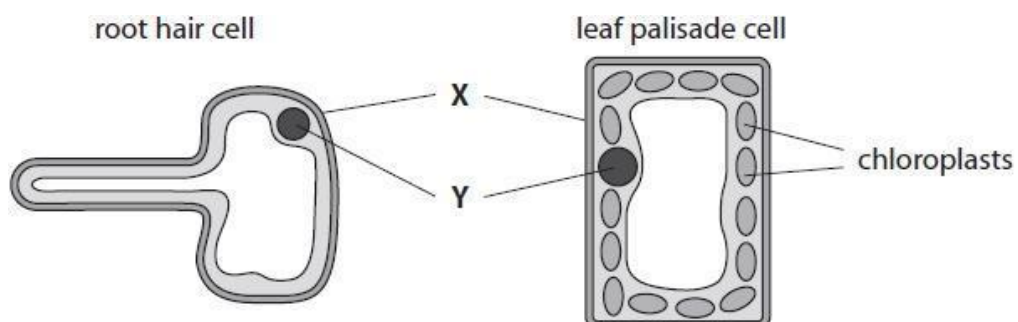
(iv) The cell labelled **Z** is magnified × 900.
    Calculate the actual diameter of the cell labelled **Z**.

(2)

actual diameter = ... µm

Q3. The diagrams show a root hair cell and a leaf palisade cell.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

The part labelled **X** is the

(1)

☒ **A** nucleus
☒ **B** cell wall
☒ **C** cytoplasm
☒ **D** vacuole

(ii) Describe the role of part **Y**.

(2)

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Q4.

(a) Describe how the structure of a red blood cell is related to its function.

(3)

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(b) Describe the function of platelets.

(2)

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Q5.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

A group of the same type of cells, such as red blood cells, is known as

(1)

☒ **A** an organ

☒ **B** an organ system

☒ **C** an organism

☒ **D** a tissue

(b) A response can be affected by drugs.
The effect of drinking alcohol on reaction time was investigated using five adult volunteers A, B, C, D and E.
After drinking a number of units of alcohol, the reaction time for each volunteer was measured three times.
The results are shown in the table.

%%%	%%%				Reaction time / ms
Volunteer	Number of units of alcohol drunk	1st attempt	2nd attempt	3rd attempt	Mean
A	0.5	34	38	27	33
B	1.5	36	47	40	41
C	3.0	59	62	59	60
D	4.5	67	60	62	
E	6.0	80	68	83	77

(i) Calculate the mean reaction time for volunteer D.

(2)

....

(ii) Explain why alcohol causes a change in reaction time.

(2)

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Q6. Bacteria are microscopic organisms.
(i) State a part of the light microscope that magnifies the bacteria.

(1)

....

Photograph A was taken using a light microscope and photograph B was taken using an electron microscope.

Photograph A

Photograph B

(ii) Describe **two** advantages of using an electron microscope to view bacteria.

(2)

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(iii) Name **one** structure of the bacterial cell that can be seen in the image from the electron microscope.

(1)

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Biology Research Task

The discovery of cells- cell theory

Produce a timeline of events that have led to the modern day cell theory. Your timeline should include the date, what the discovery was/why it was important and who discovered it. Start with Robert Hooke in 1655 and include at least 6 Scientists/discoveries.

Chemistry

Q1.

An atom of phosphorus contains 15 electrons. Describe how these 15 electrons are arranged in a phosphorus atom.

(2)

....

Q2.

Lithium, sodium and potassium are metals in group 1 of the periodic table. They are good conductors of heat and electricity. The freshly-cut metals are shiny.

(a) (i) Give another physical property of all three of these metals.

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(1)

(ii) Explain, in terms of electrons in their atoms, why lithium, sodium and potassium are in group 1 of the periodic table.

....

.... (2)

(b) A small piece of potassium is added to water.
(i) Describe what you would **see** in this reaction.

....

.... (2)

(ii) Which of these is the balanced equation for this reaction?
Put a cross (☒) in the box next to your answer.

(1)

☒ **A** $2K + 2H_2O \quad K_2O + 2H_2$
☒ **B** $2K + H_2O \quad K_2O + H_2$
☒ **C** $4K + 3H_2O \quad 4KOH + H_2$
☒ **D** $2K + 2H_2O \quad 2KOH + H_2$

(c) There is an increase in reactivity of these group 1 metals from lithium to potassium.
Explain this increase in reactivity.

....

.... (2)

Q3.

An atom of copper has an atomic number of 29 and a mass number of 63.

(i) Complete the table to show the numbers of protons, neutrons and electrons in this atom of copper.

(2)

particle	number
proton	
neutron	
electron	

(ii) Copper is in period 4 of the periodic table.

State what information this gives about the number of shells that contain electrons, in a copper atom.

(1)

....

(iii) Copper exists as isotopes.

Explain what is meant by the term **isotopes**.

(2)

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(iv) A sample of copper contains

70% of copper-63 atoms and
30% of copper-65 atoms.
Use this information to calculate the relative atomic mass of copper in this sample.

(3)

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relative atomic mass of copper = ...

Q4.
Complete the balanced equation for the reaction of iron with chlorine to form iron chloride.

(2)

.... Fe + ... Cl_2 → $2FeCl_3$

Q5. The table shows the names and formulae of three ions.

name of ion	formula of ion
calcium	Ca^{2+}
nitrate	NO_3^-
phosphate	PO_4^{3-}

What is the formula of calcium nitrate?
Put a cross (☒) in the box next to your answer.

(1)

☒ **A** Ca_2NO_3
☒ **B** $CaNO_3$
☒ **C** Ca_3NO_2
☒ **D** $Ca(NO_3)_2$

Q6.
The simplest ratio of aluminium atoms to chlorine atoms in aluminium chloride is 1 : 3.

The empirical formula of aluminium chloride is $AlCl_3$.

The simplest ratio of aluminium atoms to oxygen atoms in aluminium oxide is 2 : 3.

Give the empirical formula of aluminium oxide.

(1)

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Q7.
Complete the sentence by putting a cross (☒) in the box next to your answer.

(1)

Magnesium reacts with sulfur to form magnesium sulfide

magnesium + sulfur → magnesium sulfide

In magnesium sulfide 24 g of magnesium are combined with 32 g of sulfur.

The ratio of magnesium atoms to sulfur atoms in magnesium sulfide is

(relative atomic masses: Mg = 24, S = 32)

		ratio of magnesium atoms : sulfur atoms
☒	A	1 : 1
☒	B	1 : 2
☒	C	2 : 1
☐	D	3 : 4

Q8.
Complete the sentence by putting a cross (☒) in the box next to your answer.
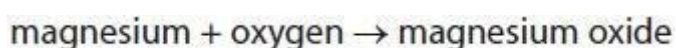
Carbon dioxide is a gas at room temperature.
A carbon dioxide molecule is a

(1)

☒   **A** giant molecule that has covalent bonds
☒   **B** giant molecule that has ionic bonds
☒   **C** simple molecule that has covalent bonds
☒   **D** simple molecule that has ionic bonds

Q9. An experiment is carried out to determine the empirical formula of magnesium oxide.

magnesium + oxygen → magnesium oxide

The following results are obtained

mass of magnesium ribbon reacted = 0.420 g
mass of magnesium oxide formed = 0.700 g

Describe an experiment to produce these results. As part of your answer show how these results can be used to obtain the empirical formula of the magnesium oxide.

(relative atomic masses: Mg = 24.0, O = 16.0)

(6)

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Total for chemistry =30 marks

Chemistry BTEC reearch task

Your chemistry transition task is to make a presentation or resource about analytical techniques in chemistry, you can choose between either titration or colorimetry. This could be a powerpoint, poster, written report, video, etc. whatever suits you best as long as it contains the following:

Titration

- a description of what titration is

- an explanation of how titration works

- a general method for titration (include specialist equipment and how to use it e.g. burette)

- examples of how titration can be used

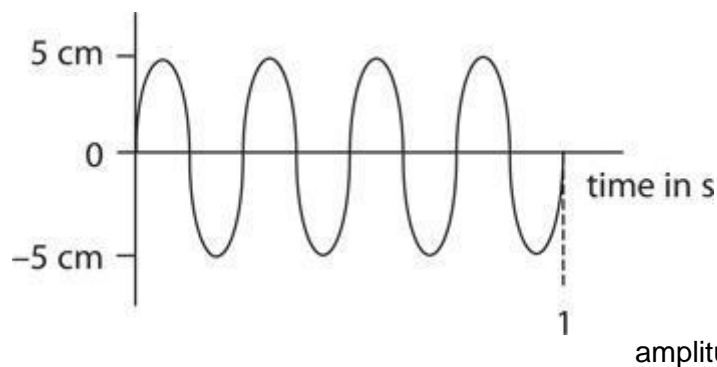- different indicators or alternatives (e.g. pH probe)

Colorimetry
- a description of what colorimetry is

- a brief explanation of how colorimetry works (you may want to include diagrams/pictures)

- examples of how colorimetry can be used

Physics

Q1.

State the amplitude of this sound wave.

amplitude =..........................

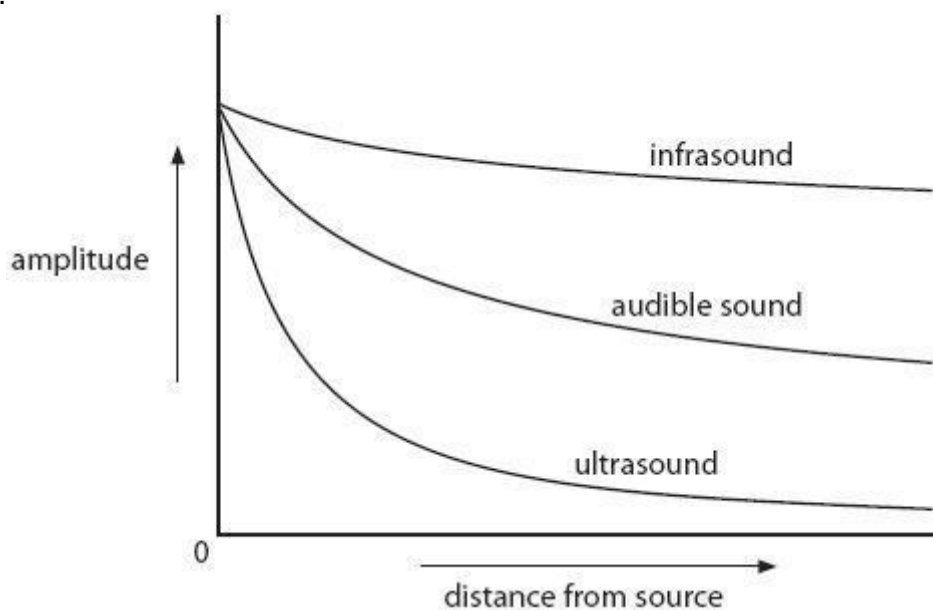**Q2.**

As a sound wave travels through water its amplitude gets smaller.
This graph shows how the amplitude of different types of sound waves decreases as they travel through water.

Whales use sound to communicate over long distances.
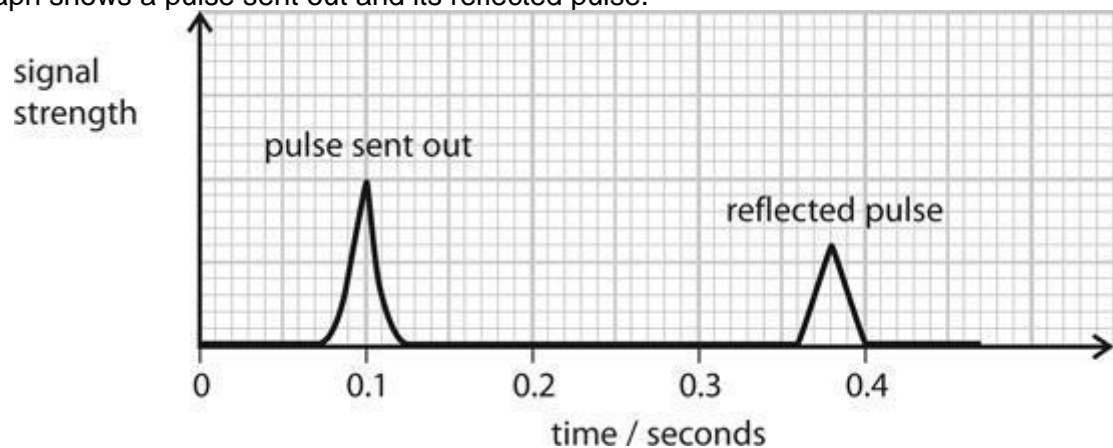Explain which is the best type of sound wave for whales to use when communicating over long distances.

(2)

....

....

....

Q3.
This fishing boat has sonar equipment.

The boat's sonar sends out pulses of ultrasound.
The pulses are reflected from the seabed.
The boat's sonar detects the reflected pulses.
The graph shows a pulse sent out and its reflected pulse.

(i)   How long did the pulse take to travel to the seabed and then back to the boat?

(1)

time = ... s

(ii) The speed of ultrasound in water is 1500 m/s.
Calculate the depth of the sea under the boat.

(2)

distance = speed × time

depth = ... m

Q4.

A wave has a frequency of 15 Hz. Its wavelength is 125 m. Calculate the speed of the wave.
State the unit.

(3)

speed................................

Q5.

The electromagnetic spectrum is continuous.
Different regions of the spectrum have different properties.
An electromagnetic wave has a frequency of 7×10^9 Hz.
The speed of the wave is 3×10^8 m/s.
Calculate the wavelength of the wave.

(3)

wavelength = ...m

Q6.

The frequency of a wave is given by the equation:

frequency = wave speed / wavelength

A seismic wave has a speed of 6 km/s. Its wavelength is 10 m. Calculate the frequency of this wave.

(3)

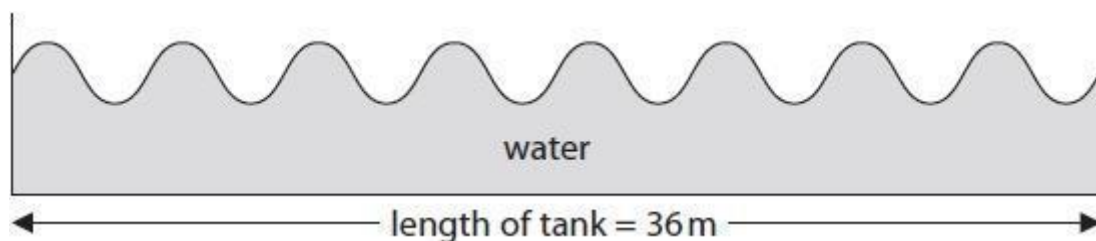frequency = ... Hz

(Total for question = 3 marks)

Q7.

Scientists use wave tanks to show the behaviour of waves.

The diagram shows a wave tank from the side.

length of tank = 36 m

(i) Calculate the wavelength of the waves.

(1)

wavelength = ... m

(ii) A crest of the wave takes 20 s to travel the whole length of the tank.

Calculate the speed of the wave.
State the unit.

(3)

speed of wave = ... unit = ...

(Total for question = 4 marks)

Q8.

Some students repeat Herschel's experiment.
(a) They place four identical thermometers, **P**, **Q**, **R** and **S**, in the shade.
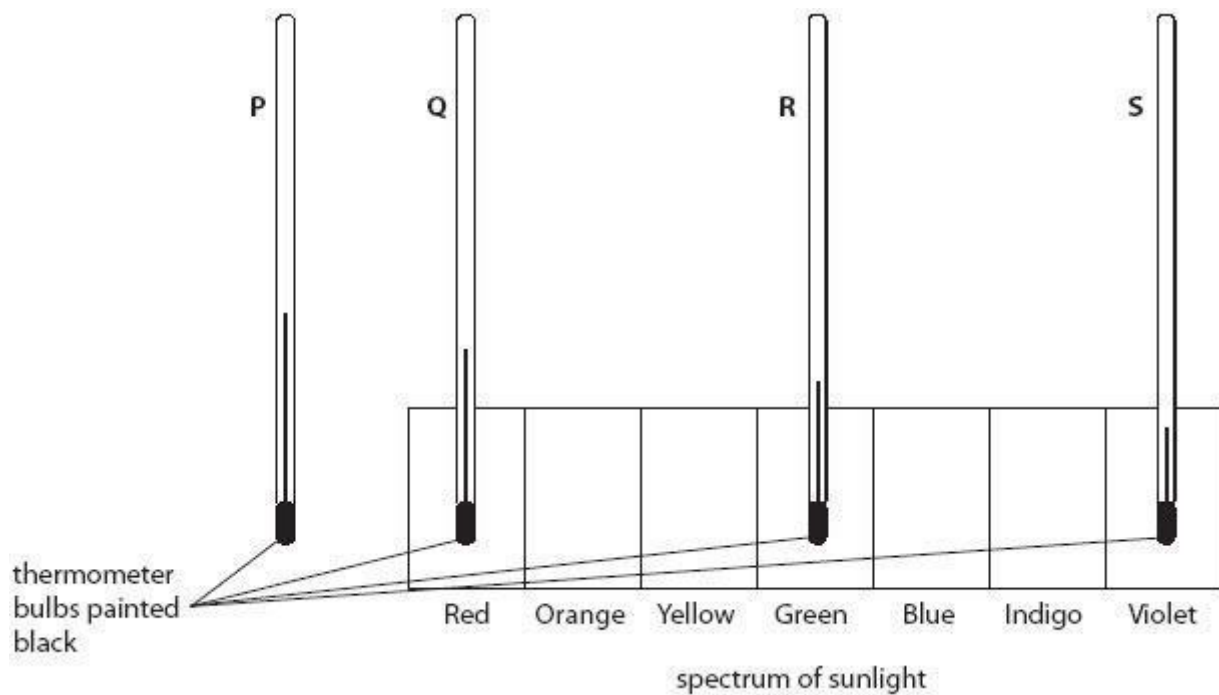The table shows some of the readings on the thermometers in the shade.
Complete the table to show the reading on thermometer **Q**.

(1)

	thermometers in the shade			
	P	**Q**	**R**	**S**
temperature / °C	18		18	18

(b) Then the four thermometers are placed in the spectrum of sunlight as shown.

spectrum of sunlight

(i) The bulbs of the thermometers are painted black.
   State why the bulbs of the thermometers are painted black.

(1)

....

....

(ii) The table shows the readings on the thermometers in the spectrum of sunlight.

	thermometers in the spectrum of sunlight			
	P	Q	R	S
temperature / °C	25	23	21	20

Describe conclusions that can be made from the students' results.

(2)

....

....

....

....

(iii) State why the students put the four thermometers together in the shade before placing them in the spectrum
   of sunlight.

(1)

....

....

  (c) Another scientist, Ritter, discovered ultraviolet radiation.
     (i) Complete the sentence by putting a cross (☒) in the box next to your answer.
   Too much exposure to ultraviolet radiation may cause

(1)

☒ **A** deafness
☒ **B** heating of internal body cells
☒ **C** damage to the eyes
☒ **D** damage to the bone cells

(ii) Three signals, ultraviolet, visible light and infrared, are sent from the surface of the Moon to an orbiting spacecraft.

The three signals are sent at the same time.
Which of these is correct for the signals arriving at the spacecraft?
Put a cross (☒) in the box next to your answer.

(1)

☒ **A** the visible light signal arrives first
☒ **B** the ultraviolet signal arrives first
☒ **C** the infrared signal arrives first
☒ **D** all three signals arrive at the same time

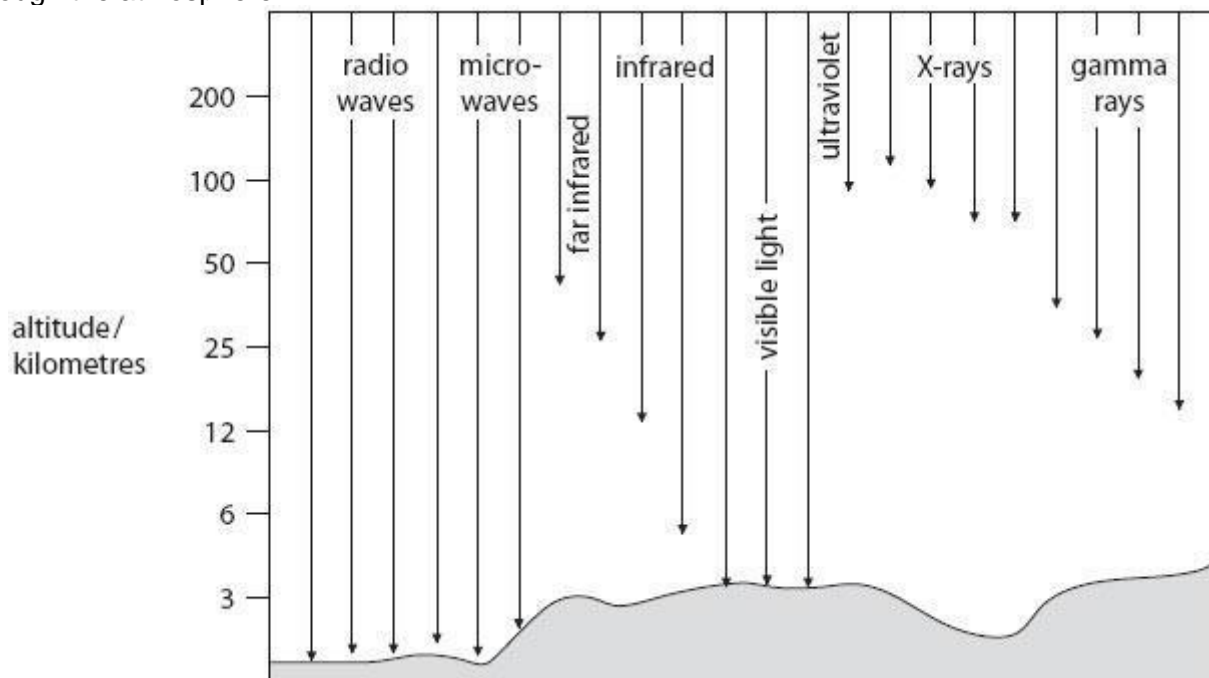(iii) Describe **one** use of ultraviolet radiation.

(2)

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....

(Total for Question is 9 marks)

Q9.

Not all electromagnetic radiation coming from space reaches the Earth's surface.
The diagram shows how far radiation from each part of the electromagnetic spectrum travels down through the atmosphere.

(i) Name **one** type of radiation that can reach the surface of the Earth from stars.

(1)

....

....

(ii) Name **one** type of radiation from stars that cannot be detected at the Earth's surface but can be detected using satellites.

(1)

....

....

Total for physics =30 marks

Physics research task

For this task you will be given a scenario and asked to create a presentation. This can be on powerpoint or google slides.

'You are an engineer working for Sky. You need to give a presentation on forms of electronic communication using the electromagnetic spectrum, explaining the different applications and their uses. You must include mobile phones, Bluetooth, Wi-Fi and IR (in TV remote controls). For each application you must explain:
- The power and range
- The number of devices that can be linked
- The frequency band on the EM spectrum
- How it is used and regulated'

The presentation should be no longer than 6 slides in length.