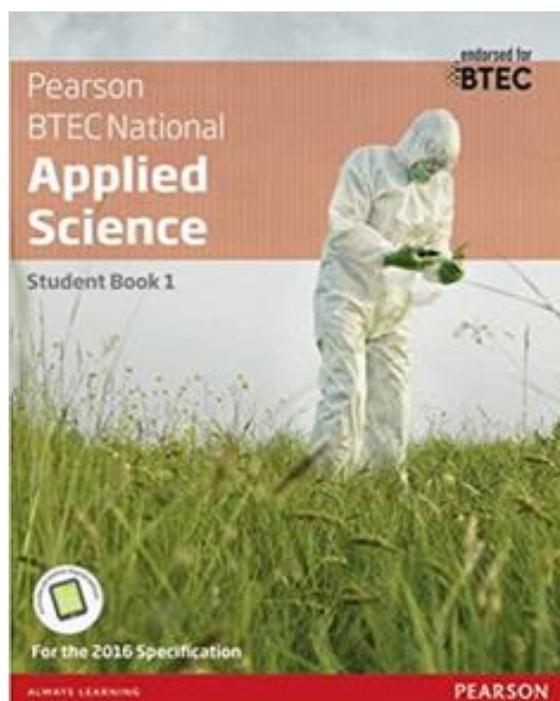


BTEC APPLIED SCIENCE BRIDGING PROJECT - SUGGESTED BOOK SUPPORT

All of the content covered during the BTEC course for year 12 and 13 is included in this book (**ISBN-13:** 978-1292134093). It is available on Amazon and you could consider clicking the 'used copy' option, which can be as little as half the price of a brand new book. Not all sections of the book are covered throughout the course; you will only be studying sections/units 1, 2, 3 and 9.

Some of the content you will have covered at GCSE, and when you return to school, we will be covering section/unit 1, which is Biology, Chemistry and Physics, so it will be worthwhile reading through this section and also revising the relevant unit 1 topics from your GCSE Science work and revision guides.



HOW TO USE THIS BOOKLET

Within this booklet, you will find access to resources that might interest you. Work your way through the resources and tasks.

The tasks that are highlighted in purple should be submitted by e-mail to:

Miss Campbell and Mrs Oxenbold

c.campbell@jws.bham.sch.uk

m.oxenbold@jws.bham.sch.uk

If you do manage to get hold of the suggested book, this would be a good introduction for you and will help you with the tasks. As previously mentioned, your GCSE Science revision notes and guides will also be very useful.

When you feel ready, complete and submit the baseline assessment at the end of the booklet.

The deadline for this baseline assessment is

Monday 29th June.

BRIDGING TASKS

The BTEC Applied Science course will use your knowledge from GCSE and build on this to help you understand new and more demanding ideas. Complete the following tasks to make sure your knowledge is up to date and you are ready to start studying:

The tasks that are in purple are required for submission

BIOLOGY

Cell Structure and Function

All living things are made of cells - they are the fundamental unit of structure, function and organisation in all living organisms. Cell theory states that both plant and animal tissue are composed of cells and that cells are the basic unit of life. You can use microscopes to see distinct cells that make up multicellular organisms and allows us to observe how their structure relates to their function. Light microscopes use visible light and magnifying lenses to observe small objects and electron microscopes use a beam of electrons in a vacuum to visualise the specimen. There are two types of cells. Prokaryotic cells are single-celled organisms such as bacteria that have a simple structure and do not have a nucleus or any membrane-bound organelles. Eukaryotic cells make up multicellular organisms such as plants and animals. They are complex cells with a nucleus and membrane-bound organelles.

Read the information on these websites:

[https://www.pearsonschoolsandcolleges.co.uk/FEAndVocational/Science/BTECAppliedScience/BTECLevel2FirstAppliedScience/Samples/FREElesson!/FREELesson31CellsandCellFunction\(StudentBookandTeacherPlanningPackMaterial\).pdf](https://www.pearsonschoolsandcolleges.co.uk/FEAndVocational/Science/BTECAppliedScience/BTECLevel2FirstAppliedScience/Samples/FREElesson!/FREELesson31CellsandCellFunction(StudentBookandTeacherPlanningPackMaterial).pdf)

<https://www.bbc.co.uk/bitesize/topics/znnycdm/articles/zr69dxs>

And take a look at these videos:

<https://www.youtube.com/watch?v=GuY0n7-zfds>

<https://www.youtube.com/watch?v=HBZcpzr5B2g&list=PL9IouNCPbCxVU74eQtCcqbaQdYmwzAnlC>

Task 1: Divide an A4 sheet of paper into three sections labelled Animal Cell, Plant Cell and Prokaryotic Cell. Draw labelled diagrams of each cell showing the differences in structures/components that each cell contains. Underneath each drawing, write the functions of each of the structures

Cell Specialisation

Many organisms are multi-cellular, meaning that they are made from billions of cells. It is important that cells within these organisms become specialised for different roles with particular functions. For example, sperm cells are male gametes in animals; they have a tail so they can swim towards the egg and they contain many mitochondria to supply the energy for this movement. Multi-cellular organisms in higher animals and higher plants are organised as follows: specialised cells; tissues; organs; organ systems and organism.

Read the information on these websites:

<https://getrevising.co.uk/revision-notes/specialised-cells-4>

[https://www.pearsonschoolsandfecolleges.co.uk/FEAndVocational/Science/BTECAppliedScience/BTECLevel2FirstAppliedScience/Samples/FREELesson!/FREELesson31CellsandCellFunction\(StudentBookandTeacherPlanningPackMaterial\).pdf](https://www.pearsonschoolsandfecolleges.co.uk/FEAndVocational/Science/BTECAppliedScience/BTECLevel2FirstAppliedScience/Samples/FREELesson!/FREELesson31CellsandCellFunction(StudentBookandTeacherPlanningPackMaterial).pdf)

<https://www.bbc.co.uk/bitesize/guides/zpqpqh/v/revision/12>

And take a look at this video:

<https://www.youtube.com/watch?v=UZwT-Jx8LzY&list=PL9IouNCPbCxVU74eQtCcqbaQdYmwzAnlC&index=6>

Task 2: Explain how the following cells are adapted to their function. You should discuss at least 3 adaptations for each cell and attempt to draw a diagram of each cell to illustrate your explanations

Sperm Cells

Nerve Cells

Muscle Cells

Root Hair Cells

Phloem and Xylem Cells

CHEMISTRY

Electronic Structure and Bonding

All substances are made up of atoms. They're really tiny – too small to see, even with your microscope. Atoms contain protons, neutrons and electrons. The nucleus contains positive protons and neutral neutrons and surrounding the nucleus are energy shells containing negative electrons. Each shell can hold electrons up to a maximum number. When atoms lose or gain electrons, they form ions and when they do this they are trying to get a full shell because atoms with full outer shells are very stable.

Ionic bonding occurs when an atom of an element loses one or more electrons and donates it to an atom of a different element - this usually occurs when a metal and a non-metal react together. Covalent bonding usually occurs between atoms of two non –metals. A covalent bond forms when an electron is shared between the atoms.

Read the information on these websites:

<https://www.chemguide.co.uk/atoms/properties/elstructs.html>

<https://getrevising.co.uk/revision-notes/btec-unit-1-chemistry>

<https://www.bbc.co.uk/bitesize/guides/zg923k7/revision/3>

And take a look at these videos:

<https://www.youtube.com/watch?v=xK4Nnwp9I8M>

<https://www.youtube.com/watch?v=Biq-e9hsbil>

<https://www.youtube.com/watch?v=lenvZEcMc60>

Task 3: Draw the electronic arrangement and configuration for the first 3 elements in Group 1, Group 2, Group 7 and Group 0, AND draw two dot and cross diagrams to show how ionic compounds are formed, and two dot and cross diagrams to show how covalent compounds are formed

Elements and The Periodic Table

The periodic table shows all the chemical elements arranged in order of increasing atomic number. Chemists use it to predict how elements will behave, or what the physical or chemical properties of the element may be. The elements of the periodic table are organised into groups (vertical columns) and periods (horizontal columns). Chemical properties are similar for elements in the same group. For example, going down group 1, the melting and boiling points decrease. Melting and boiling points depend on the strength of the forces between the atoms in an element, so in group 1 this means that the forces of attraction get weaker.

Read the information on these websites:

<https://filestore.aqa.org.uk/resources/science/AQA-1775-PT.PDF>

<https://www.chemguide.co.uk/atoms/properties/elstructs.html>

<https://www.bbc.co.uk/bitesize/guides/zg923k7/revision/1>

And take a look at these videos:

https://www.youtube.com/watch?v=L3NEXz9iry&list=PL9IouNCPbCxULWXC09jt0PsuAbxYpw2_1

<https://www.youtube.com/watch?v=x3azcCq08IA>

Task 4: Produce a revision poster that describes and explains the trends in reactivity, melting and boiling points, and relative atomic mass for group 1 elements and group 7 elements

PHYSICS

Waves and Electromagnetic Waves

Waves transfer energy from one place to another without transferring any matter (stuff). When waves travel through a medium, the particles of the medium oscillate and transfer energy between each other. But, overall, the particles stay in the same place – only energy is transferred. When oscillations (vibrations) are perpendicular to the direction of energy transfer, it is a transverse wave. When oscillations are parallel to the direction of energy transfer, it is a longitudinal wave. Electromagnetic waves are transverse waves and they travel at the same speed through air or a vacuum but at different speeds in different materials. Because of their different properties, different electromagnetic waves are used for different purposes. Wave speed is the speed at which energy is being transferred and the wave equation applies to all waves: wave speed (m/s) = frequency (Hz) x wavelength.

Read the information on these websites:

<https://www.brainscape.com/packs/btec-science-physics-unit-1-working-with-waves-8387177>

<https://getrevising.co.uk/revision-notes/btec-unit-1-physics>

<https://www.bbc.co.uk/bitesize/guides/zgf97p3/revision/1>

<https://www.bbc.co.uk/bitesize/guides/z9bw6yc/revision/3>

And take a look at these videos:

https://www.youtube.com/watch?v=0f5iYCNCnow&list=PL9louNCPbCxX1-0Nr5_bMDJnN-9RqMuA6

<https://www.youtube.com/watch?v=ITe6snlZBp8>

<https://www.youtube.com/watch?v=u5vkYjV1V1A>

Task 5: Draw an annotated wave diagram which illustrates and describes the different properties of a wave. Draw an annotated diagram which explains the difference between a transverse wave and a longitudinal wave

Refraction

When a wave crosses a boundary between two materials it changes speed. If the wave is travelling along the normal it will change speed but it's not refracted, however, if the wave hit the boundary at an angle it changes direction - it's refracted. The wave bends towards the normal if it slows down and it bends away from the normal if it speeds up so how much it is refracted depends on how much the wave speeds up or slows down, which usually depends on the density of the two materials; usually the higher the density of a material, the slower a wave travels through it.

Read the information on these websites:

<https://www.brainscape.com/packs/btec-science-physics-unit-1-working-with-waves-8387177>

<https://www.bbc.co.uk/bitesize/guides/zw42ng8/revision/1>

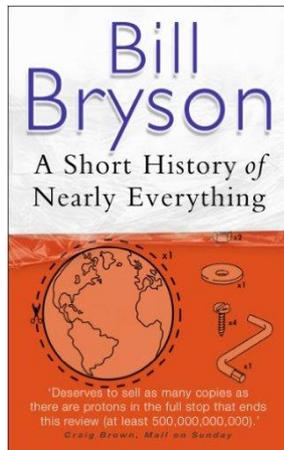
And take a look at this video:

<https://www.youtube.com/watch?v=wO49W5IsP0s>

Task 6: Write a method describing how a pupil can carry out an experiment that observes refraction. The method should include the equipment required, a labelled ray diagram explaining the different parts of the ray diagram, and a set of instructions on how to carry out the practical accurately and safely

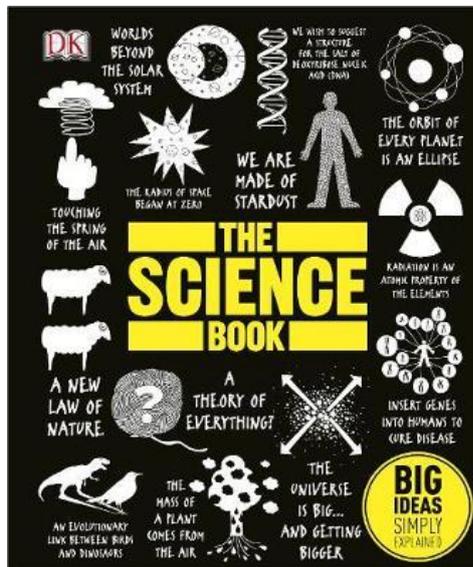
BOOK RECOMMENDATIONS

Kick back this summer with a good read. The books below are popular science books and great for extending your understanding of science topics

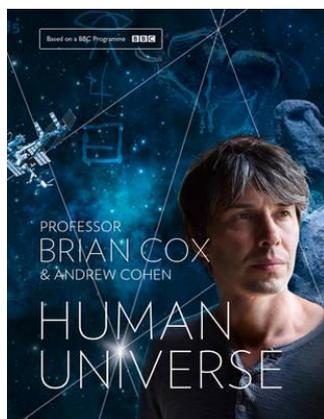


A Short History of Nearly Everything

A whistle-stop tour through many aspects of history from the Big Bang to now. This is a really accessible read that will re-familiarise you with common concepts and introduce you to some of the more colourful characters from the history of science! Available at amazon.co.uk



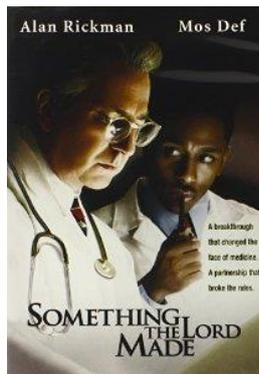
Written in plain English, *The Science Book* presents 80 of the most trailblazing ideas in physics, chemistry, and biology. It is packed with short, pithy explanations that cut through the jargon, step-by-step diagrams that untangle knotty theories, classic quotes that make scientific discoveries memorable, and witty illustrations that enhance and play with our understanding of science



Human Universe tackles some of the greatest questions that humans have asked to try and understand the very nature of ourselves and the Universe in which we live.

Through the endless leaps of human minds, it explores the extraordinary depth of our knowledge today and where our curiosity may lead us in the future. With groundbreaking insight it reveals how time, physics and chemistry came together to create a creature that can wonder at its own existence

MOVIE RECOMMENDATIONS



Something the Lord Made (2004)

Professor Snape (the late great Alan Rickman) in a very different role. The film tells the story of the scientists at the cutting edge of early heart surgery as well as issues surrounding racism at the time.

Everyone loves a good story and everyone loves some great science. Here are some of the picks of the best films based on real life scientists and discoveries.



Gorillas in the Mist (1988)

An absolute classic that retells the true story of the life and work of Dian Fossey and her work studying and protecting mountain gorillas from poachers and habitat loss. A tear jerker.



The Theory of Everything is a 2014 biographical romantic drama film^[6] directed by James Marsh. Set at the University of Cambridge, it details the life of the theoretical physicist Stephen Hawking. It was adapted by Anthony McCarten from the memoir *Travelling to Infinity: My*



Lorenzo's Oil (1992)

Based on a true story. A young child suffers from an autoimmune disease. The parents research and challenge doctors to develop a new cure for his disease.

MOVIE RECOMMENDATIONS

If you have 30 minutes to spare, here are some great presentations (and free!) from world leading scientists and researchers on a variety of topics. They provide some interesting answers and ask some thought-provoking questions. Use the link to view:

A New Superweapon in the Fight Against Cancer

Available at :

http://www.ted.com/talks/paula_hammond_a_new_superweapon_in_the_fight_against_cancer?language=en

Cancer is a very clever, adaptable disease. To defeat it, says medical researcher and educator Paula Hammond, we need a new and powerful mode of attack.



Why Bees are Disappearing

Available at :

http://www.ted.com/talks/marla_spivak_why_bees_are_disappearing?language=en

Honeybees have thrived for 50 million years, each colony 40 to 50,000 individuals coordinated in amazing harmony. So why, seven years ago, did colonies start dying en-masse?



Growing New Organs

Available at :

http://www.ted.com/talks/anthony_atalla_growing_organs_engineering_tissue?language=en

Anthony Atalla's state-of-the-art lab grows human organs — from muscles to blood vessels to bladders, and more.



Why Doctors Don't Know About the Drugs They Prescribe

Available at :

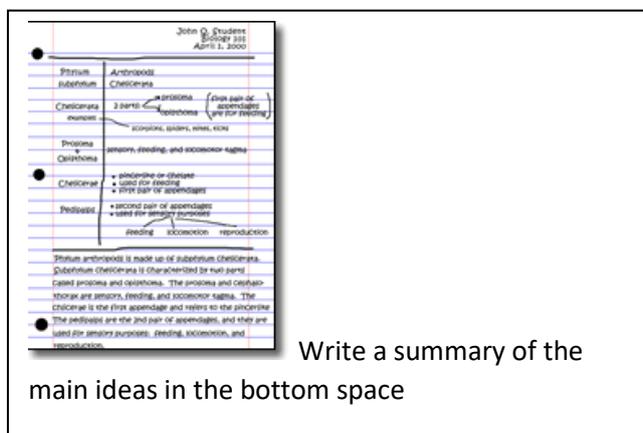
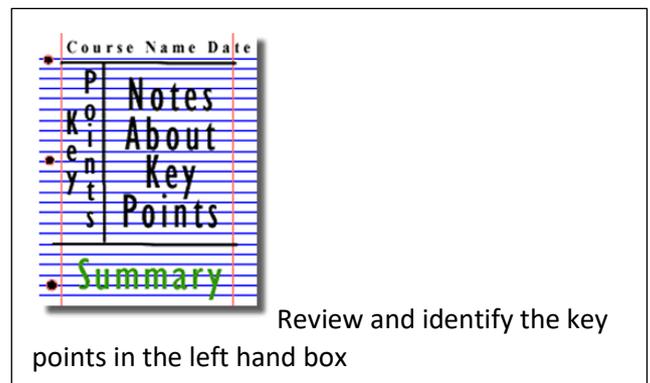
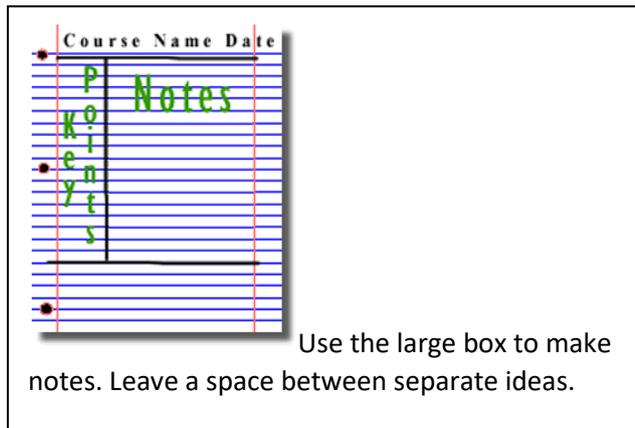
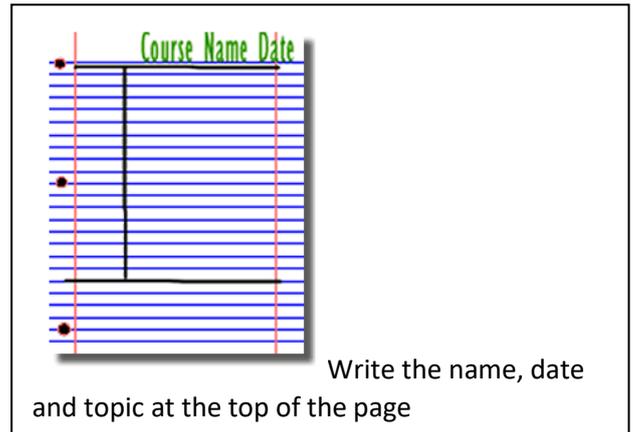
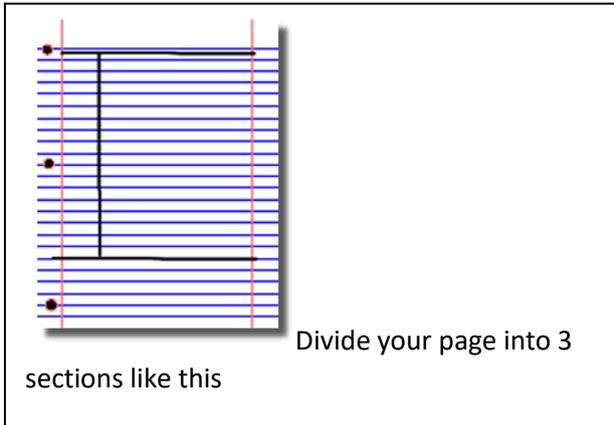
http://www.ted.com/talks/ben_goldacre_what_doctors_dont_know_about_the_drugs_they_prescribe?language=en

When a new drug gets tested, the results of the trials should be published for the rest of the medical world — except much of the time, negative or inconclusive findings go



RESEARCH ACTIVITIES

Research, reading and note making are essential skills for the BTEC science course, especially for the coursework units. For the following task you are going to produce 'Cornell Notes' to summarise your reading of the topics below. For your coursework, you will be carrying out practicals related to these topics and will need to complete a write-up of the practical, so it will be useful for you to do a little bit of background research before you begin



TOPICS TO RESEARCH:

Calibrating Equipment in Science

Titration

Colorimetry

Calorimetry

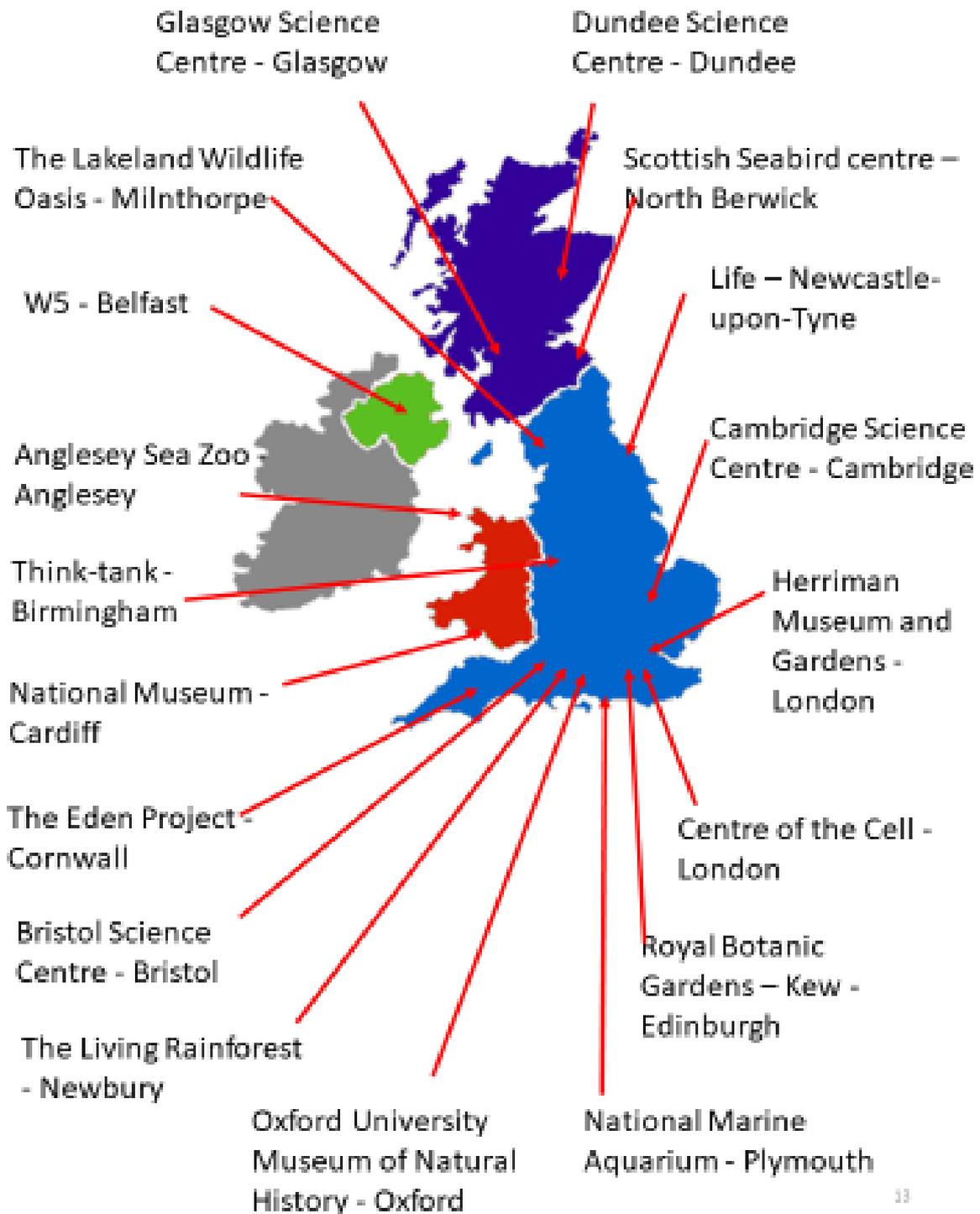
Chromatography

On the back of your work write down the references you have used i.e. where you got your information from - this can be books, websites, magazines, YouTube.

IDEAS FOR DAY TRIPS

Ideas for Day Trips

If you are on holiday in the UK, or on a staycation at home, why not plan a day trip to one of these :



Ideas for Day Trips

If you are on holiday in the UK, or on a staycation at home, why not plan a day trip to one of these :

Remember there are also lots of zoos, wildlife and safari parks across the country, here are some you may not have heard of or considered:

Colchester Zoo, Cotswold Wildlife Park, Banham Zoo (Norfolk), Tropical Birdland (Leicestershire), Yorkshire Wildlife Park, Peak Wildlife Park, International Centre for Birds of Prey (York), Blackpool Zoo, Beale Park (Reading)

There are also hundreds of nature reserves (some of which are free) located all over the country including:

RSPB sites at Lochwinnoch, Saltholme, Fairburn Ings, Old Moor, Conwy, Minsmere, Rainham Marshes, Pulborough Brooks, Radipole Lake, Newport Wetlands.

Wildlife Trust Reserves and others at Rutland Water, Pensthorpe, Insh Marshes, Attenborough Centre, Inversnaid, Skomer, Loch Garten, Donna Nook, Chapmans Well, Woodwalton Fen, London Wetland Centre, Martin Down and Woolston Eyes Reserve.

Many organisations also have opportunities for people to volunteer over the summer months, this might include working in a shop/café/visitor centre, helping with site maintenance or taking part in biological surveys. Not only is this great experience, it looks great on a job or UCAS application.

For opportunities keep an eye out in your local press, on social media, or look at the websites of organisations like the RSPB, Wildlife Trust, National Trust or Wildlife & Wetland Trust.

There are also probably lots of smaller organisations near you who would also appreciate any support you can give!

Science on Social Media

Science communication is essential in the modern world and all the big scientific companies, researchers and institutions have their own social media accounts. Here are some of our top tips to keep up to date with developing news or interesting stories:



Follow on Twitter:

Commander Chris Hadfield – former resident aboard the International Space Station
[@cmdrhadfield](#)

Tiktaalik roseae – a 375 million year old fossil fish with its own Twitter account!
[@tiktaalikroseae](#)

NASA's Voyager 2 – a satellite launched nearly 40 years ago that is now travelling beyond our Solar System [@NSFVoyager2](#)

Neil dGrasse Tyson – Director of the Hayden Planetarium in New York [@neiltyson](#)

Sci Curious – feed from writer and Bethany Brookshire tweeting about good, bad and weird neuroscience [@scicurious](#)

The SETI Institute – The Search for Extra Terrestrial Intelligence, be the first to know what they find! [@setiinstitute](#)

Carl Zimmer – Science writer Carl blogs about the life sciences [@carlzimmer](#)

Phil Plait – tweets about astronomy and bad science [@badastronomer](#)

Virginia Hughes – science journalist and blogger for National Geographic, keep up to date with neuroscience, genetics and behaviour [@virginiahughes](#)

Maryn McKenna – science journalist who writes about antibiotic resistance [@marynmck](#)



Find on Facebook:

Nature - the profile page for nature.com for news, features, research and events from Nature Publishing Group

Marin Conservation Institute – publishes the latest science to identify important marine ecosystems around the world.

National Geographic - since 1888, National Geographic has travelled the Earth, sharing its amazing stories in pictures and words.

Science News Magazine - Science covers important and emerging research in all fields of science.
BBC Science News - The latest BBC Science and Environment News: breaking news, analysis and debate on science and nature around the world.

Science: Things to do!

Day 4 of the holidays and boredom has set in? There are loads of citizen science projects you can take part in either from the comfort of your bedroom, out and about, or when on holiday. Wikipedia does a comprehensive list of all the current projects taking place. Google 'citizen science project'



AgeGuess



big butterfly count
(29th July - 23rd August)



The Big Moss Map

MOOC

Want to stand above the rest when it comes to UCAS? Now is the time to act. MOOCs are online courses run by nearly all Universities. They are short FREE courses that you take part in. They are usually quite specialist, but aimed at the public, not the genius! There are lots of websites that help you find a course, such as edX and Future learn.

You can take part in any course, but there are usually start and finish dates. They mostly involve taking part in web chats, watching videos and interactives.



Completing a MOOC will look great on your Personal statement and they are dead easy to take part in!



BTEC SCIENCE TRANSITION BASELINE ASSESSMENT TEST

The following 40 minute test is designed to test your recall, analysis and evaluative skills and knowledge. Remember to use your exam technique and look at the command words and the number of marks each question is worth. The assessment has been split into Biology (33 Marks), Chemistry (32 marks) and Physics (29 marks)

BIOLOGY

Q1.

Living organisms are made of cells.

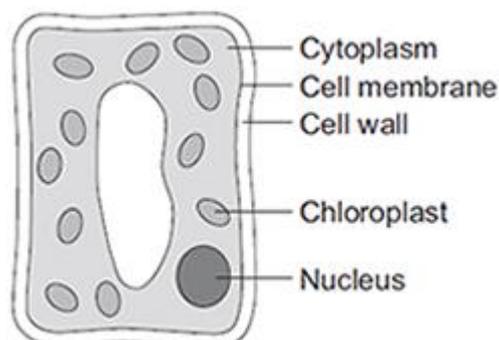
- (a) Animal and plant cells have several parts. Each part has a different function.

Draw **one** line from each cell part to the correct function of that part.

Cell part	Function
Cell membrane	Where most energy is released in respiration
Mitochondria	Controls the movement of substances into and out of the cell
Nucleus	Controls the activities of the cell
	Where proteins are made

(3)

- (b) The diagram below shows a cell from a plant leaf.



Which **two** parts in the diagram above are **not** found in an animal cell?

1.

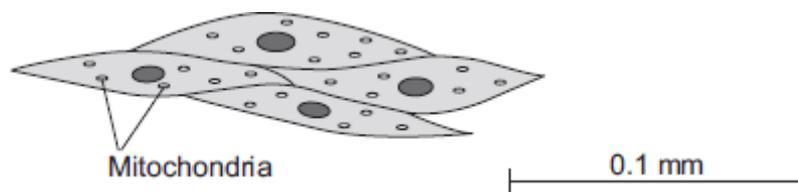
2.

(2)

(Total 5 marks)

Q2.

The image below shows some muscle cells from the wall of the stomach, as seen through a light microscope.



(a) Describe the function of muscle cells in the wall of the stomach.

(2)

(b) The figure above is highly magnified. The scale bar in the figure above represents 0.1 mm. Use a ruler to measure the length of the scale bar and then calculate the magnification of the figure above.

Magnification = _____ times

(2)

(c) The muscle cells in **Figure above** contain many mitochondria.

What is the function of mitochondria?

(2)

(d) The muscle cells also contain many ribosomes. The ribosomes cannot be seen in the figure above.

(i) What is the function of a ribosome?

(1)

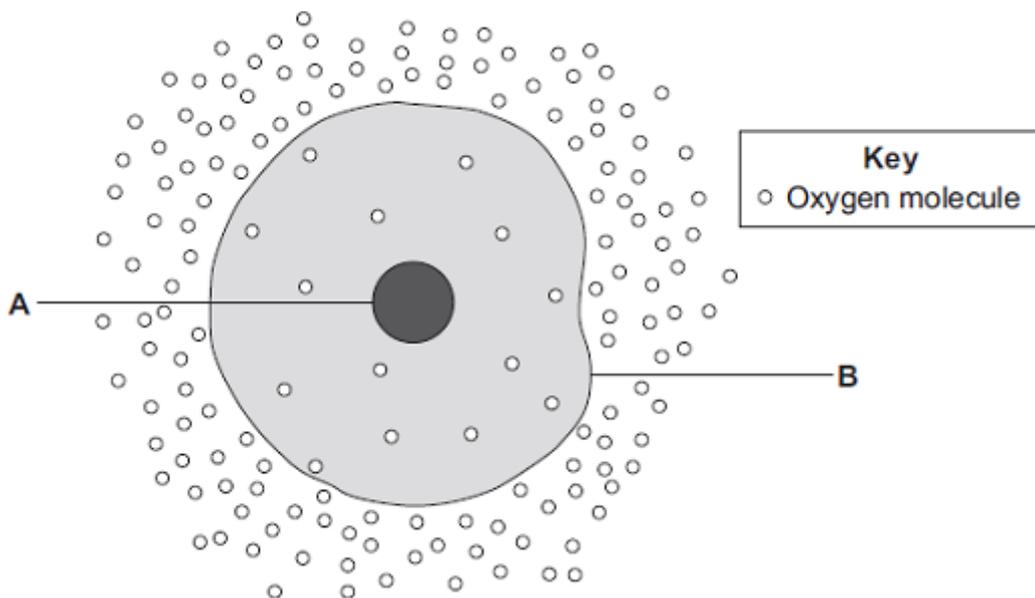
(ii) Suggest why the ribosomes **cannot** be seen through a light microscope.

(1)

(Total 8 marks)

Q3.

The diagram shows a cell.



(a) (i) Use words from the box to name the structures labelled **A** and **B**.

cell membrane	chloroplast	cytoplasm	nucleus
---------------	-------------	-----------	---------

A _____

B _____

(2)

(ii) The cell in the diagram is an animal cell.

How can you tell it is an animal cell and **not** a plant cell?

Give **two** reasons.

1.

2.

(2)

(b) Oxygen will diffuse into the cell in the diagram.

Why?

Use information from the diagram.

(1)

(c) The cell shown in the diagram is usually found with similar cells.

Draw a ring around the correct answer to complete the sentence.

Scientists call a group of similar cells

an organ.

a system.

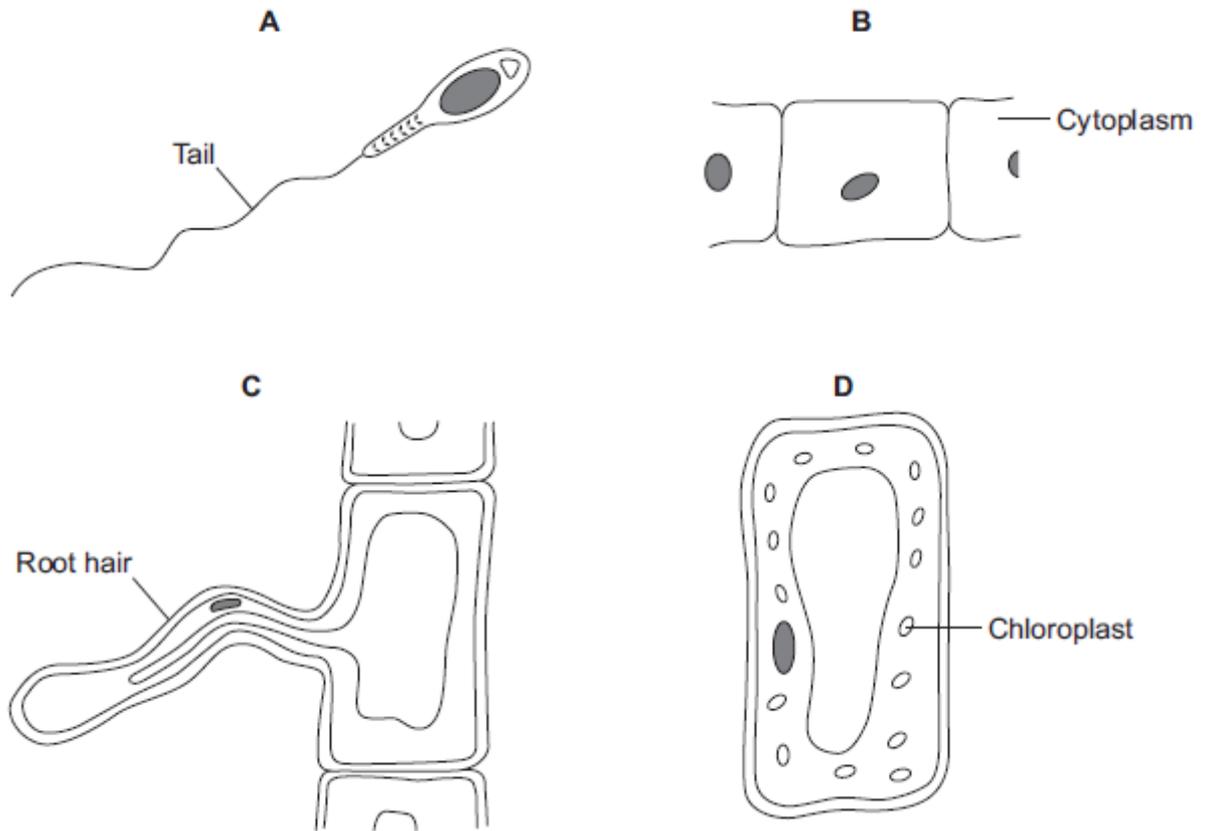
a tissue.

(1)

(Total 6 marks)

Q4.

The diagrams show four types of cell, **A**, **B**, **C** and **D**.
Two of the cells are plant cells and two are animal cells.



(a) (i) Which **two** of the cells are plant cells?

Tick (✓) **one** box.

- A and B**
- A and D**
- C and D**

(1)

(ii) Give **one** reason for your answer.

(1)

(b) (i) Which cell, **A**, **B**, **C** or **D**, is adapted for swimming? (1)

(ii) Which cell, **A**, **B**, **C** or **D**, can produce glucose by photosynthesis? (1)

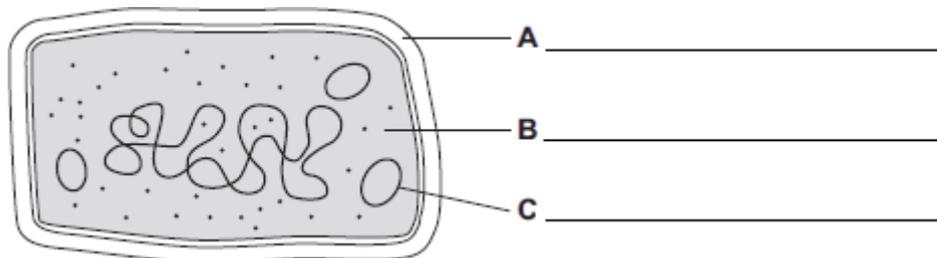
(c) Cells **A**, **B**, **C** and **D** all use oxygen.
For what process do cells use oxygen?
Draw a ring around **one** answer.

osmosis **photosynthesis** **respiration**

(1)
(Total 4 marks)

Q5.

(a) The diagram shows the structure of a bacterial cell.



(i) On the diagram use words from the box to label structures **A**, **B** and **C**.

cell membrane	cell wall	chloroplast	cytoplasm	plasmid
----------------------	------------------	--------------------	------------------	----------------

(3)

(ii) Give **one** difference between the structure of the bacterial cell and an animal cell.

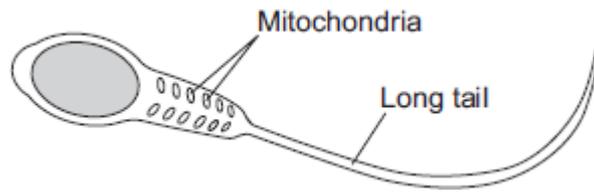
(1)

(iii) Name **one** structure that is found in a plant cell but is **not** found in a bacterial or an animal cell.

(1)

(b) Cells can be specialised for a particular job.

The diagram shows the structure of a human sperm cell.



Describe how the long tail and the mitochondria help the sperm to do its job.

Long tail

Mitochondria

(4)
(Total 9 marks)

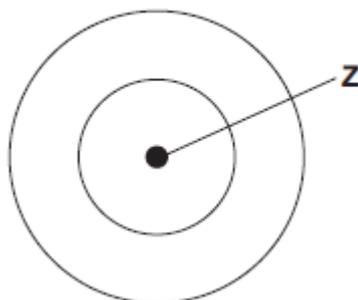
CHEMISTRY

Q1.

There are eight elements in the second row (lithium to neon) of the periodic table.

- (a) **Figure 1** shows an atom with two energy levels (shells).

Figure 1



- (i) Complete **Figure 1** to show the electronic structure of a boron atom.

(1)

- (ii) What does the central part labelled **Z** represent in **Figure 1**?

(1)

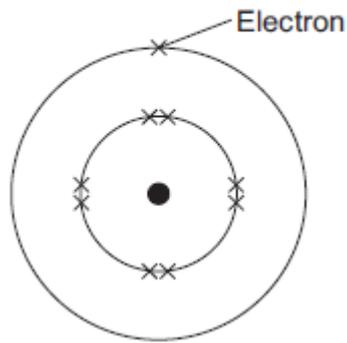
- (iii) Name the sub-atomic particles in part **Z** of a boron atom.

Give the relative charges of these sub-atomic particles.

(3)

- (b) The electronic structure of a neon atom shown in **Figure 2** is **not** correct.

Figure 2



Explain what is wrong with the electronic structure shown in **Figure 2**.

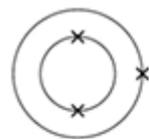
(3)

(Total 8 marks)

Q2.

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

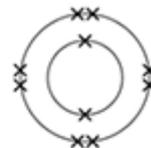
The letters are **not** the symbols of the elements.



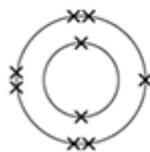
Element A



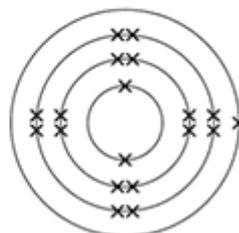
Element B



Element C



Element D



Element E

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.

Relative atomic mass = _____

(4)

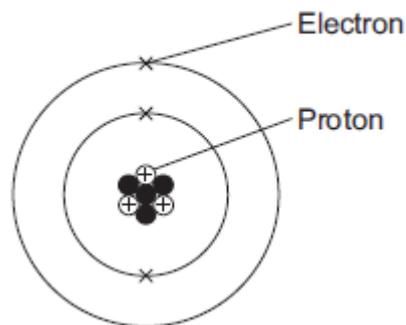
(Total 8 marks)

Q3.

There are eight elements in the second row (lithium to neon) of the periodic table.

(a) **Figure 1** shows a lithium atom.

Figure 1



(i) What is the mass number of the lithium atom in **Figure 1**?

Tick (✓) **one** box.

3

4

7

(1)

(ii) What is the charge of an electron?

Tick (✓) **one** box.

-1

0

+1

(1)

(iii) Protons are in the nucleus.

Which other sub-atomic particles are in the nucleus?

Tick (✓) **one** box.

ions

molecules

neutrons

(1)

(b) What is **always** different for atoms of different elements?

Tick (✓) **one** box.

number of neutrons

number of protons

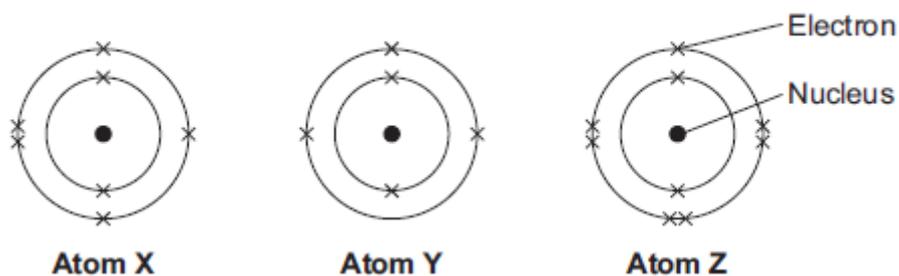
number of shells

(1)

(c) **Figure 2** shows the electron arrangements of three different atoms, **X**, **Y** and **Z**.

These atoms are from elements in the second row (lithium to neon) of the periodic table.

Figure 2



Which atom is from an element in Group 3 of the periodic table?

Tick (✓) **one** box.

Atom X

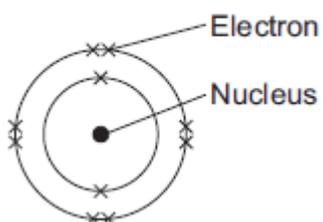
Atom Y

Atom Z

(1)

- (d) **Figure 3** shows the electron arrangement of a different atom from an element in the second row of the periodic table.

Figure 3



- (i) Give the chemical symbol of this element.

(1)

- (ii) Why is this element unreactive?

(1)

(Total 7 marks)

Q4.

The halogens are elements in Group 7.

- (a) Bromine is in Group 7.

Give the number of electrons in the outer shell of a bromine atom.

_____ (1)

- (b) Bromine reacts with hydrogen. The gas hydrogen bromide is produced.

What is the structure of hydrogen bromide?

Tick **one** box.

Giant covalent

Ionic lattice

Metallic structure

Small molecule

(1)

- (c) What is the formula for fluorine gas?

Tick **one** box.

F

F₂

F²

2F

(1)

A student mixes solutions of halogens with solutions of their salts.

The table below shows the student's observations.

	Potassium chloride (colourless)	Potassium bromide (colourless)	Potassium iodide (colourless)
Chlorine (colourless)		Solution turns orange	Solution turns brown
Bromine (orange)	No change		Solution turns brown
Iodine (brown)	No change	No change	

(d) Explain how the reactivity of the halogens changes going down Group 7.

Use the results in the table above.

(3)

A company uses chlorine to produce titanium chloride from titanium dioxide.

(e) What is the relative formula mass (M_r) of titanium dioxide, TiO_2 ?

Relative atomic masses (A_r): O = 16 Ti = 48

Tick **one** box.

64

80

128

768

(1)

- (f) The company calculates that 500 g of titanium dioxide should produce 1.2 kg of titanium chloride.

However, the company finds that 500 g of titanium dioxide only produces 900 g of titanium chloride.

Calculate the percentage yield.

Percentage yield = _____ %

(2)

(Total 9 marks)

PHYSICS

Q1.

The diagram below shows the position of three types of wave in the electromagnetic spectrum.

Radio waves	A	B	C	Ultraviolet	X-rays	D
-------------	---	---	---	-------------	--------	---

(a) Which position shows where visible light is in the spectrum?

Tick **one** box.

A B C D

(1)

(b) Which **one** of the statements about electromagnetic waves is correct?

Tick **one** box.

Radio waves have a higher frequency than X-rays.

Radio waves have a longer wavelength than ultraviolet.

X-rays have a longer wavelength than radio waves.

X-rays travel faster through the air than ultraviolet.

(1)

(c) Give **one** possible danger of exposing your skin to ultraviolet radiation.

(1)

- (d) Having an X-ray taken exposes a person to ionising radiation.

The table below gives the average radiation dose for an X-ray of the chest and an X-ray of the upper digestive system.

Part of the body	Radiation dose in millisieverts (mSv)
Upper digestive system	5.0
Chest	0.1

The risk of an X-ray causing cancer is about 1 in 20 000 for each mSv of radiation received.

Compare the risk of developing cancer from having an X-ray of the upper digestive system with the risk from having an X-ray of the chest.

Use the data in the table.

(2)

(Total 5 marks)

Q2.

P-waves and S-waves are two types of seismic wave caused by earthquakes.

- (a) Which **one** of the statements about P-waves and S-waves is correct?

Tick **one** box.

P-waves and S-waves are transverse.

P-waves and S-waves are longitudinal.

P-waves are transverse and S-waves are longitudinal.

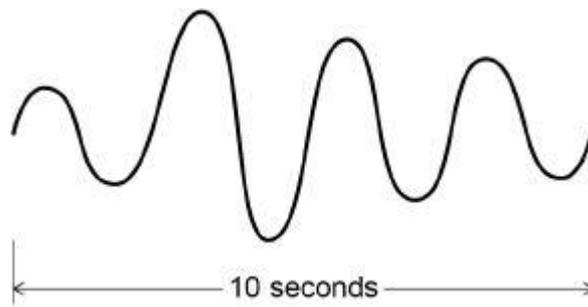
P-waves are longitudinal and S-waves are transverse.

(1)

Seismometers on the Earth's surface record the vibrations caused by seismic waves.

The diagram below shows the vibration recorded by a seismometer for one P-

wave.



(b) Calculate the frequency of the P-wave shown in the diagram above.

Frequency = _____ Hz

(1)

(c) Write down the equation which links frequency, wavelength and wave speed.

(1)

(d) The P-wave shown in the diagram above is travelling at 7200 m/s.
Calculate the wavelength of the P-wave.

Wavelength = _____ m

(3)

(Total 6 marks)

Q3.

(a) Which one of the following is not an electromagnetic wave?

Tick **one** box.

Gamma rays

Sound

Ultraviolet

X-rays

(1)

(b) What type of electromagnetic wave do our eyes detect?

(1)

(c) What is a practical use for infrared waves?

Tick **one** box.

Cooking food

Energy efficient lamps

Medical imaging

Satellite communications

(1)

Scientists have detected radio waves emitted from a distant galaxy.

Some of the radio waves from the distant galaxy have a frequency of 1 200 000 000 hertz.

(d) Which is the same as 1 200 000 000 hertz?

Tick **one** box.

1.2 gigahertz

1.2 kilohertz

1.2 megahertz

1.2 millihertz

(1)

(e) Radio waves travel through space at 300 000 kilometres per second (km/s).

How is 300 000 km/s converted to metres per second (m/s)?

Tick **one** box.

$300\,000 \div 1000 = 300\text{ m/s}$

$300\,000 \times 1000 = 300\,000\,000\text{ m/s}$

$300\,000 + 1000 = 301\,000\text{ m/s}$

$300\,000 - 1000 = 299\,000\text{ m/s}$

(1)

(f) Write the equation which links frequency, wavelength and wave speed.

(1)

(g) Calculate the wavelength of the radio waves emitted from the distant galaxy.

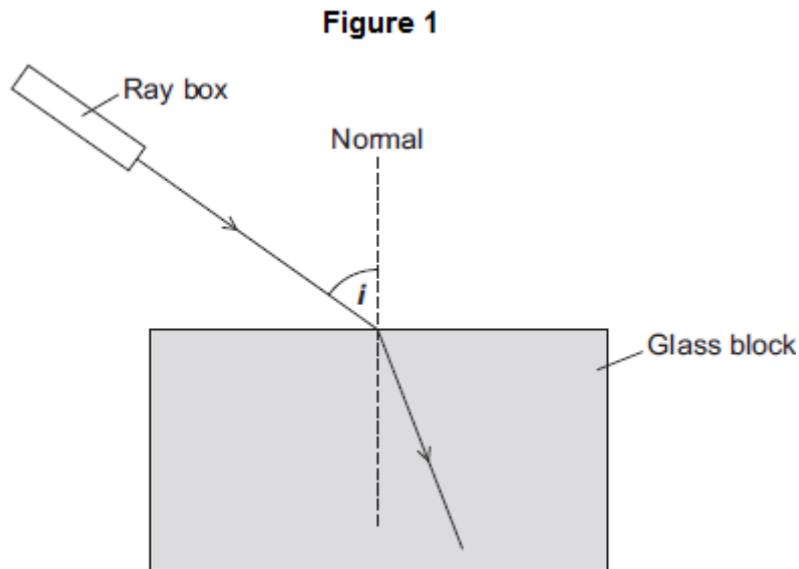
Give your answer in metres.

wavelength = _____ m

(3)
(Total 9 marks)

Q4.

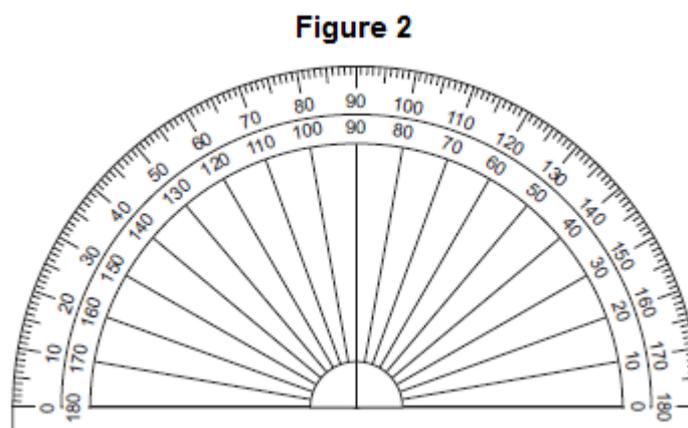
(a) **Figure 1** shows a ray of light entering a glass block.



(i) The angle of incidence in **Figure 1** is labelled with the letter i .
On **Figure 1**, use the letter r to label the angle of refraction.

(1)

(ii) **Figure 2** shows the protractor used to measure angles i and r .



What is the resolution of the protractor?

Tick (✓) **one** box.

1 degree	<input type="checkbox"/>	5 degrees	<input type="checkbox"/>	10 degrees	<input type="checkbox"/>
----------	--------------------------	-----------	--------------------------	------------	--------------------------

(1)

- (iii) The table shows calculated values for angle i and angle r from an investigation.

Calculated values
$\sin i = 0.80$
$\sin r = 0.50$

Use the values from the table to calculate the refractive index of the glass.

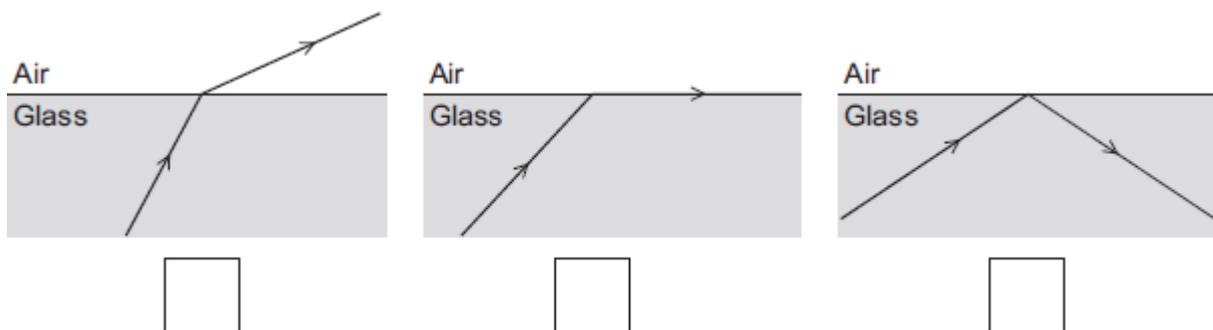
Refractive index = _____

(2)

- (b) The diagrams below show a ray of light moving through glass.

Which diagram correctly shows what happens when the ray of light strikes the surface of the glass at the critical angle?

Tick (✓) **one** box.

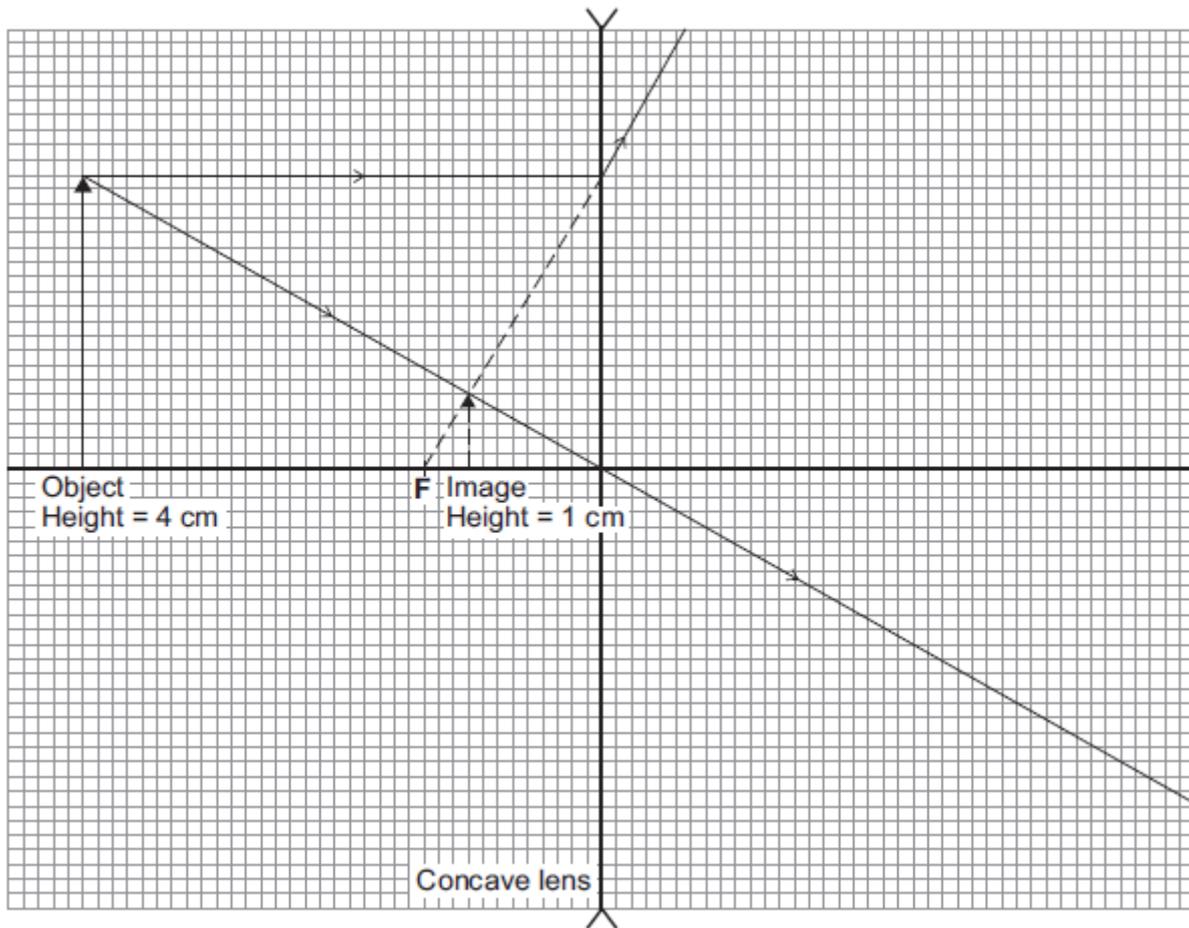


(1)

- (c) A concave (diverging) lens is fitted into a door to make a security spyhole.

Figure 3 shows how this lens produces an image.

Figure 3



- (i) State **one** word to describe the nature of the image in **Figure 3**.

(1)

- (ii) Use data from **Figure 3** to calculate the magnification of the image.

Magnification = _____

(2)

- (iii) What is another use for a concave lens?

Tick (✓) **one** box.

A magnifying glass

Correcting short sight

To focus an image in a camera

(1)
(Total 9 marks)