Wath Sixth Form Subject Preparation Pack

BTEC APPLIED SCIENCE

World-class learning World-class learning every lesson, every day	**The highest expectations** Everyone can be successful; always expect the highest standards	**No excuses** Create solutions not excuses; make positive thinking a habit	**Growth mindset** Believe you can improve; work hard and value feedback	**Never give up** Resilience is essential; be relentless in the pursuit of excellence	**Everyone is valued** Diversity is celebrated; see the best in everyone	**Integrity** Be trustworthy and honest; deliver on promises and walk the talk

- What is BTEC Applied Science?
- Why should I study BTEC Applied Science?
- What careers could A Level BTEC Applied Science lead to?
- The BTEC Applied Science team
- What will I study?
- How will I be assessed?
- Recommended resources
- Additional resources
- Activities

What is BTEC Applied Science?

BTEC Applied Science is widely recognised qualification by industry and universities. The course enables students to study biology, chemistry and physics post 16 using a combination of exams and coursework for assessment. The course is equivalent to one A level and is usually studied either alongside other BTEC qualifications or A levels.

The BTEC Applied Science course covers various topics from each of the three sciences including cell biology, waves and the electronic structure of atoms. In addition, there is strong focus on the investigative skills used in science, and students will be expected to plan and carry out experiments and then evaluate the outcomes.

Why should I study BTEC Applied Science?

BTEC Applied Science develops students' knowledge across all three sciences. Students study biology, chemistry and physics in greater depth than at GCSE. In addition, the practical side of the course develops student's laboratory skills and this in turn leads to them improving their analytical skills and their ability to plan and evaluate scientific experiments. Finally, the BTEC Applied Science helps students learn time management skills given they work to deadlines from the very start of the course (there is no leaving it to the last minute) in order to complete coursework alongside preparation for exams.

BTEC Applied Science is fundamentally an experimental subject, BTEC Applied Science provides numerous opportunities to use practical experiences to link theory to reality and equip students with the essential practical skills.

With a track record of over 30 years BTEC qualifications are welcomed by universities and employers. Students studying BTEC Applied Science at Wath Academy have gone on to university to become paramedics, midwives, nurses, physiotherapists and range of other health care roles. In addition, others have undertaken degrees in teaching, history, economics and forensic sciences. For students choosing to gain employment or an apprenticeship the qualification demonstrates a range of skills and the analytical, critical thinking and evaluative skills it develops makes it a strong addition to a CV.

What careers could BTEC Applied Science lead to?

BTEC Applied Science could lead to any number of careers. The course develops a full range of skills so that it works alongside other BTEC qualifications and A levels.

Significant numbers of students may choose to find careers in health care including nursing, midwifery, physiotherapist, health care workers and paramedics.

The qualification is ideal for those looking for a career in education and can be a steppingstone to primary or secondary teaching, early years teacher and nursery nurse.

The strong emphasis on practical skills means students can look to use BTEC Applied Science as a step onto becoming a laboratory technician or a forensic scientist.

Some students study BTEC Applied Science to move into sports science, including becoming personal trainers, sports coach, fitness trainer or nutritionist.

The BTEC Applied Science Team

The teachers for BTEC Applied Science are Mrs Kerr and Mrs Teather who are the Vocational Science Cooridnators. In additon Mrs Pritchard teaches the physics studied in Unit 1 while Miss Grima teachers the chemistry. All these staff have been teaching BTEC Applied science for many years. They have a wealth of experience in covering the content in preparation for the exams and coursework elements of the course.

We love BTEC Applied Science because it enables students to develop a range of skills including problem-solving skills, critical thinking, the ability to learn independently and the ability to research actively and methodically. The course emphasises evaluation of students' skills and encourages students to reflect on their work and consider what they need to do to improve and how they can do this. Over their time studying this course we see students become much more confident learners who learn to manage their time effectively in order to achieve the grade that will take them onto the next stage in their career or education.

What will I study?

The BTEC Applied Science course is made up of 4 units. Unit 1 and Unit 2 are taught in year 12. Unit 3 and Unit 12 are taught in year 13.

Unit 1 content includes the electronic structure of atoms, the periodic table, cell structure and function, cell specialisation, tissue structure and function, features common to all waves, principles of fibre optics and the use of electromagnetic waves in communication.

Unit 2 covers a range of practical experiments including titration, colorimetry, calorimetry and chromatography.

Unit 3 teachers science investigative skills including planning a scientific investigation, data collection, processing and analysis and interpretation. Students then learn to draw conclusions and evaluate their experiment and their practical skills. The practical work covered includes enzymes as biological catalysts in chemical reactions, diffusion of molecules, plants and their environment, energy content of fuels and electricity.

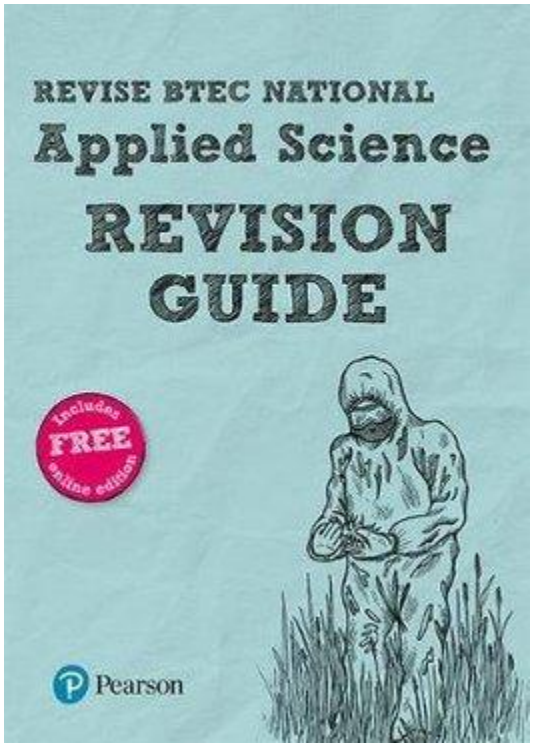
Unit 12 teaches students about the causes of diseases and how the transmission of disease can be prevented. It also covers treatment of disease and how the body defends itself from pathogens.

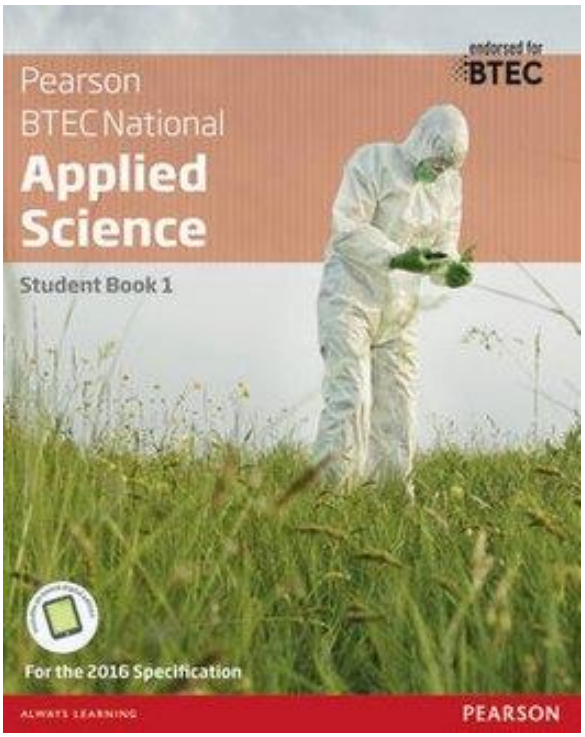
How will I be assessed?

For students in year 12 they will complete Units 1 and 2. Unit 1 is an externally examined unit sat in the summer term. There are three exams each of 40 minutes. Unit 2 is a coursework assessed unit that will be completed throughout year 12.

In year 13 students complete Units 3 and 12. Unit 3 is an externally examined unit and this is sat in January. Should students be dissatisfied with their grade they can resit in the summer term. Unit 12 is a coursework assessed unit that is completed during year 13.

Recommended resources





Specification

The BTEC Applied Science Extended Certificate Specification can be looked at here:

https://qualifications.pearson.com/content/dam/pdf/BTEC-Nationals/Applied-Science/2016/specification-and-sample-assessments/9781446938164_BTECNat_AppSci_ExtCert_Spec.pdf

Additional Resources

Chemguide

This is a fantastic resource for students studying BTEC Applied Science. So much of the chemistry content in Unit 1 is covered and clearly explained. Students can read up on the atomic structure of atoms, ionic and covalent bonding, metallic bonding and intermolecular forces.

https://www.chemguide.co.uk/atoms/structsmenu.html#top

Biologymad

This is useful for students studying Unit 1 cell biology and microscopes. Students can use this to help them deepen their knowledge of eukaryotic and prokaryotic cells. In addition, students can learn about the different types of microscope and how the size of an organelle or the magnification can be calculated.

http://www.biologymad.com/

Physicsclassroom

This is a comprehensive resource covering waves essential for the physics in Unit 1. Some of the content is a review of what students will have learnt at GCSE while the higher-level lessons cover more challenging material.

https://www.physicsclassroom.com/class/waves

Activities

Identifying ions

Part 1: Identifying ions

Below is a list of ions.

Carbonate	Hydroxide	Chloride	Oxide
Copper (II) ion	Calcium ion	Nitrate	Silver(I) ion
Barium ion	Lithium ion	Aluminium ion	Sodium ion
Sulphate	Iodide	Hydrogen carbonate	Phosphate
Hydrogen ion	Magnesium ion	Fluoride	Ammonium

Match the name from the table above to the ion.

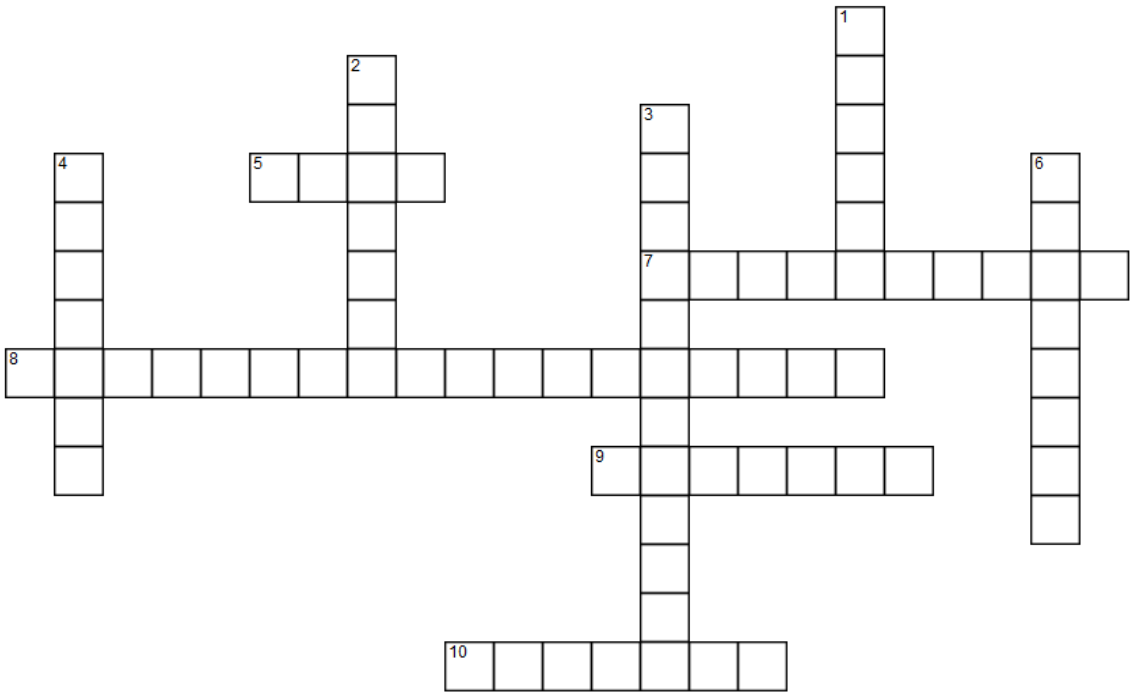
Ion	Name
I^-	
NH_4^+	
^-OH	
F^-	
CO_3^{2-}	
NO_3^-	
SO_4^{2-}	
Li^+	
Al^{3+}	
Cl^-	
HCO_3^-	
Ca^{2+}	
Cu^{2+}	
H^+	
Mg^{2+}	
Ag^+	
PO_4^{3-}	

Part 2: Molecular formula of ionic compounds

Use the table above to work out the formula of the compounds from the name. Remember, the charges must balance so you need to have an equal number of +ive and –ive charges.

Name	Ions present	Molecular formula
Calcium chloride	Ca^{2+} and 2 x Cl^-	$CaCl_2$
Potassium hydroxide		
Aluminium chloride		
Magnesium carbonate		
Ammonium fluoride		
Copper (II) chloride		
Potassium carbonate		
Magnesium fluoride		
Sodium hydrogen carbonate		
Silver nitrate		
Magnesium hydrogen carbonate		
Lithium iodide		
Calcium hydroxide		

Atoms Keywords crossword



ACROSS

5 The smallest particle of a chemical element that can exist (4 letters, starts with A)

7 The total number of protons and neutrons in a nucleus.
(Two words, 4 & 6 letters, starts with M & N)

8 The average mean mass of one atom of an element. It is an average of the mass numbers of all the different isotopes of that element (3 words, 8, 6 & 4 letters, starts with R, A & M)

9 The positively charged central core of an atom, consisting of protons and neutrons and containing nearly all its mass. (7 letters, starts with N)

10 A subatomic particle of about the same mass as a proton but without an electric charge, present in all atomic nuclei except those of ordinary hydrogen (7 letters, starts with N)

DOWN

1 A stable subatomic particle occurring in all atomic nuclei, with a positive electric charge equal in magnitude to that of an electron (6 letters, starts with P)

2 Forms of the same element with the same number of protons, but different numbers of neutrons (7 letters, starts with I)

3 The number of protons in the nucleus of an atom, which is characteristic of a chemical element and determines its place in the periodic table. Also known as an element's proton number (Two words, 6 & 6 letters, starts with A & N)

4 A substance consisting of atoms which all have the same number of protons
(7 letters, starts with E)

6 A stable subatomic particle with a charge of negative electricity (8 letters, starts with E)

Ionic bonding diagrams

Draw ionic bonding diagrams of the following compounds

a) Lithium hydride (LiH)	b) Potassium fluoride (KF)
c) Magnesium oxide (MgO)	d) Calcium chloride ($CaCl_2$)
e) Calcium sulphide (CaS)	f) Sodium sulphide (Na_2S)
g) Sodium nitride (Na_3N)	h) Aluminium fluoride (AlF_3)

Covalent bonds

Draw dot-cross diagrams for the following covalent compounds

Water (H_2O)	Carbon dioxide (O=C=O)
Ammonia (NH_3)	Boron trifluoride (BF_3)
Hydroxide ion (^{-}OH)	Ethene ($H_3C=CH_3$)
Chloroform ($CHCl_3$)	Formaldehyde (CH_2O)

Cell Biology

Task 1: Use the internet and find or draw a large diagram of a typical plant and animal cell.

Label the nucleus, 80S ribosomes, cellulose cell wall, mitochondria, cytoplasm, permanent vacuole, rough endoplasmic reticulum, smooth endoplasmic reticulum, Golgi apparatus centrioles & chloroplasts (Not all are in both cells).

Task 2: Annotate their functions.

Task 3: Find a diagram of a prokaryote and label the nucleoid, cytoplasm, cell membrane, slime capsule, cells wall, 70S Ribosomes, plasmids and flagellum.

Task 4: Annotate their functions.

Task 5: What is a prokaryote cell and what is a eukaryote cell?

ii) Which cells are examples of which?

iii) What are the differences in their organelles?

Task 5: Find and label diagrams of muscle cells, egg cells, White blood cells, red blood cell, root hair cell and sperm cells. For each one write a sentence to explain the function of the cell.

Animal and Plant Cells

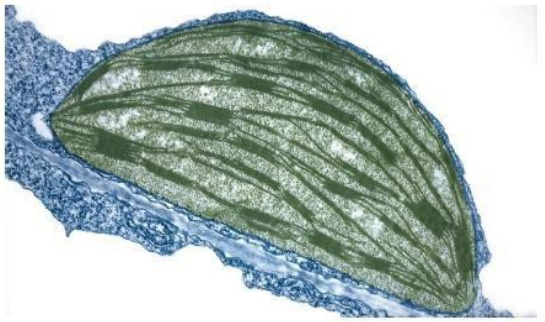
1. Look at the table below. How many structures inside plant and animal cells can you name?

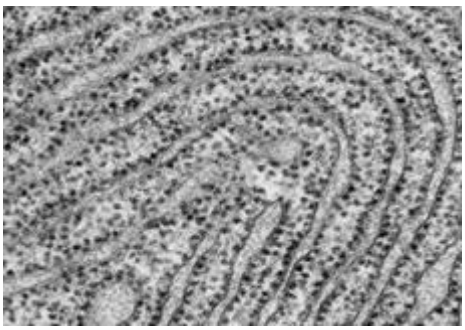
Plant Cells – name 18	Animal Cells – name 12

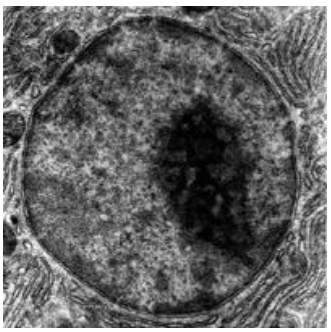
2. Why don't animal cells contain chloroplasts?

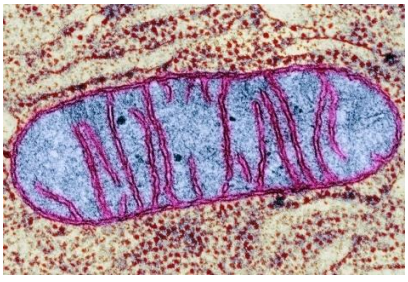
3. Write a short essay on 'The similarities and differences between animal and plant cells.'

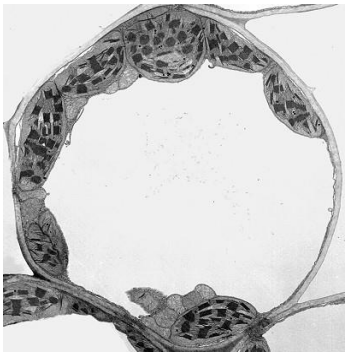
4. Identify the following structures. Some images may have more than one structure to identify. For each one describe its structure and function and whether it is present in plant cells, animal cells or both.





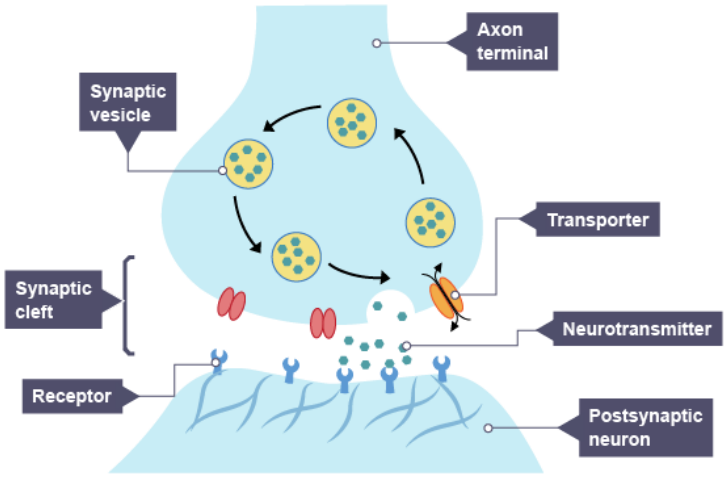






Parkinson's Disease and Depression

Parkinson's disease and clinical depression are both caused by imbalances in neurotransmitters in the brain. Neurotransmitters are chemicals involved in passing nerve impulses from one nerve cell to the next across a synapse. Where two neurons meet there is a small gap called a synapse. The plasma membranes of each neuron are in very close contact and are separated by a narrow space called a synaptic cleft. An electrical impulse cannot directly cross the gap so a different mechanism has to be used.

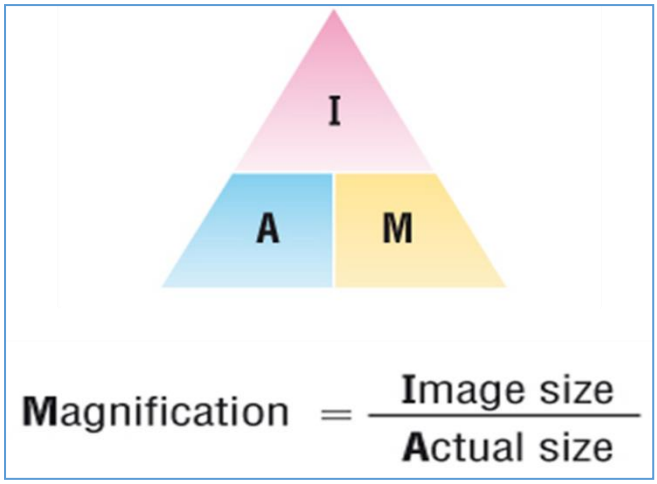


1. An electrical nerve impulse travels along the axon of the first neuron (presynaptic neuron).
2. When the nerve impulse reaches the dendrites at the end of the axon, chemical messengers called neurotransmitters are released.
3. These chemicals diffuse across the synaptic cleft. The chemicals bind with receptor molecules on the membrane of the second neuron (postsynaptic neuron).
4. The receptor molecules on the second neuron can only bind to the specific neurotransmitters released from the first neuron.
5. The binding of neurotransmitter to the receptors stimulates the second neuron to transmit an electrical impulse along its axon. The signal therefore has been carried from one neuron to the next.

Use the BTEC revision guide that you can access online or alternatively use the internet to answer the following questions.

1. Define the following:
    a. Dopamine
    b. Blood brain barrier
    c. Pathology
    d. Palliative
2. Find out how Parkinson's disease presents? What are the symptoms?
3. How is Parkinson's disease caused? What are the risk factors for Parkinson's disease?
4. Why is Parkinson's disease difficult to treat?
5. What role does L-Dopa play in the treatment of Parkinson's? How does it work?
6. What are the symptoms of depression?
7. What is serotonin and what role does it play in the brain?
8. How do drugs like Prozac help treat depression?

Magnification



Step 1)

Measure the image size using a ruler in millimetres (mm)

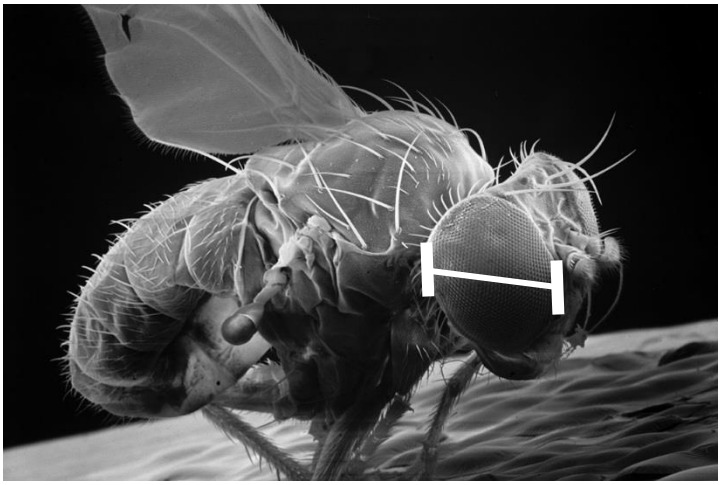
Step 2)

Convert the millimetres (mm) into micrometres (µm)

Step 3)

Divide your answer by the actual size

Question 1



This is a fly. Its actual eye size is 1,000µm.
What is the magnification?

1) Length of eye is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

4) Magnification = Image ÷ Actual

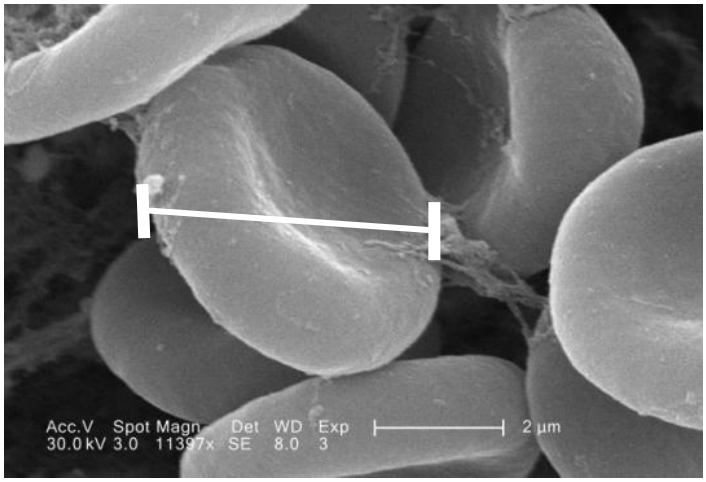
Magnification = _____ µm ÷ _____ µm

Magnification = _____

The picture shows the eye magnified (zoomed in) by _____ times.

Question 2

This is a red blood cell. Its actual size is 300µm. What is the magnification?



1) Length of cell is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

4) Magnification = Image ÷ Actual

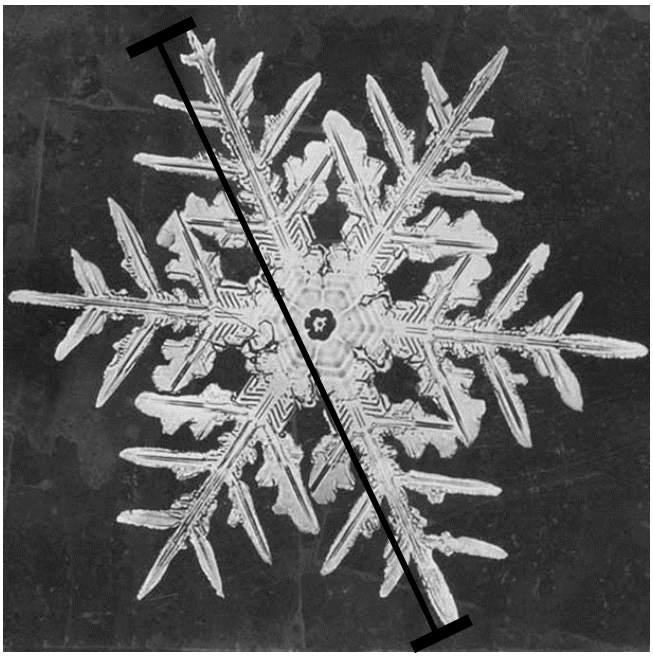
Magnification = _____ µm ÷ _____ µm

Magnification = _____

The picture shows the cell magnified (zoomed in) by _____ times.

Question 3

This is a snowflake. Its actual height is 700µm. What is the magnification?



1) Length of snowflake is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

4) Magnification = Image ÷ Actual

Magnification = _____ µm ÷ _____ µm

Magnification = _____

The picture shows the snowflake magnified (zoomed in) by _____ times.

Question 4

This is an insect. Its wings are 2,500µm.
What is the magnification?

1) Length of wing is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

4) Magnification = Image ÷ Actual

Magnification = _____ µm ÷ _____ µm

Magnification = _____

The picture shows the wing magnified (zoomed in) by _____ times.

Question 5

This is a chloroplast. Its actual length is 50µm. What is the magnification?

1) Length of chloroplast is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

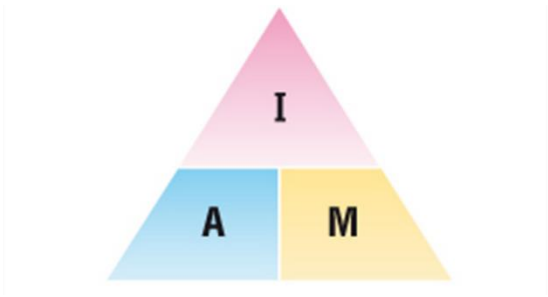
4) Magnification = Image ÷ Actual

Magnification = _____ µm ÷ _____ µm

Magnification = _____

The picture shows the chloroplast magnified (zoomed in) by _____ times.

Actual Size



$$\text{Actual size} = \frac{\text{Image size}}{\text{Magnification}}$$

Step 1)

Measure the image size using a ruler in millimetres (mm)

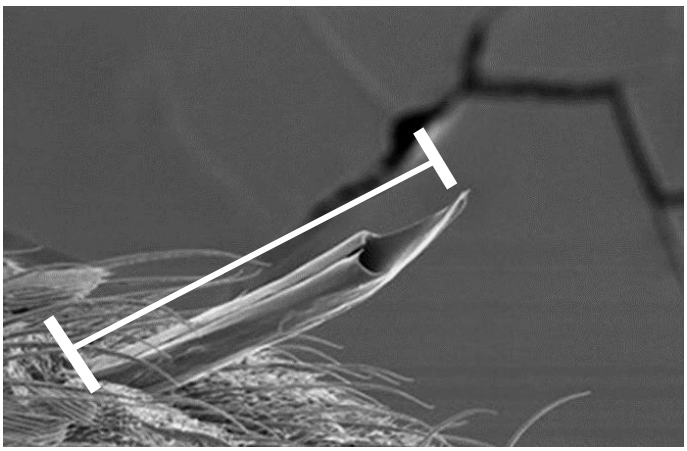
Step 2)

Convert the millimetres (mm) into micrometres (µm)

Step 3)

Divide your answer by the magnification

Question 1



This is a mosquito stinger. The magnification is x4. What is the actual size?

1) Length of stinger is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

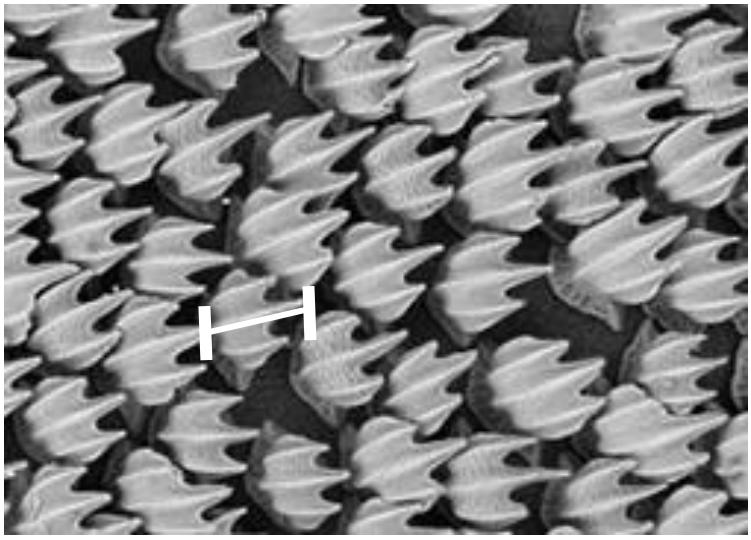
4) Actual size = Image ÷ Magnification

Actual size = _____ µm ÷ _____

Actual size = _____

The actual size of this stinger is _____ µm. We can see it because it has been magnified.

Question 2



This is shark skin. It is made of teeth. The magnification is x50. What is the actual size of 1 tooth?

1) Length of tooth is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

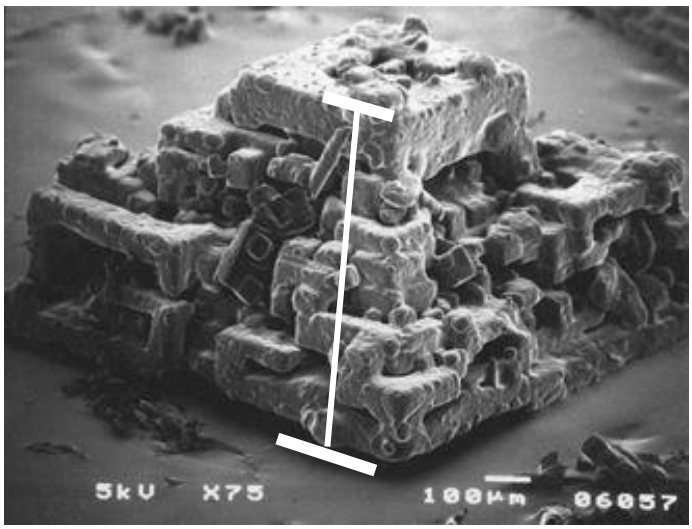
4) Actual size = Image ÷ Magnification

Actual size = _____ µm ÷ _____

Actual size = _____

The actual size of this tooth is _____ µm. We can see it because it has been magnified.

Question 3



This is a grain of salt. The magnification is x100. What is the actual size of the salt?

1) Size of salt is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

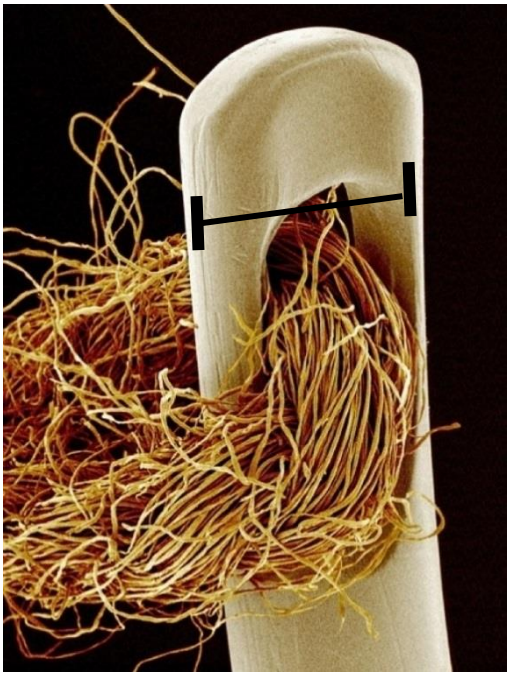
4) Actual size = Image ÷ Magnification

Actual size = _____ µm ÷ _____

Actual size = _____

The actual size of this salt is _____ µm. We can see it because it has been magnified.

Question 4



This is a needle and thread. The magnification is x4. What is the actual size of the needle?

1) Size of needle is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

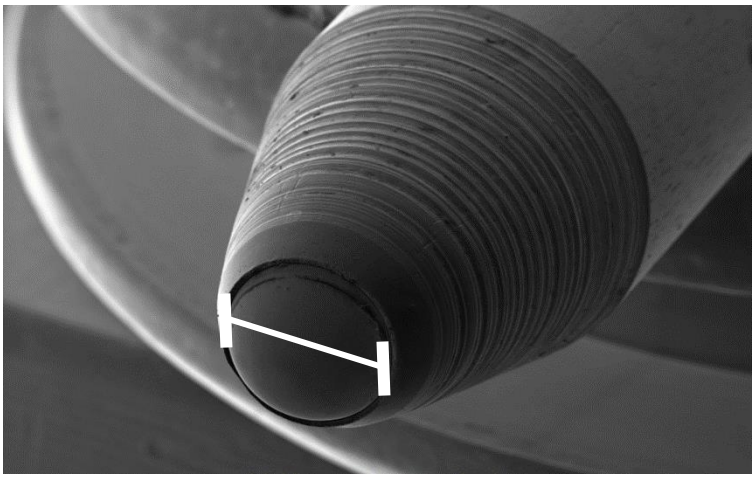
4) Actual size = Image ÷ Magnification

Actual size = _____ µm ÷ _____

Actual size = _____

The actual size of this needle is _____ µm. We can see it because it has been magnified.

Question 5



This is a ballpoint pen. The magnification is x20. What is the actual size of the ballpoint pen?

1) Size of pen is _____ mm

2) _____ mm x1000 = _____ µm

3) Image size = _____ µm

4) Actual size = Image ÷ Magnification

Actual size = _____ µm ÷ _____

Actual size = _____

The actual size of this ballpoint pen is _____ µm. We can see it because it has been magnified.

Introduction to Waves Worksheet

LOs

- Describe the main features of waves
- Distinguish between longitudinal and transverse waves

Key Words: (Select 5 or more keywords)

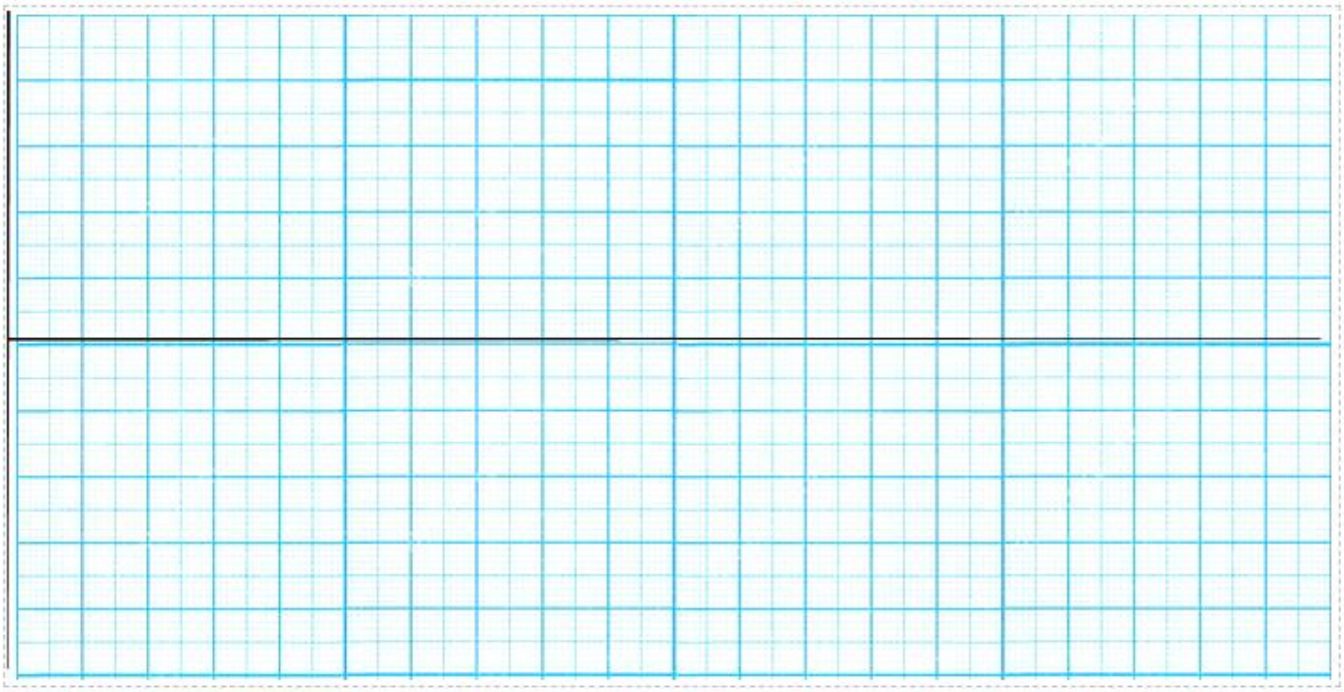
1) Sketch a transverse wave in the box below:

	Examples of transverse waves:

2) Sketch a longitudinal wave in the box below:

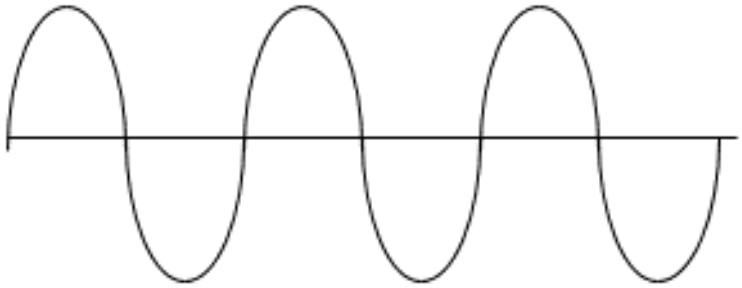
	Examples of longitudinal waves:

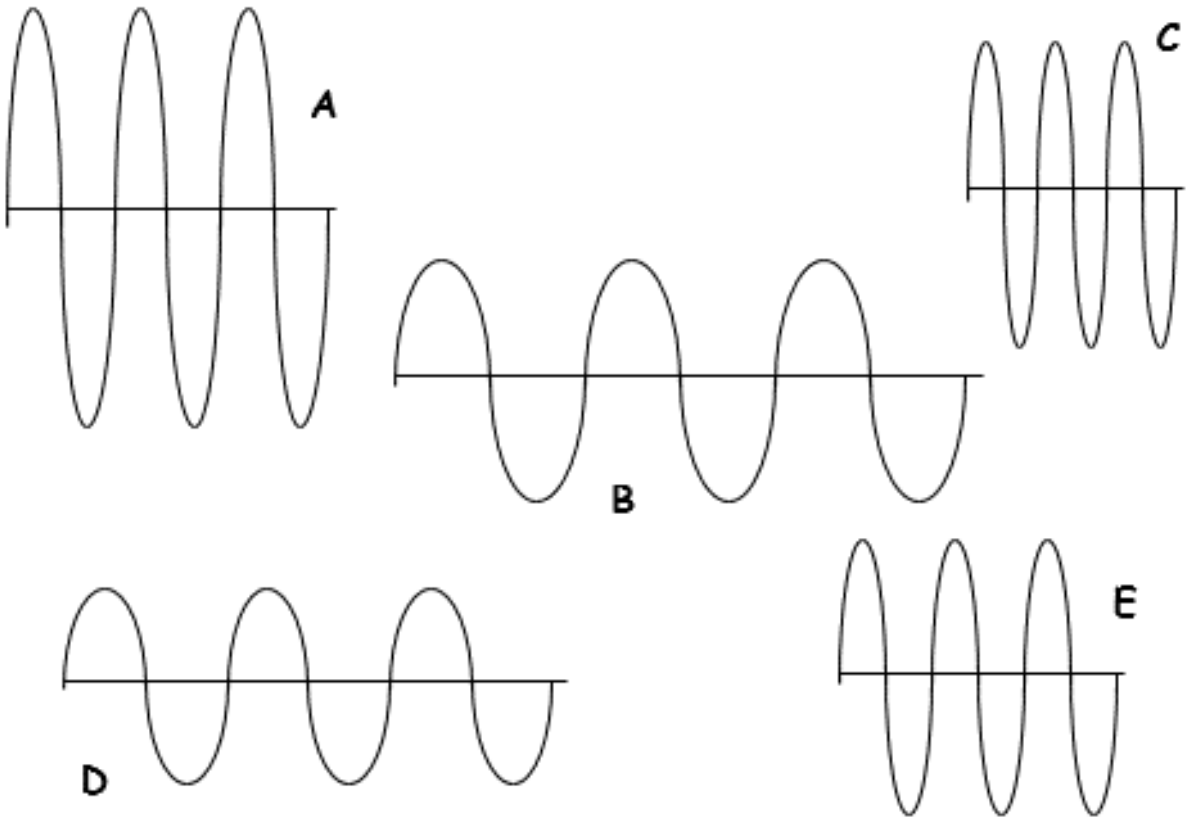
3) Draw and label a wave diagram in the area below:



Waves

Label the amplitude and wavelength for each of the waves below. Once you have done this, answers the questions at the bottom of the worksheet in your book.





Which of the above waves has: **(NB You might need a ruler!)**

The highest frequency?

The shortest wavelength?

The largest amplitude?

The longest wavelength?

The lowest pitch?

The loudest intensity?

The smallest amplitude?

Measuring waves

The formula for calculating wave speed is

Wave speed = frequency x wavelength

(metres per second, m/s) (hertz, Hz) (metre, m)

(v) = (f) x (λ)

1. Using the equation above can you fill in the table to calculate the different **wave speeds**?

Remember to change units of wavelength into meters if they are in cm.

Frequency (Hz)	Wavelength (cm)	Wavelength (m)	Wave speed (m/s)
10 Hz	10 cm	0.1	
2.5 Hz	10 cm		
30 Hz	2 cm		
50 Hz	1 cm		
200 Hz	-	10	
1000 Hz	-	5	

2. Rearrange the equation at the top of the page so you can calculate **wavelength** from **frequency** and **wave speed**?

ii) Use your re-arranged equation to calculate the wavelength of the waves and fill in the table?

Wave speed (m/s)	Frequency (Hz)	Wavelength (m)
0.6	24	
0.6	30	
0.6	12	
0.6	20	

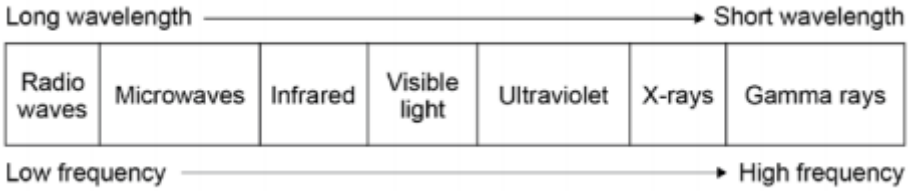
3.) Rearrange the equation so you can calculate **frequency** from **wavelength** and **wave speed**?

ii) Use your re-arranged equation to calculate the frequency of the ocean waves and fill in the table?

Wave speed (m/s)	**Wavelength (m)**	**Frequency (Hz)**
1.5 (m/s)	**0.75**	
1.2 (m/s)	**0.4**	
4 (m/s)	**0.5**	
3 (m/s)	**0.3**	

Electromagnetic Waves

Electromagnetic _____ are transverse waves that transfer _____ from the source of the waves to an absorber. Electromagnetic waves form a continuous spectrum and all types of _____ wave travel at the same velocity through a vacuum (space) or air. The waves that form the electromagnetic spectrum are grouped in terms of their _____ and their frequency. Going from long to short wavelength (or from _____to high frequency) the groups are: radio, _____, infrared, visible light (red to violet), _____, X-rays and gamma rays.



Our eyes only detect visible _____ and so detect a limited range of electromagnetic waves.

Radio waves	Cooking food, electrical heaters, infrared cameras.
Microwaves	Energy efficient lamps, sun tanning
Infrared	Medical imaging and treatments
Visible light	Television and radio.
Ultraviolet	Sterilising medical equipment.
X-rays	Satellite communications and cooking food
Gamma rays	Fibre optic communications