GCSE to BTEC Applied Science unit 1 - bridging the gap pack 1

Overview –

BTEC applied science starts with a compulsory externally examined unit called Unit 1 – Principles and applications of science 1.

It is a blend of biology, chemistry and physics topics.

Unit 1 covers; animal and plant cells; tissues; atomic structure and bonding; chemical and physical properties of substances related to their uses; waves and their application in communications. There is a written examination consisting of 3 separate papers that are put together to give you a Pass, Merit or Distinction(*) grade. The exam normally take place in January and students can be entered for a second attempt in June.

To help you to retain knowledge in these areas from your GCSE course this bridging pack will help you revise relevant areas that are revisited and expanded in the BTEC course. There are 12 lessons and all work needs to be completed by the 31st of May 2020.

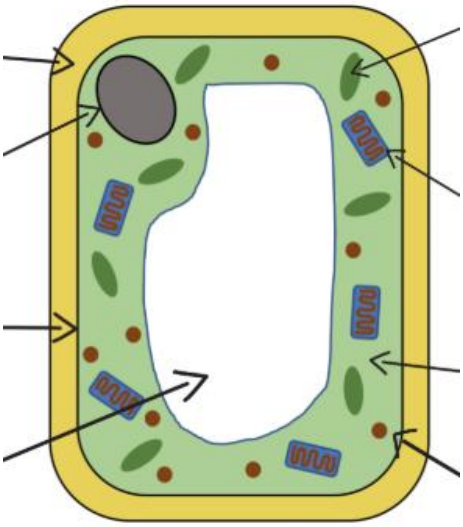
The work highlighted in green is what I would like you to photograph and /or send to me for marking at the end of each lesson.

Lesson	GCSE topic for revising	1 hour Task
1	Structure and function of Plant cells	Starter – Label a plant cell Main – Create a revision poster describing the appearance of each of the organelles of a plant cell and explaining what their function is. Plenary – Past paper question on plant cells
2	Structure and function of Animal cells	Starter – Label an animal cell Main – Create a revision poster describing the appearance of each of the organelles of an animal cell and explaining what their function is. Retrieval practice table Plenary – Past paper question on animal cells
3	Tissues	Starter – Put key words in order Main – Draw flow diagrams of human organ systems Plenary – Past paper question on the blood and blood vessels
4	microscopy	Starter – Revise structure and function of a light microscope Main A – Create instruction leaflets/worksheets on how to prepare microscope slides and view them under a light microscope and an electron scanning microscope

		Main B – Microscopy calculation revision using BBC bitesize then complete calculations worksheet Plenary – Past paper question
5	The structure of the atom and isotopes	Starter – Revise atomic structure and isotopes using bbc bitesize Main – Questions on isotopes and atomic structure Plenary -
6	Ionic, covalent and Metallic Bonding and structures	Starter – Define the three types of chemical bond Main – Create a knowledge organiser of the types of chemical bond, their properties and example structures Plenary – Complete the comparison table
7	Structure of the periodic table including trends in Group1 and Group 7	Starter – Retrieval practice on bonding using assignment on Seneca learning Main – Complete the revision pack on the periodic table Plenary – Summary flash cards
8	Calculations such as Mr, number of moles, empirical formula, etc	Starter – Revise relative molecular mass online Main – Complete the calculations tasks Plenary – 3 Find the formula questions
9	Properties of waves	Starter – Matching ideas about different waves Main - Knowledge organiser poster on properties of longitudinal and transverse waves Plenary – Past paper questions
10	The wave equation	Starter – Retrieval practice on wave forms Main – Wave equation practice Plenary – Past paper question
11	The EM spectrum	Starter- Revise EM spectrum using BBC bitesize and take the test – Send in your score via email Main- Complete the knowledge organiser placemat Plenary- Complete the past paper questions
12	Ultrasound and infrasound	Starter – Watch the you tube clip and make notes Main – complete the Tasks based on the videos about ultrasound and infrasound Plenary – Past paper questions

Lesson 1 – structure and function of Plant cells

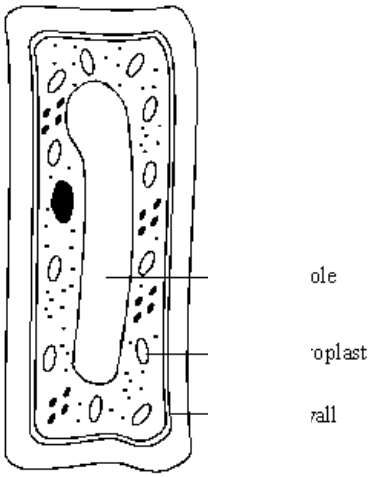
Starter - Label this plant cell diagram with the names of the organelles



Main activity – use a GCSE revision guide or the internet to create a revision poster describing the appearance of each of the 8 organelles of a plant cell and explaining in detail what their function is.

Plenary – testing your understanding complete this past paper question

Question 1 (a) (i) This plant cell also contains chloroplasts, a cell wall and a vacuole. Label **each** of these parts on the diagram.



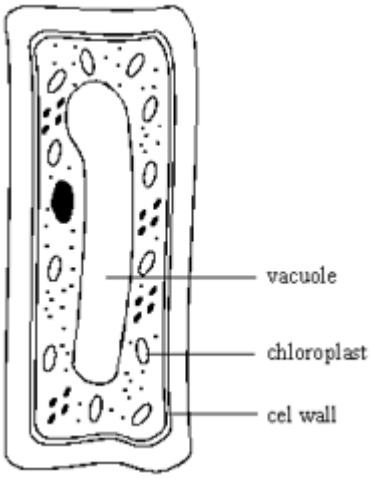
(3)

(ii) Complete the table giving the function of these parts of a plant cell.

Chloroplast	
Cell wall	
Vacuole	

(3)
(Total 6 marks)

Mark scheme to mark and green pen your answer



Q1 (a) (i) one mark for each correctly labelled part

cell wall
*do **not** accept anything inboard of the inner edge vacuole*
accept anything inboard of transplant

chloroplast: site of photosynthesis/ for photosynthesis
*accept word equation **or** balanced equation*

1

cell wall: supports the cell/keeps the shape/keeps it rigid
*do **not** accept protects the cells*

2

(ii) vacuole: acts as reservoir for water / chemicals/(cell)/sap

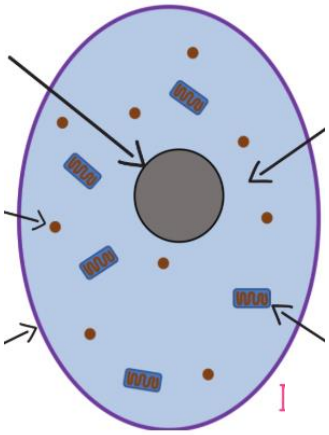
3

or
keeps cell turgid/pushes content to edge
or
maintains concentration gradient
or
allows cell elongation (not growth)

1

Lesson 2 – structure and function of animal cells

Starter - Label this plant cell diagram with the names of the organelles



Main activity – use a GCSE revision guide or the internet to create a revision poster describing the appearance of each of the 5 organelles of a plant cell an laining in detail what their function is.

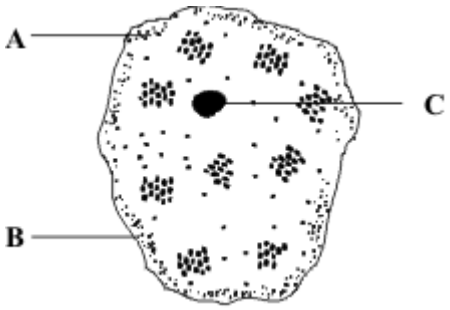
Retrieval practice – Draw a table of all the organelles in plant and animal cells with the headings of the one below

Name of the organelle	Only in plant cells	Only in animal cells	Common to both plant and animal cells

Plenary – complete this past paper question on animal cells and green pen your work using the mark scheme

Q1.

The diagram shows an animal cell.



(a) Complete the table below naming **each** labelled part and give its function.

Part	Name	Function
A		
B		
C		

(6)

Mark scheme

Q1.

(a) A cytoplasm

1

where (chemical) reactions take place

*do **not** accept where cell functions take place*

1

or

carries/holds the organelles/named organelles / named chemicals (including nutrients)

*do **not** accept keeps the shape of the cell*

or

contains water

or

presses out on the membrane

allow: keeps cell turgid
allows transport through the cell

B membrane

*do **not** accept by themselves:*
protects cell
gives shape

1

controls what enters/leaves the cell

1

or

contains the cell/holds the cell together

*do **not** accept keeps harmful substances out*

or

allows movement into and out of the cell C nucleus

1

contains the genetic material/DNA/genes/chromosomes

*do **not** accept:*
brain of the cell
stores information/instructions
tells cell what to do

or

controls (the activity) of the cell

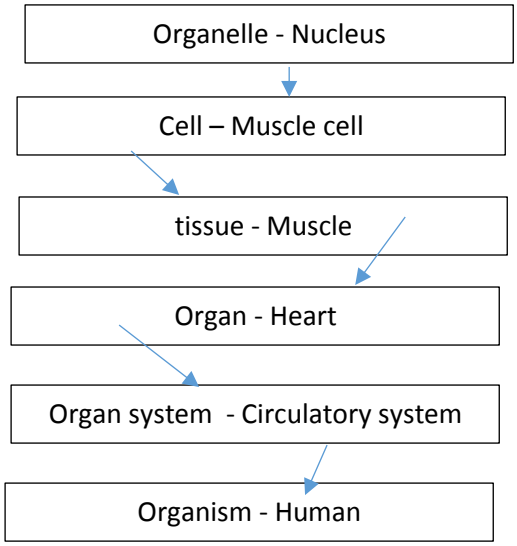
1

Lesson 3 – Tissues

Starter – Place the following structures in order of size smallest to largest

Cells, organism, organs, Organelles, tissues, organ systems

Main Activity - Draw 6 separate flow-diagrams giving an example of a tissue from each of the body's organ systems– see the example below of how to lay out a flow-diagram

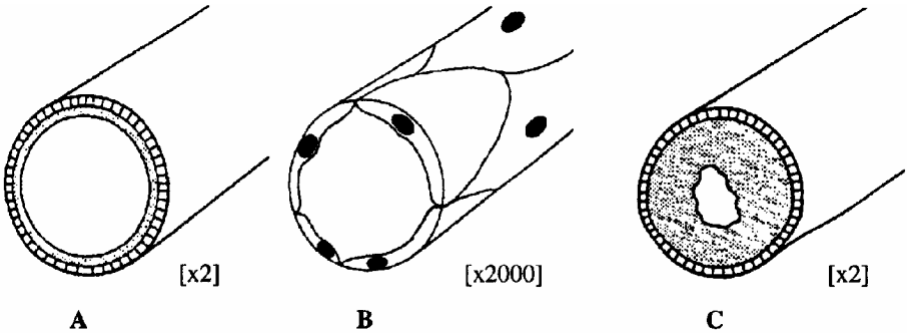


The body's systems are

- Circulatory (example)
- Nervous
- Muscular- skeletal
- Endocrine
- Excretory
- Digestive
- Reproductive

Plenary - The circulatory system has some very specialised tissues in blood vessels and the blood. Complete the following question on blood vessels and the blood using a revision guide or the internet to help you. Mark your work using the markscheme.

1. The drawings show the structure of three types of blood vessel, **A**, **B** and **C**. They are drawn to the scales indicated.



(a) Name the **three** types of blood vessel.

A .....

B .....

C .....

(3)

(b) Describe the job of blood vessel **B**.

.....

.....

.....

.....

(2)
(Total 5 marks)

2. (a) What type of blood vessels join arteries to veins?

.....

(1)

(b) How are oxygen and carbon dioxide carried in the blood?

.....

.....

.....

(2)

(c) List **three** things that are carried around the body in the blood plasma.

1. .....

2. .....

3. .....

(3)
(Total 6 marks)

3. Capillaries are blood vessels in the body which join the arteries to the veins. They have walls which

are one cell thick and so are able to exchange substances with the body cells.

(i) Name **two** substances that travel from the muscle cells to the blood in the capillaries.

1 .....

2 .....

(2)

(ii) Glucose is one substance that travels from the blood in the capillaries to the body cells. Explain how this happens.

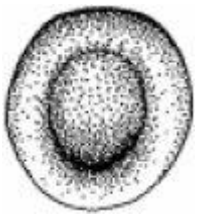
.....

.....

.....

(2)
(Total 4 marks)

5. The diagram shows a red blood cell.



(a) What is the function of red blood cells?

.....

.....

(1)

(b) Explain, as fully as you can, how the structure of a red blood cell is related to its function.

.....

.....

.....

.....

.....

.....

(3)
(Total 4 marks)

Total 19 marks

Q1.

(a) (i) transport of substances **or** named substance **or** blood around the body

each for 1 mark

2

(ii) breaks down *(**not digests**)* food absorption (into blood)

each for 1 mark

3

(b) water filtered from blood
smaller proportion reabsorbed
therefore larger volume
of dilute urine produced

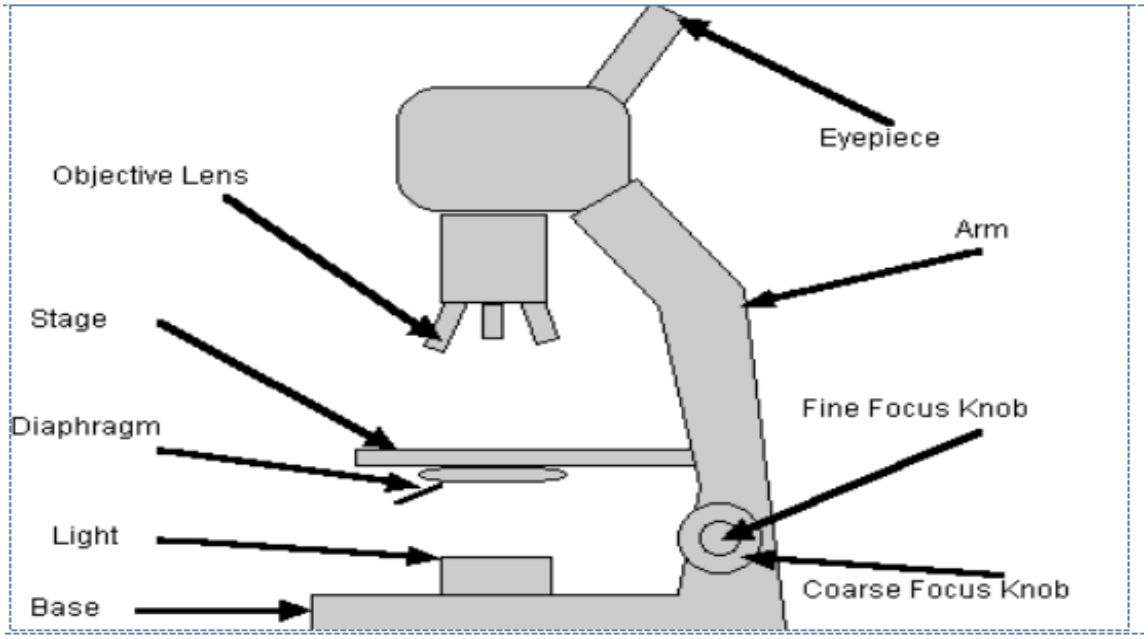
each for 1 mark

4

[9]

Lesson 4 – Microscopy

<u>Starter</u> - Microscope revision – Copy this diagram and its labels onto an A4 sheet – use your paper in the landscape orientation. Now, match the function of each part of the microscope to a label and add the function information to your drawing<u>.</u>



Eyepiece Lens	This keeps the microscope steady on the desk and stops it from tipping over.
Objective Lens	This is used to get the microscope slide into focus so that you can see the image clearly.
Stage	There are three lenses of different strengths which can be used to look at the slide in more detail.
Diaphragm	This is the place where you put a microscope slide.
Light	This is the lens closest to your eye. It normally makes the image tens times bigger than real life.
Base	This is used to get the microscope slide into focus so that the image is very sharp and clear.
Arm	This controls the amount of light that goes onto the microscope slide.
Fine Focus Knob	This holds the eyepiece lens above the stage.
Coarse Focus Knob	This projects light onto the microscope slide.

Main activity

Main activity A –

1. Use your revision guide or the Internet to write an instruction leaflet or worksheet to advise students on how to prepare a cheek cell microscope slide and how to view it under a light microscope. Also draw a micrograph of what they should see using the maximum objective lens.
2. Use the internet to describe how specimens are prepared to be able to be observed using an electron microscope
3. Give 3 advantages of using an electron microscope rather than a light microscope and 1 disadvantage.

Main activity B – go to https://www.bbc.co.uk/bitesize/guides/zpqpqhv/revision/1

Work through the Cell measurement section and complete the microscopy calculation question.

Now complete this worksheet

Microscopy Practice Calculations

1.

Convert the following distances:

A. 5 mm = _____µm

B. 2.5 mm = _____ µm

C. 80 µm = _____mm

D. 7.4 mm = _____ µm

E. 10 um = _____ mm

F. 2.9 mm = _____ µm

G. 1.7 mm = _____ µm

H. 47 um = _____mm

2. A microscope has a magnification of X 40. At this magnification, the field of view is 5 mm. What is the field of view when the magnification is X 80? _____

3. A microscope has a magnification of X400. At this magnification, the field of view is 200 um. How big will the field of view be if the magnification is changed to X100? _____

4. Fill in the table below:

Ocular	Objective	Magnification
X 5	X 10	
X 5		X 100
X 10		X 200

5. Fill in the table below:

The pattern is:

If the magnification is multiplied by two, the field of view is halved. If the magnification is multiplied by three, the field of view is divided by three. If the magnification is multiplied by ten, the field of view is divided by ten.

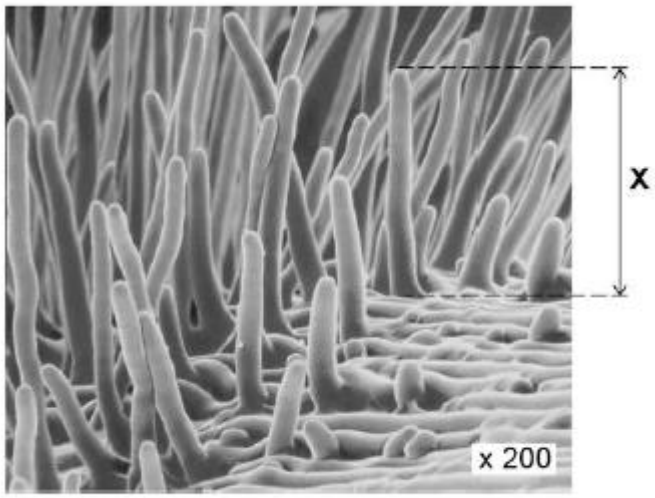
(Can you see the pattern?!

Magnification	Field of view
X 40	80 mm
X 80	
X 160	
X 400	
X 800	

Plenary/retrieval practice – Complete the past paper question and the Calculations worksheet

Q1.

The image below shows part of a root from a cress plant.



(a) What type of microscope was used to create the image above?

_____

(1)

(b) The magnification of the cress root in the image above is × 200.

There are 1000 micrometres (μm) in a millimetre (mm).

Calculate the real length of the root hair, **X**.

Give your answer in micrometres (μm).

Real length **X** = _____ μm

(2)

(c) Root hair cells take up water from the soil.

Explain **one** way in which the root hair cell is adapted to this function.

(2)

The table shows the water uptake by a plant's roots on two different days.

	Mean water uptake in cm^3 per hour
Cold day	1.8
Hot day	3.4

(d) Explain why the mean rate of water uptake is higher on a hot day than on a cold day.

(3)

(e) The concentration of mineral ions in the soil is lower than in root hair cells.

Root hair cells take up mineral ions from the soil.

Root hair cells contain mitochondria.

Explain why root hair cells contain mitochondria.

(4)

(Total 12 marks)

Mark schemes

Q1 (a) electron (microscope)

1

(b) $\frac{30000}{200}$

*an answer of 150 (μm) scores **2** marks*

1

150 (μm)

*if answer is incorrect allow for **1** mark sight of 0.015 / 0.15 / 1.5 / 15*

*allow ecf for incorrect measurement of line **X** for max **1** mark*

1

(c) **either**

large surface area

allow (vacuole contains) cell sap that is more concentrated than soil water (1)

1

for more / faster osmosis

create / maintain concentration / water potential gradient (1)

or

allow thin (cell) walls

for short(er) diffusion distance

1

(d) (on hot day) more water lost

allow converse for a cold day if clearly indicated

1

more transpiration

or

more evaporation

1

so more water taken up (by roots) to replace (water) loss (from leaves)

1

(e) (aerobic) respiration occurs in mitochondria

*do **not** accept anaerobic respiration*

1

(mitochondria / respiration) release energy

*do **not** accept energy produced / made / created*

1

(energy used for) active transport

1

to transport ions, against the concentration gradient

or

from a low concentration to a high concentration

1

[12]

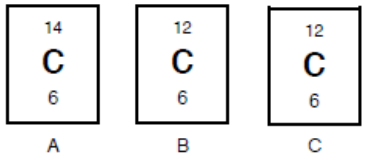
Lesson 5 – The structure of the atom and isotopes

Starter – Go to https://www.bbc.co.uk/bitesize/guides/z3sg2nb/revision/6 work through the 6 revision pages making notes as necessary then check your understanding by taking the test.

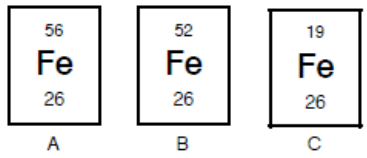
Main – Complete the following 4 questions

Isotopes are copies of an element, that have the same proton (atomic) number, but different mass numbers/number of neutrons in the nucleus.

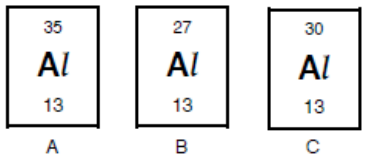
- Identify the isotopes, then write the name of the element.

1. 

name:

2. 

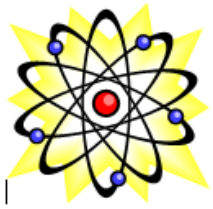
name:

3. 

name:

4. Complete the table.

	No. of protons	No. of neutrons	No. of electrons
$^{24}_{13}X$			13
$^{28}_{13}X$	13	15	



Radioactivity and atomic structure

Atomic Structure Rule Box

1. The number of protons in the nucleus is called the **atomic** or **proton** number.
2. The number of **nucleons** (neutrons + protons) is called the **mass** number.
3. In a neutral atom, number of electrons = number of protons.
4. Isotopes of an element have the same number of protons in the nucleus but different numbers of neutrons.

Questions

1. An isotope of carbon contains 6 protons and 8 neutrons.

   a) What is its atomic number? _____
   b) What is its mass number? _____
   c) Write down the symbol for this isotope_____
   d) How many electrons would a neutral atom have?_____

2. Complete this table

Symbol	Number of protons	Number of neutrons	Number of electrons	Atomic number	Mass number
$^{4}_{2}He$	2	2			
$^{12}_{6}C$					
	6	8			
$^{16}_{8}O$					
	8				17
$^{54}_{26}Fe$					
		30		26	

3. Which of the atoms in this table are isotopes of the same element?

   _____

Plenary- Complete this past exam paper question and mark it using the mark-scheme

Q1.

This question is about atoms and isotopes.

(a) Atoms contain protons, neutrons and electrons.

A lithium atom has the symbol $^{7}_{3}Li$

Explain, in terms of sub-atomic particles, why the mass number of this lithium atom is 7.

_____

_____

_____

_____

_____

_____

(3)

(b) Amounts of substances can be described in different ways.

Complete the sentences.

One mole of a substance is the relative formula mass in

_____

The relative atomic mass of an element compares the mass of an atom of an element with the mass of an atom of

_____

(2)

(c) Two isotopes of oxygen are $^{18}_{8}O$ and $^{16}_{8}O$

Describe the similarities and differences between the isotopes $^{18}_{8}O$ and $^{16}_{8}O$

You should refer to the numbers of sub-atomic particles in each isotope.

_____

_____

_____

_____

(3)

(Total 8 marks)

Q1.

(a) because this lithium atom has

3 protons

1

and 4 neutrons

1

mass number is total of neutrons and protons

accept protons and neutrons have a mass of 1
accept number of neutrons = 7 - 3(protons)
ignore mass of electron is negligible

1

(b) grams

accept g

1

^{12}C

allow carbon-12 ***or*** *C-12*
ignore hydrogen ***or*** *H*

1

(c) any **three** from:

max ***2*** *if no numbers given*
numbers if given must be correct

- both have 8 protons
  accept same number of protons
- ^{18}O has 10 neutrons
- ^{16}O has 8 neutrons
  accept different number of neutrons or ^{18}O *has two more neutrons for* ***1*** *mark*
- both have 8 electrons.
  accept same number of electrons

3

[8]

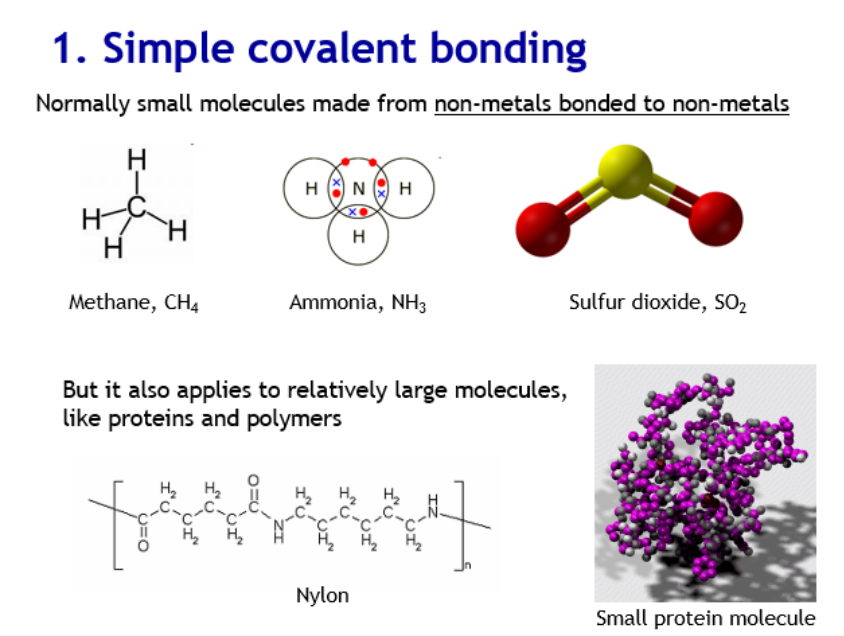
Lesson 6 - Ionic, covalent and Metallic Bonding and structures

Starter – Go to https://www.youtube.com/watch?v=QXT4OVM4vXI for a brief recap of chemical bonding. Write a definition for all 3 types of chemical bond. Metallic, covalent and ionic.

Main – Go to
https://cmat.sharepoint.com/SVAIntranet/Departments/Science/Student%20Documents/Forms/AllItems.aspx?viewid=1b245e86%2D359c%2D44ac%2D96f4%2D49b32c488a40&id=%2FSVAIntranet%2FDepartments%2FScience%2FStudent%20Documents%2Fkey%20stage%205%2FBTEC%20bridging%20packresources

The power-point presentation is called Types of bonding and the first slide looks like this

Work through the slides making notes and copying diagrams to create a knowledge organiser

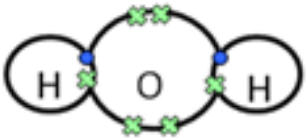


Plenary – complete the following task

Use this list to complete the table of the three types of chemical bond

- Metal and non-metal atoms
- Non-metal atoms only
- Metal atoms only
- Form giant lattices that are easy to crush
- Forms a strong lattice structure with
- Form molecules with weak forces of attraction so are mainly gases and liquids
- High melting point and boiling point
- High melting point and boiling point
- Low melting point and boiling point
- Many are soluble in water
- Are not soluble in water
- Are not soluble in water
- Some are magnetic
- Not magnetic

- Mot magnetic
- Will conduct electricity when solid or molten
- Will not conduct electricity
- Will conduct electricity when molten or dissolved in water
- Water need for life
- Copper –used in wiring electrical appliances
- Sodium chloride –used to flavour food



Property \ Bonding Type	Ionic	Covalent (simple)	Metallic
Which types of atoms does it involve?			
How are they structured?			
An example of the bonding type is			
What is the melting point or boiling point like?			
Are they magnetic?			
Are they soluble in water?			
Do they conduct electricity when solid liquid, gas or dissolved?			
Give an example substance with a use			

Lesson 7- Periodic table and group 1 and 7 elements

Starter – Retrieval practice – Use the link email to you to access Seneca Learning and complete the assignment

Main- Complete the following tasks

Fill in the missing words

Elements are arranged in rows and columns in the periodic table in order of increasing atomic mass. The vertical _____are called **groups** and the _____rows are called **periods**. Li, ____ and K are in the same group while N,____ , F are in the same period.

Elements in the same groups have the same number of electrons in their outer_____. For example, all the elements in _____ have 7 electrons on their outer shells. Elements in the same groups have similar _____and physical properties

Some groups have specific names: **Group 1 elements are called Alkali, Group 2 Alkali Earth metal, Group 7 – halogen, Group 0- Noble Gases**. Elements in the same period have the same number of outer shells.

O, Group VII , columns, horizontal, chemical, shells, Na

Elements in Group 7 (halogens)

A. Write down the names or symbols of the first 5 elements in Group 7

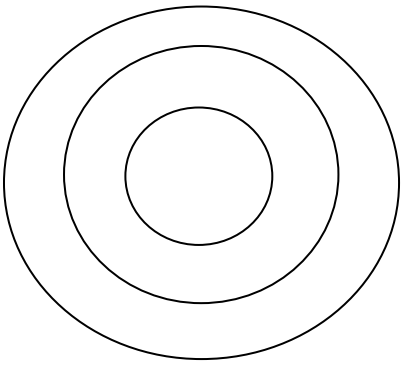
1. _____
2. _____
3. _____
4. _____
5. _____

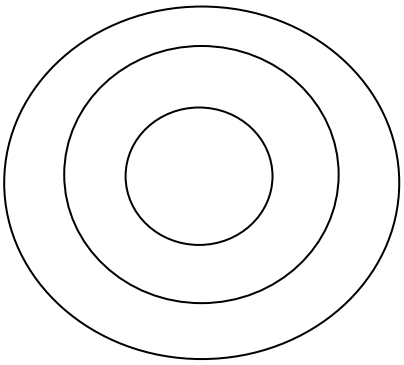
B. Write down the electron arrangement for Fluorine and Chlorine

1. Fluorine: atomic number 9: _____

2. Chlorine: Atomic number 17: _____

C. Draw the arrangement of fluorine and Chlorine below





D. What do you notice about the number of electrons in the outer shell?

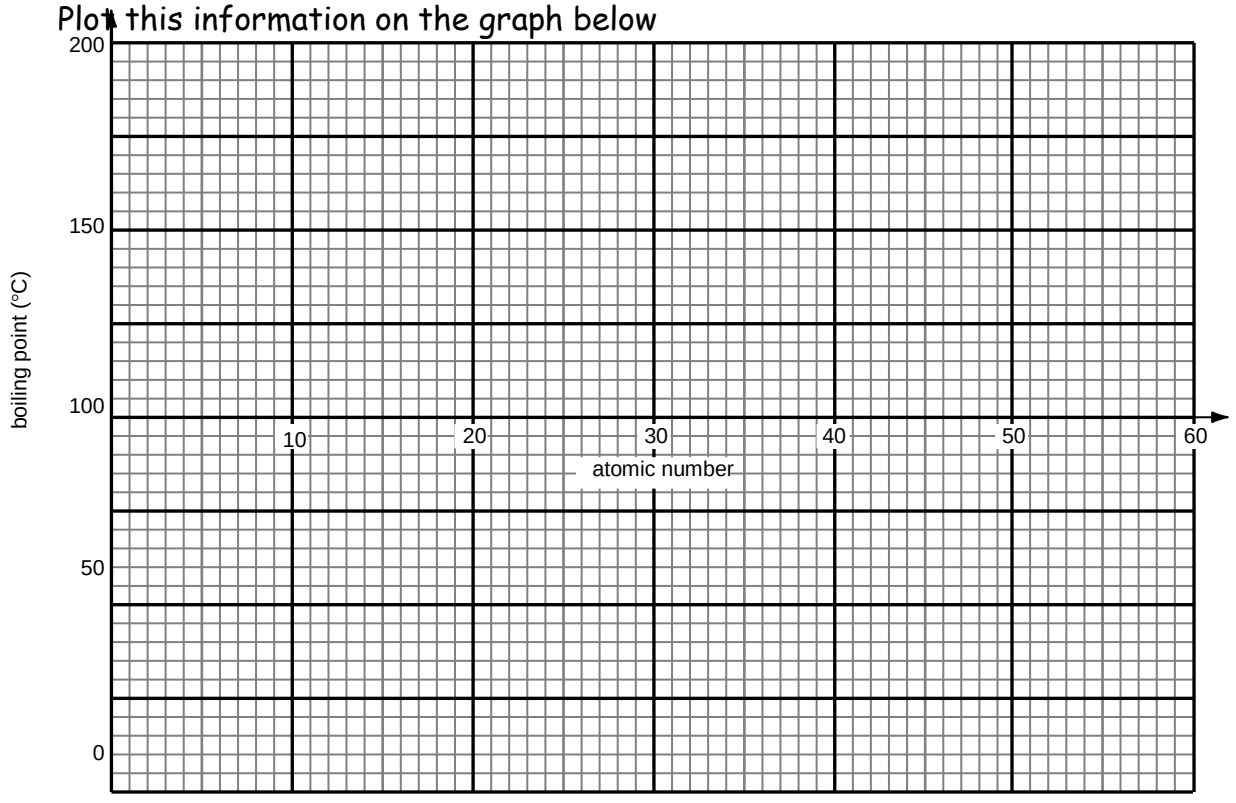
_____

E. how many more electrons would it need to make a full shell?_____

Trends in Group 7 – The Halogens - Look at the table below:

halogen	atomic number	boiling point (°C)
fluorine	9	-188
chlorine	17	-34
bromine	35	58
iodine	53	184

Plot this information on the graph below



Questions

1 What is the pattern going down Group 7?

2 Which halogens are gases at room temperature (25 °C)?

3 Astatine is below iodine in Group 7.
Predict its physical state at room temperature.

Trends and properties of group 7

I. Complete the table to describe their appearance of chlorine, bromine and iodine by using research from the information in your revision guide or on the internet

Halogen	**State at room temperature (25°)**	**Appearance**	**Atomic number**
Fluorine			
Chlorine			
Bromine			
Iodine			

II. Research the use of at least two of the group VII elements.

1.

2.

III. Note one interesting fact from your research.

Trends in group 1 – The alkali metals

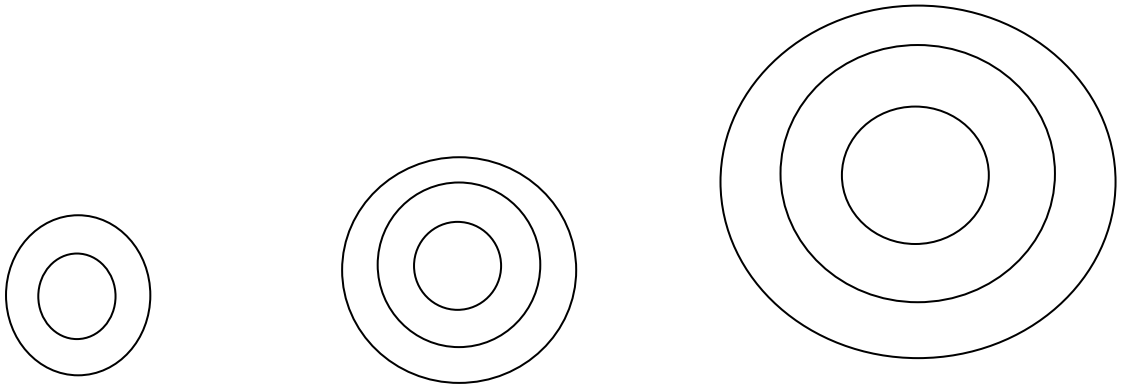
A. Write down the names or symbols of the first 5 elements in Group I

1. _____
2. _____
3. _____
4. _____
5. _____

B. Write down the electron arrangement for Li, Na, K

1. Lithium: atomic number 3: _____
2. Sodium: Atomic number 11: _____
3. Potassium Atomic number 19_____

C. Draw the arrangement of Li, Na, K below:



C. What do you notice about the number of electrons in the outer shell?

_____

E. how many more electrons would it need to make a full shell?_____

Trends in group 1 – The alkali metals Look at the table below:

Element	Atomic number	Melting point (°C)
Lithium	3	180
Sodium	11	98
Potassium	19	63
Rubidium	37	39
Casesium	55	29

Questions

1. How does the melting point change as you go down Group 1?

---

2. What state are these elements likely to exist in at room temperature?

---

3. How does the size of the atom change as you go down a group?

---

4. Describe how the size of the atom changes with the melting point.

---

5. Francium is below Caesium in the periodic table. Suggest what the melting point may be?

6. What state do you predict francium to be in at room temperature?

Reaction of alkali metals with water:

I. Complete the table to describe their appearance and reactions of alkali metals with water using: research from the internet at https://www.youtube.com/watch?v=0KonBvfnzdo

Record what **CHANGES** that you **SEE** happen, in the table below.

METAL	SYMBOL	APPEARANCE	OBSERVATIONS
lithium			
sodium			
potassium			

1. Use your **observations** to put the metals in order of their reactivity.

Highest 1. _____2. _____3. _____ Lowest

2. Why did you put them in this order?

_____

3. Which **gas** was produced? _____.

(b) How do you know?_____

4. What type of solution is formed from the reaction of alkali metals with water?

_____.

(b)How do you know?_____

Trends in group 2 – The alkali earth metals

A. Write down the names of the first 5 elements in Group II

1. _____

2. _____

3. _____

4. _____

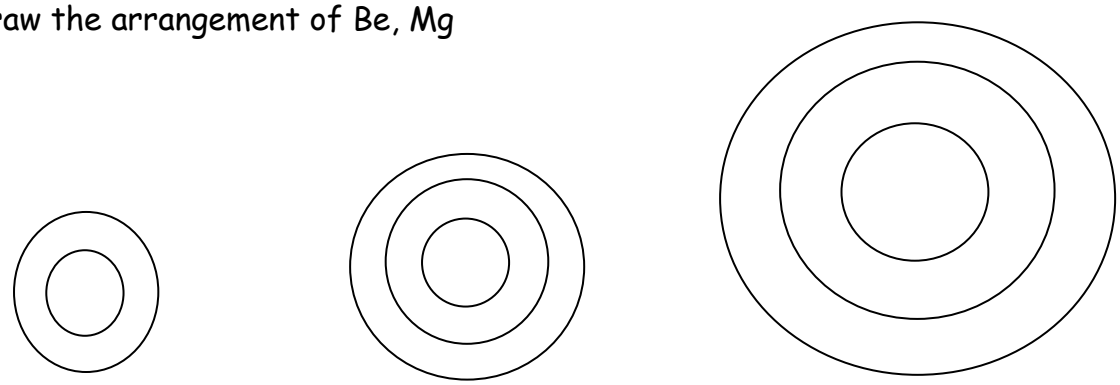
5. _____

D. Write down the electron arrangement for Be, Mg

1. Lithium: atomic number 4: _____

2. Sodium: Atomic number 12: _____

C. Draw the arrangement of Be, Mg



D. What do you notice about the number of electrons in the outer shell?

_____

E. how many more electrons would it need to make a full shell?_____

Elements in Group O (noble gases)

A. Another name for noble gases is inert gases. Why do you think **inert** means?

_____

B. Write down the names or symbols of the first 5 elements in Group 0

1. _____

2. _____

3. _____

4. _____

5. _____

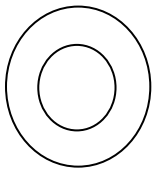
C.Write down the electron arrangement for He, Ne, Ar,

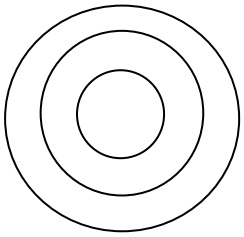
1. Helium: atomic number 2: _____

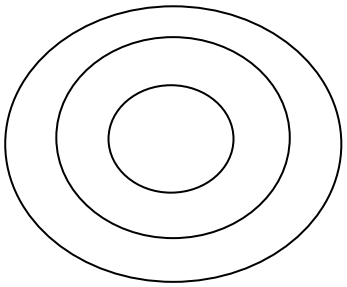
2. Neon: Atomic number 10: _____

3. Argon: Atomic number 18: _____

D. Draw the arrangement of He, Ne, Ar below:







E. What do you notice about the number of electrons in the outer shell?

_____

Plenary – Complete 3 summary revision flash cards, 1 on the "rules of the periodic table, 1 on group 1 elements and 1 on group 7 elements

Lesson 8 - Calculations such as Mr, number of moles, empirical formula, etc

Starter – Go to https://www.youtube.com/watch?v=q49NwIrjaFw and revise Relative molecular mass. Make notes as necessary.

Main

RELATIVE MOLECULAR MASS

Chemists cannot weigh atoms directly, but they can compare the weight of atoms with each other. This gives us the **relative atomic mass** or $\mathbf{A_r}$. This gives a relative mass compared with the ^{12}C isotope, which is given the value of 12.000 . It has no units because it is a ratio. On this scale, A_r (H)=1.0097 (it is not a whole number because it is an average for the different isotopes which have different A_r values.) and A_r (O)=15.999 . Some periodic tables round up the A_r values, or quote the **mass number** instead which is the relative mass of an individual isotope.

To find the relative mass of a compound, we add up the relative masses of all the atoms present. This means we have to take into account the numbers in the formula (the *stoichiometries*!)

The result is called the **relative molecular mass** ($\mathbf{M_r}$) for small molecules, but for giant structures we call it the **relative formula mass**.

eg from the periodic table, A_r (Na)=23 and A_r(Cl) = 35.5

so the relative formular mass of NaCl=23 + 35.5 = 37.5

and for NH_3, A_r (N) = 14 and A_r (H)= 1

so M_r (NH_3) = 14 + 1+ 1+ 1 =17

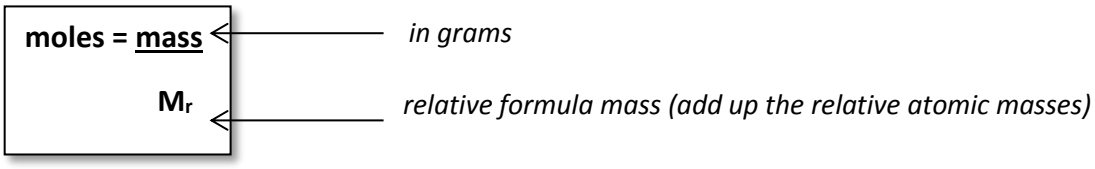
and for glucose, $C_6H_{12}O_6$

$M_r(C_6H_{12}O_6)$ = (6x12) + (12x1) + (6x16)
= 72 + 12 + 96
=180

Calculate the relative molecular mass or relative formular mass of the following compounds...

Formula	calculation	M_r or RFM
H_2O		
SO_2		
NaBr		
$CaCl_2$		
$LiNO_3$		
HNO_3		
C_2H_6		
C_2H_6O		
SF_6		
CO		
CO_2		
NI_3		
$Mg(NO_3)_2$		
$Al(OH)_3$		
PCl_5		
$AgNO_3$		
$BaSO_4$		
H_2SO_4		
O_3		

Mole Calculations



Calculate M_r for each of the following then use the equation above to calculate the number of moles. An example is done for you.

88g of CO_2 *$M_r = 12 + (16 \times 2) = 44$*

No. of moles = $\frac{mass}{M_r} = \frac{88}{44} = 2$ moles

1. 146g of HCl
2. 20g of NaOH
3. 25.5g of Al_2O_3
4. 73.6g of NO_2
5. 15g of $CaCO_3$
6. 47.7g of CuO
7. 192g of Br_2
8. 12g of MgO
9. 9.8g of H_2SO_4
10. 6.3 g of HNO_3
11. 11.2 g of KOH
12. 6.6g of Xe
13. 1.6g of Fe_2O_3
14. 19.2g of SiO_2
15. 8.92g of $Mg(OH)_2$

Rearrange the equation to calculate the mass of the following. An example is done for you.

3 moles of NH_3 $M_r = 14 + (1 \times 3) = 17$

Mass = moles x M_r = 3 x 17 = 51g

1. 2 moles of Al_2O_3
2. 5 moles of MgO
3. 1.5 moles of NH_3
4. 0.7 moles of Br_2
5. 1.3 moles of H_2SO_4
6. 21 moles of CuO
7. 0.6 moles of HNO_3
8. 1.2 moles of NO_2
9. 1.4 moles of $CaSO_4$
10. 2.1 moles of Na_2CO_3
11. 1.3 moles of $MgCl_2$
12. 0.4 moles of $Cu(NO_3)_2$

CALCULATING EMPIRICAL FORMULA

You will need to refer to a periodic table to find values for relative atomic masses of the elements. Use the data presented in each question to calculate the empirical formula for each of the compounds. The first one has been completed for you as an example.

1. A compound which contains 11.6% nitrogen and 88.4% chlorine.

List the elements present:	N	Cl
What is the % or mass?	11.6	88.4
Divide by the A_r of each element	14	35.5
This gives a ratio between the elements	= 0.8286	= 2.4901
Divide by the smallest number	0.8286	0.8286
Simplest whole number ratio is	1	3

So empirical formula is NCl_3

2. A compound which contains 40% sulphur and 60% oxygen.

3. A compound which contains 37.21% carbon, 7.75% hydrogen and 55.04% chlorine.

Plenary- Find the formula of each of the following.

1. Iron oxide, in which 11.2g of iron combine with3.2g of oxygen gas.
2. Carbon fluoride, where 24g of carbon react with 152g of fluorine.
3. Methane, in which 2.4g of carbon combine with 0.8g of hydrogen gas.

Lesson 9 Properties of Waves

Starter – revisit these ideas about waves and complete the matching task

The nature of waves

1. Waves (level 3/4)

Waves are vibrations (movements up and down) that move.

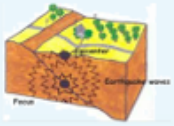
They transfer energy from one place to another.

There are lots of different types of wave.

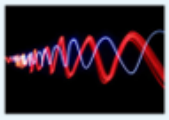
Task 1: In your books state the type of wave and match it to its description.


1. Sound waves


2. Radio waves


3. Seismic waves

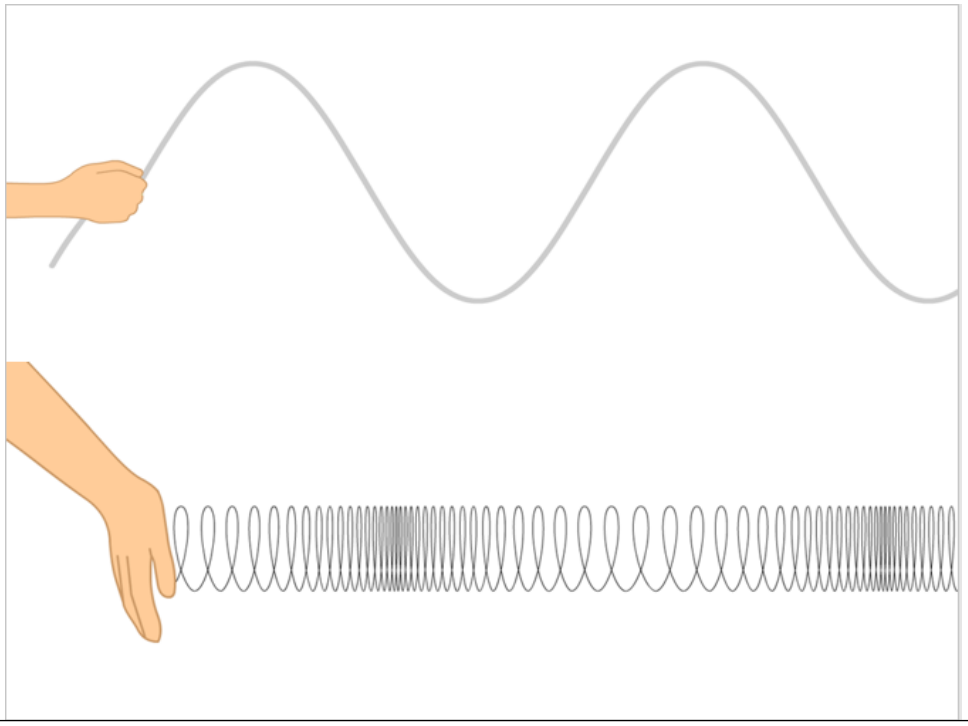

4. X-Rays


5. Light waves


6. Water waves

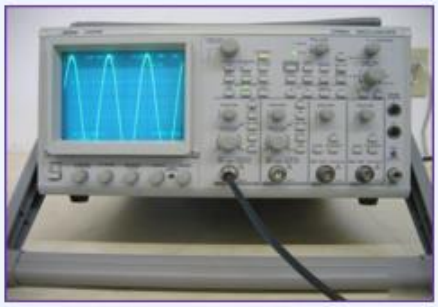
Travels through the ground and causes earthquakes.	These types of wave allow us to see.	High energy waves, passes through some solid objects. Can be developed on photographic film.	Can be used to carry information between electronic devices.	Can be caused by the Moon orbiting the Earth, or by something hitting the surface.	Travels through air, allows us to hear noises.

Main activity – Using this diagram create a revision poster that has the following keywords on it explaining the properties of longitudinal and transverse waves. Add as much information as you can.

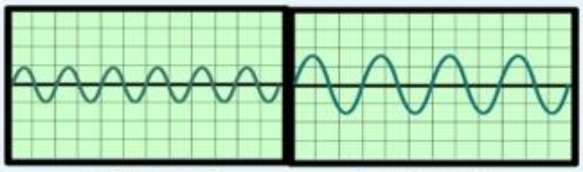


Longitudinal, transverse, wavelength, peak, trough, rarefaction, compression, frequency, period, direction of wave, sound, light, amplitude,

Finally add the ideas below about how waveforms change with amplitude and wavelength to your poster

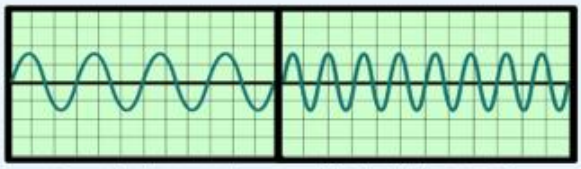


An oscilloscope is a piece of equipment that measures sound waves using a microphone and turns them into picture.



quiet sound loud sound

Task 5: In your books sketch the diagram. Which has a larger amplitude, a **quiet sound** or a **loud sound**?



low pitch sound high pitch sound

Task 6: In your books sketch the diagram. Which has a larger wavelength, a **low pitch sound** or a **high pitch sound**?

Plenary – Complete the past paper questions and mark them using the markscheme

Q1.

Waves may be longitudinal or transverse.

(a) Describe the differences between longitudinal waves and transverse waves.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 3 marks)

Q2.

(a) The student is using a microphone connected to a cathode ray oscilloscope (CRO).

The CRO displays the sound waves as waves on its screen. What does the microphone do?

_____

_____

_____

(2)

(b) The amplitude, the frequency and the wavelength of a sound wave can each be either increased or decreased.

(i) What change, or changes, would make the sound quieter?

_____

(1)

(ii) What change, or changes, would make the sound higher in pitch?

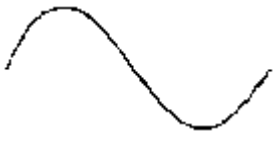
_____

(1)

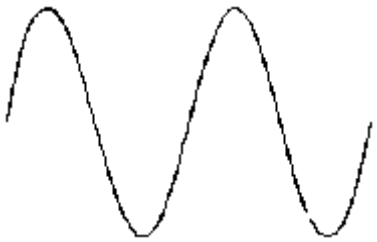
(Total 4 marks)

Q3.

Some students made a small hand-turned a.c. generator, similar to a bicycle dynamo. They connected it to the Y plates of a cathode ray oscilloscope, CRO, and turned the generator slowly. The trace on the CRO looked like this:



They then turned the generator faster and the trace looked like this:



(a) Why did the trace on the CRO show:

(i) an increase in frequency;

_____

(1)

(ii) a decrease in wavelength;

_____

(1)

(iii) an increase in amplitude?

_____

(1)

(b) One way to alter the output from the generator is to change the speed of turning. State **two** other ways to adapt parts of the generator to increase its output.

_____

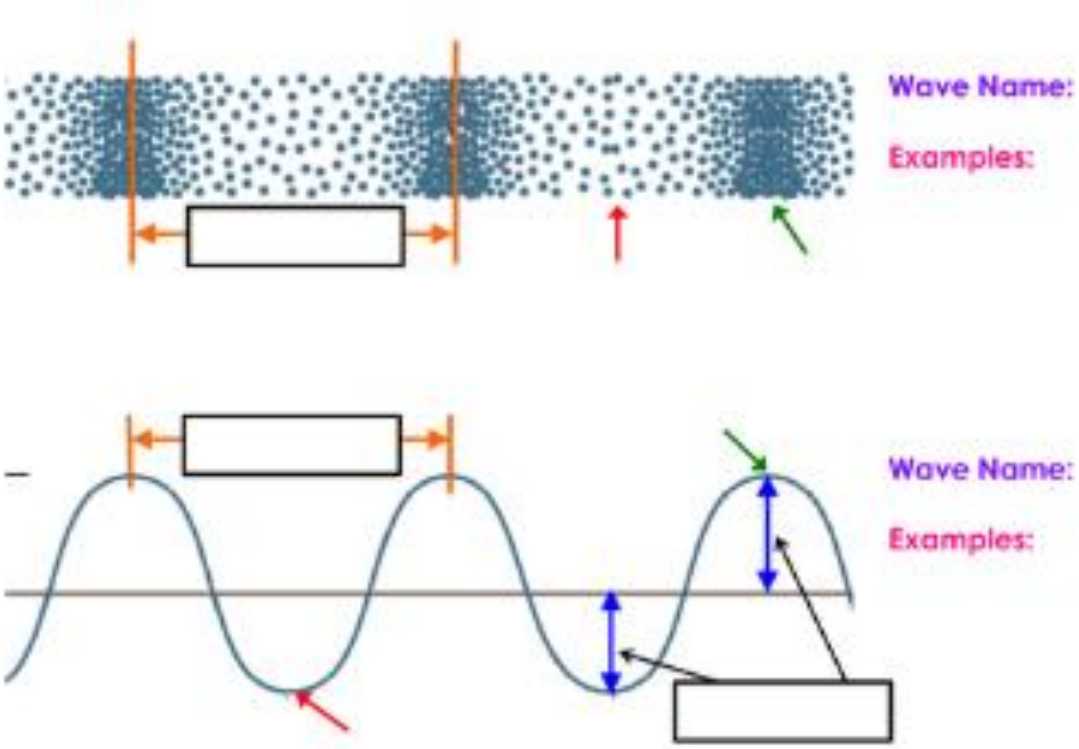
_____

(2)

(Total 5 marks)

Lesson 10 - The wave equation

Starter- retrieval practice – From memory complete this labelling task



Main Activity – The wave equation calculation practice

Calculating Wave Speed

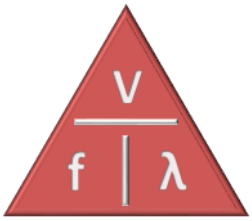
Wave speed is the speed at which energy is transferred (or the wave moves) through a medium.

All waves obey the following equation:

Wave speed (m/s) = frequency (Hz) x wavelength (m)

$$V = f\lambda$$

Take note of the units used for each of the variables – meters per second, hertz and meters.



Using this information complete the following calculations

Calculate the following:

1. The speed of a wave with a frequency of 10kHz and a wavelength of 2m.

2. The speed of a wave with a wavelength of 50cm and a frequency of 4kHz

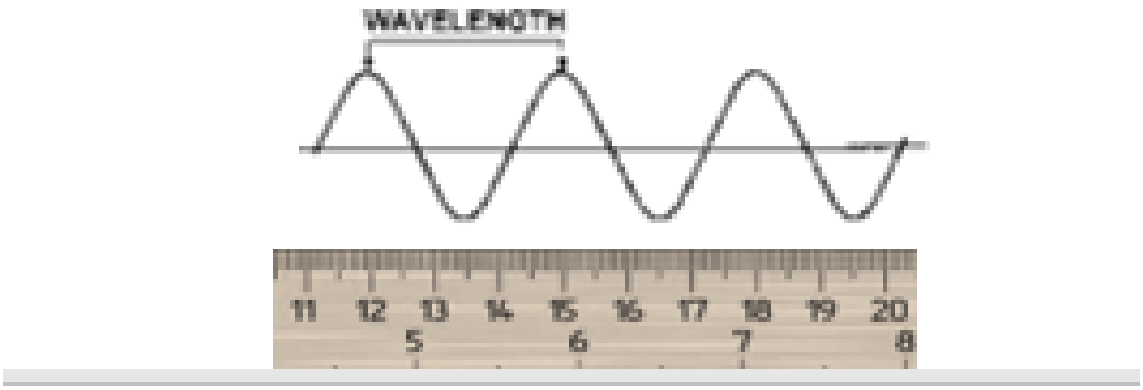
3. The frequency of a wave travelling at 500m/s with a wavelength of 25m

4. The speed of a radio wave with a wavelength of 3000m and a frequency of 100kHz

5. The speed of a wave with a frequency of 30MHz and wavelength of 10m

6. The wavelength of a wave travelling at 11km/s with a frequency of 5.5kHz

7. The frequency of the wave below, which is travelling at 9km/s



Plenary – Past paper question complete them and mark them with the markscheme.

Q1.

(i) Use the words frequency, wavelength and wave speed to write an equation which shows the relationship between them.

_____

(1)

(ii) Calculate the speed of a sound wave with a frequency of 250 Hz and a wavelength of 1.3 m.

Show how you get to your answer and give the unit.

_____

_____

Speed = _____

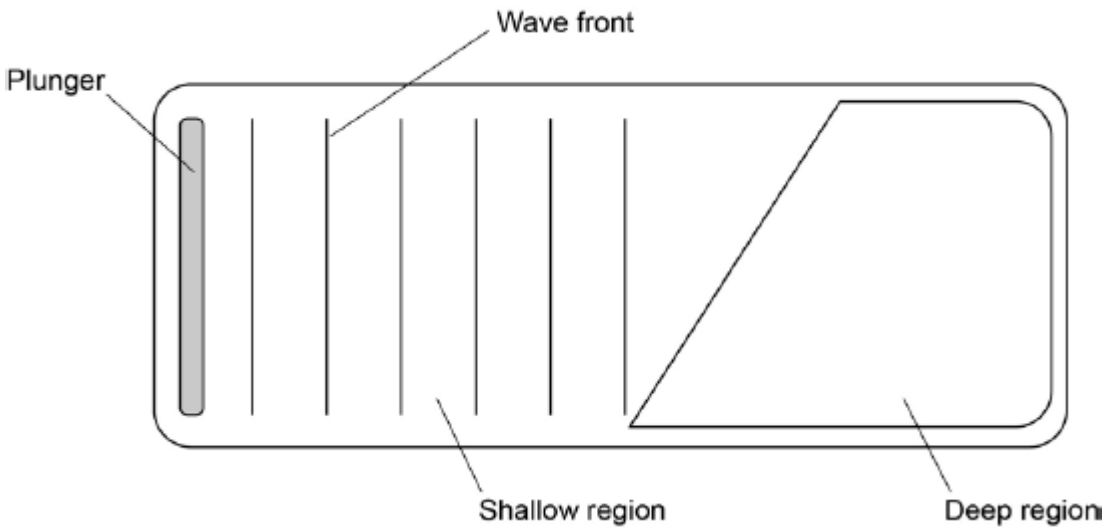
(2)

(Total 3 marks)

Q2.

Some students did an investigation to study the behaviour of waves.

The figure below shows a ripple tank that they used to model the behaviour of waves.



(a) Complete the wave fronts on the figure above.

Show how the wave is refracted as it passes from the shallow region into the deep region.

(1)

(b) Explain what happens to the waves as they pass into the deep region.

_____

(2)

(c) The waves generated on the surface of the water are transverse waves.

Describe the differences between longitudinal waves and transverse waves.

You may include labelled diagrams to help your answer.

(3)

(d) Some students investigate the properties of the waves generated in the figure above.

Student **A** says 'the waves move water from one end of the tank to the other'.

Student **B** says 'that's wrong. Only the waves move, not the water'.

Suggest what the students could do to decide which of them is correct.

(2)

(e) Another student uses a ripple tank where all the water is the same depth.

She measures the wavelength of each wave as 0.34 m.

The period of each wave is 0.42 s.

Calculate the speed of the wave.

Use the correct equation from the Physics Equation Sheet.

Give the unit.

Give your answer to three significant figures.

_____

_____

_____

_____

_____

Speed = _____

Unit = _____

(5)

(Total 13 marks)

Q1.

(i) (wave) speed = frequency × wavelength

or *any correctly transposed version*

accept $v = f \times \lambda$

or *transposed version*

accept $m/s = 1 / s \times m$

or *transposed version*

or 

but only if subsequently used correctly

1

(i) 325

1

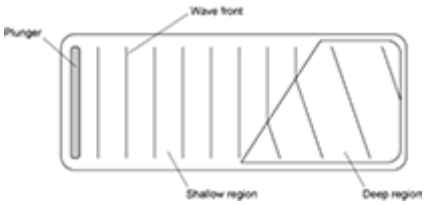
metres per second

or *m / s* ***or*** *0.325 km/s for 2 marks*

1

[3]

Q2.

(a) 

lines should be further apart with the bottom of the wave fronts further to the right than the top

1

(b) they will speed up

1

so wave (fronts) move further apart

1

(c) longitudinal waves:

- the oscillations are parallel to the direction of energy transfer

1

- show areas of compression and rarefaction

1

transverse waves:

- the oscillations / movement are perpendicular to the direction of energy transfer.

1

(d) place a floating object / plastic duck on the surface of the water

1

it will stay in the same place **or** only bob up and down if the water doesn't move

1

(e) 0.42 = 1 / f

1

f = 2.38

1

v = 2.38 × 0.34

1

= 0.809

*allow 0.809 with no working shown for **4** marks*

1

*incorrect sig. figs max **3** marks*

m / s

correct unit

1

[13]

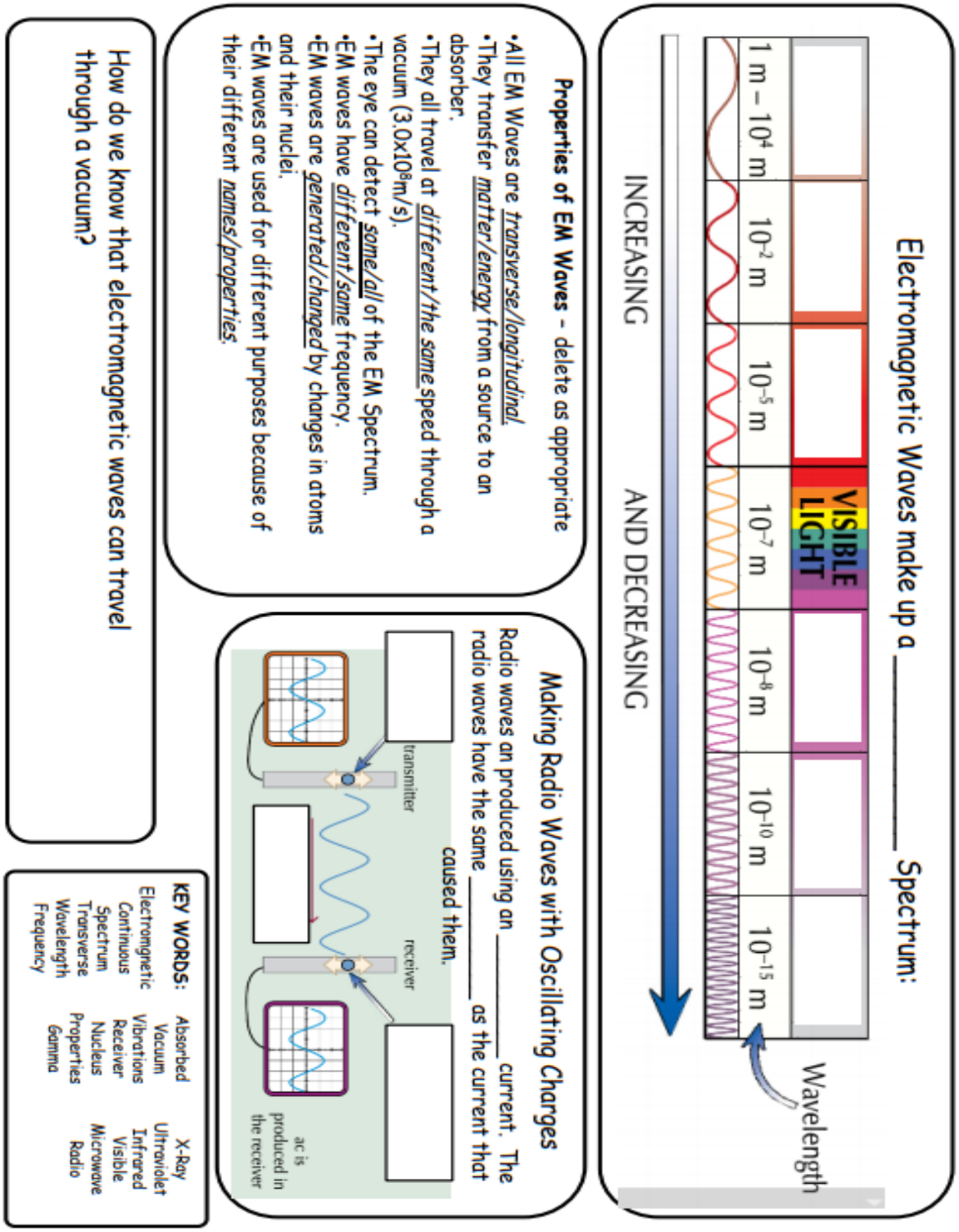
Lesson 11 – EM Spectrum

Starter – revise the GCSE course content using bbc bitesize -
https://www.bbc.co.uk/bitesize/guides/zc36w6f/revision/1

Then take the test to check your understanding and send in your score by email

https://www.bbc.co.uk/bitesize/guides/zc36w6f/test

Main – Complete these prompt boxes to create an A4 knowledge organiser placemat

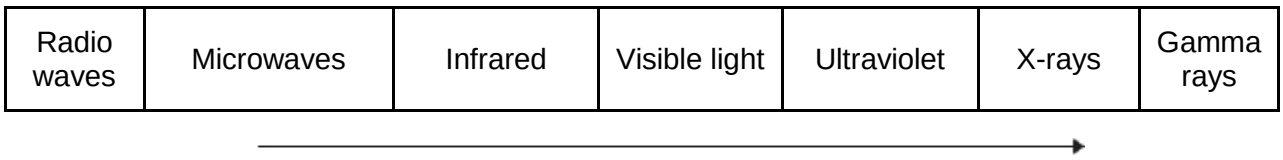


Plenary – Complete the past paper question and send it to me for marking. Complete as much as you can in **30 minutes**

Q1.

Different parts of the electromagnetic spectrum have different uses.

(a) The diagram shows the electromagnetic spectrum.



(i) Use the correct answers from the box to complete the sentence.

amplitude	**frequency**	**speed**	**wavelength**

The arrow in the diagram is in the direction of increasing _____

and decreasing _____ .

(2)

(ii) Draw a ring around the correct answer to complete the sentence.

The range of wavelengths for waves in the electromagnetic spectrum is approximately

- 10^{-15} to 10^{4}
- 10^{-4} to 10^{4}
- 10^{4} to 10^{15}

metres.

(1)

(b) The wavelength of a radio wave is 1500 m.
The speed of radio waves is 3.0×10^{8} m / s.

Calculate the frequency of the radio wave.

Give the unit.

_____

_____

_____

Frequency = _____

(3)

(c) (i) State **one** hazard of exposure to infrared radiation.

_____

(1)

(ii) State **one** hazard of exposure to ultraviolet radiation.

_____

(1)

(d) X-rays are used in hospitals for computed tomography (CT) scans.

(i) State **one** other medical use for X-rays.

_____

_____

(1)

(ii) State a property of X-rays that makes them suitable for your answer in part **(d)(i)**.

_____

_____

(1)

(iii) The scientific unit of measurement used to measure the dose received from radiations, such as X-rays or background radiation, is the millisievert (mSv).

The table shows the X-ray dose resulting from CT scans of various parts of the body.

The table also shows the time it would take to get the same dose from background radiation.

Part of the body	X-ray dose in mSv	Time it would take to get the same dose from background radiation
Abdomen	9.0	3 years
Sinuses	0.5	2 months
Spine	4.0	16 months

A student suggests that the X-ray dose and the time it would take to get the same dose from background radiation are directly proportional.

Use calculations to test this suggestion and state your conclusion.

_____

_____

_____

_____

_____

(3)

(Total 13 marks)

Q2.

(a) The wavelengths of four different types of electromagnetic wave, including visible light waves, are given in the table.

Type of wave	Wavelength
Visible light	0.0005 mm
A	1.1 km
B	100 mm
C	0.18 mm

Which of the waves, **A**, **B**, or **C**, is an infra red wave?

_____

(1)

(b) A TV station broadcasts at 500 000 kHz. The waves travel through the air at 300 000 000 m/s.

Calculate the wavelength of the waves broadcast by this station.

Show clearly how you work out your answer.

_____

_____

Wavelength = _____ m

(2)

(c) What happens when a metal aerial absorbs radio waves?

_____

_____

_____

_____

(2)

(d) Stars emit all types of electromagnetic waves. Telescopes that monitor X-rays are mounted on satellites in space.

Why would an X-ray telescope based on Earth **not** be able to detect X-rays emitted from distant stars?

_____

_____

(1)

(Total 6 marks)

Q3.

Radio waves and microwaves are two types of electromagnetic wave.

Both waves:

- can be used for communications
- travel at the same speed through air.

(a) Give **two** more properties that are the same for both radio waves and microwaves.

1. _____

_____

2. _____

_____

(2)

(b) Some satellites are used to transmit television programmes. Signals are sent to, and transmitted from, the satellites using microwaves.

What is the property of microwaves that allows them to be used for satellite communications?

_____

_____

(1)

(c) Electromagnetic waves travel at a speed of 3.0×10^8 m/s.

A radio station transmits waves with a wavelength of 2.5×10^2 m.

Calculate the frequency of the radio waves.

Show clearly how you work out your answer and give the unit.

_____

_____

_____

Frequency = _____

(3)

(Total 6 marks)

Q4.

(a) Microwaves are one type of electromagnetic wave.

(i) Which type of electromagnetic wave has a lower frequency than microwaves?

_____

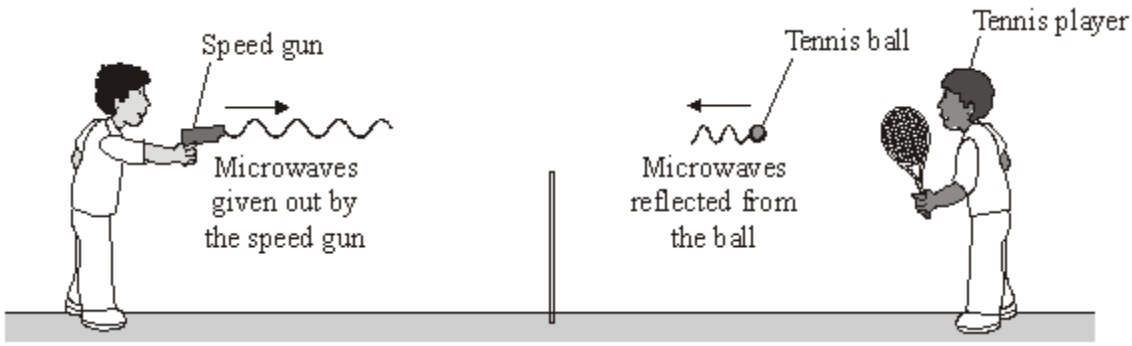
(1)

(ii) What do all types of electromagnetic wave transfer from one place to another?

_____

(1)

(b) The picture shows a tennis coach using a speed gun to measure how fast the player serves the ball.



(i) The microwaves transmitted by the speed gun have a frequency of 24 000 000 000 Hz and travel through the air at 300 000 000 m/s.

Calculate the wavelength of the microwaves emitted from the speed gun.

Show clearly how you work out your answer.

_____

_____

Wavelength = _____ m

(2)

(ii) Some of the microwaves transmitted by the speed gun are absorbed by the ball.

What effect will the absorbed microwaves have on the ball?

_____

_____

(1)

(Total 5 marks)

Total marks 30 minutes

Lesson 12 – Ultrasound and Infrasound

Starter – watch the revision video on you tube - ultrasound gcse physics

https://www.youtube.com/watch?v=l1F6h9skFXU

Make notes as you watch.

Main – Task 1 Ultrasound - Complete the following questions based on the information in the video

1. **What is the definition of ultrasound.**
2. **What is the threshold in Hertz of ultrasound**
3. **Between what, do ultrasound waves reflect?**
4. **How do you calculate the distance between the probe and the kidney?**
5. **Why is ultrasound safer than x-ray?**
6. **Which structures can be imaged?**
7. **How is ultrasound used in industrial settings?**
8. **What is the equation used to determine distance using ultrasound**
9. **What is the speed of ultrasound in water?**
10. **Copy the worked example on how to use the equation.**
11. **Why do you need to dived the distance calculated by 2 to get the correct answer?**
12. **What would the distance to the sea bed be if the time taken is 5 seconds (show your working out)**

Task 2 – Infrasound – watch the you tube video
https://www.youtube.com/watch?v=AqVJ4b5tkwo

1. **Complete a labelled diagram showing the internal structure of the Earth**
2. **Describe how are seismic waves are recorded?**
3. **What is the cause of p and s waves?**
4. **What type of waves are p waves and what materials can they pass through?**
5. **What types of waves are s waves?**
6. **Which wave type is the fastest?**
7. **Why can't s-waves travel through the Earth's internal structures?**
8. **Explain what is meant by the s-wave shadow.**
9. **Explain how P-wave shadow zones are formed.**
10. **Why do scientists think there is a solid inner core?**

Plenary – Complete the past paper question and use the mark scheme to mark your work.

Q1.

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. ☐

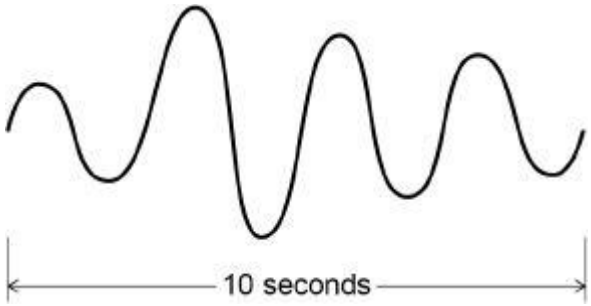
P-waves are longitudinal and S-waves are transverse. ☐

(1)

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

Figure 1 shows the vibration recorded by a seismometer for one P-wave.

Figure 1



(b) Calculate the frequency of the P-wave shown in **Figure 1**.

_____

_____

Frequency = _____ Hz

(1)

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

_____

(1)

(d) The P-wave shown in **Figure 1** is travelling at 7200 m/s.

Calculate the wavelength of the P-wave.

_____

Wavelength = _____ m

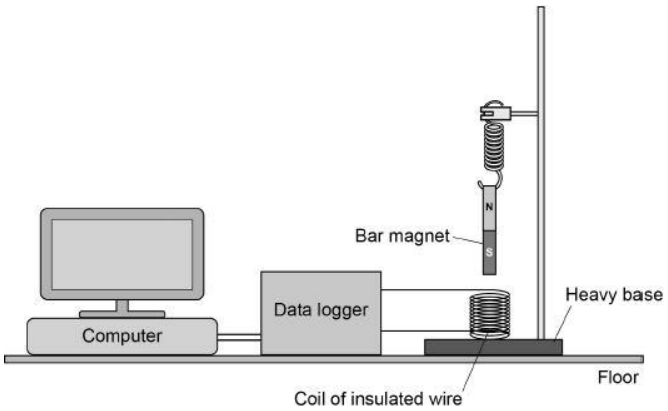
(3)

(e) Explain why the study of seismic waves provides evidence for the structure of the Earth's core.

(2)

Figure 2 shows a simple seismometer made by a student.

Figure 2



To test that the seismometer works, the student pushes the bar magnet into the coil and then releases the bar magnet.

(f) Why does the movement of the bar magnet induce a potential difference across the coil?

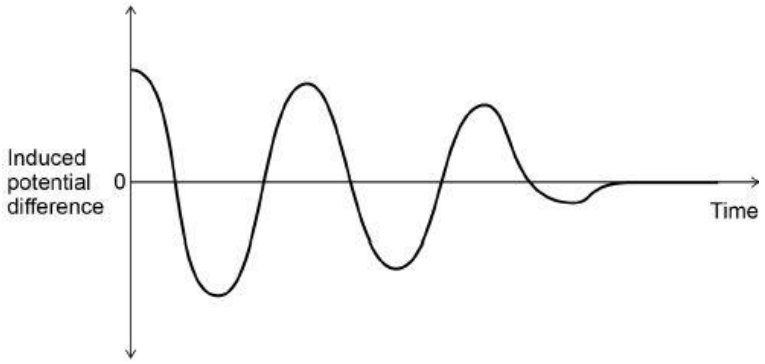
(1)

(g) Why is the induced potential difference across the coil alternating?

(1)

(h) **Figure 3** shows how the potential difference induced across the coil varies after the bar magnet has been released.

Figure 3



Which statement describes the movement of the magnet when the induced potential difference is zero?

Tick **one** box.

Accelerating upwards. ☐

Constant speed upwards. ☐

Decelerating downwards. ☐

Stationary. ☐

(1)

(i) The seismometer cannot detect small vibrations.

Suggest **two** changes to the design of the seismometer that would make it more sensitive to small vibrations.

1. _____

_____

2. _____

_____

(2)

(Total 13 marks)

Mark schemes

Q1.

(a) P-waves are longitudinal and
S-waves are transverse

1

(b) 0.4

1

(c) wave speed = frequency × wavelength

allow $v = f\lambda$

1

(d) 7200 = 0.4 × wavelength

1

$$\text{wavelength} = \frac{7200}{0.4}$$

1

wavelength = 18 000 (m)

*allow up to full marks for ecf using their answer to part **(b)***

a method shown as
7200 × 2.5 = 18 000
*scores **0** marks*

1

*an answer 18 000 scores **3** marks*

(e) because S-waves cannot travel through a liquid

1

and S-waves do not travel through the (outer) core

*allow some (seismic) waves cannot travel through a liquid and do not go through the core for **1** mark*

1

(f) magnetic field around the coil changes
or
the magnetic field (lines) cut by the coil

allow the generator effect

1

(g) because the magnet changes direction

1

(h) stationary

1

(i) any **two** from:

- stronger magnetic field

  allow stronger magnet
  allow heavier magnet
  bigger magnet is insufficient

- more turns on the coil

bigger coil is insufficient
*do **not** accept more coils of wire*

- turns pushed closer together

- spring with a lower spring constant

  allow less stiff spring
  allow weaker spring
  *do **not** accept add an iron core*

2

[13