# BTEC National Extended Diploma in Applied Science

# Summer Independent Learning

# Y12-13

## Part 1 – Compulsory Content (pages 2-32)

There are 3 sections to the compulsory content (Biology, Physics and Chemistry)

For each section.

1. Watch the videos and complete the notes – you may consider adding flashcards / condensed notes, so you can use them to test yourself (metacognition)
2. Complete the follow up application questions

## Part 2 – Highly Recommended (pages 33-43)

There are 3 sections to the highly recommended content (Biology, Physics and Chemistry)

# Part 1 – Compulsory Content

## BIOLOGY

## Organs and Systems

***Use the following links to support you with the questions***

*The Heart: https://www.savemyexams.com/gcse/biology/aqa/18/revision-notes/2-organisation/2-2-organisation-the-cardiovascular--respiratory-system/2-2-2-the-heart/*

*The Cardiac Cycle: https://www.youtube.com/watch?v=3ZYh00GJZSI*

### Cardiovascular System

***Q1. Describe the structure and function of the different types of blood vessels***

**MEMORISE FOR RETRIEVAL TEST**

| Vessel | Structure | Function |
|---|---|---|
| Arteries | | |
| Capillaries | | |
| Veins | | |

***Q2. Complete the table below on the ABO blood type system***

| | Group A | Group B | Group AB | Group O |
|---|---|---|---|---|
| Red Blood Cell Type | | | | |
| Antibodies in Plasma | | | | |
| Antigens on red blood cell | | | | |

***Q3. What is the Rhesus system?***

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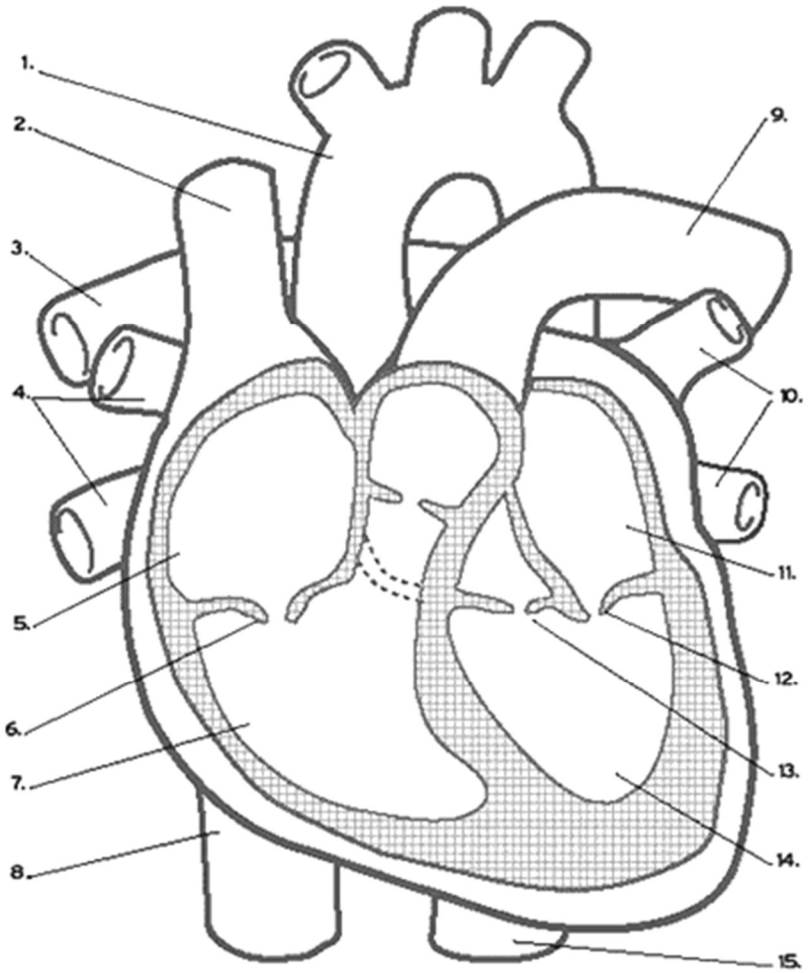
***Q4. Label the diagram of the heart below. Shade in RED the areas where there is flow of oxygenated blood. Shade in BLUE the areas where there is flow of deoxygenated blood.***

**MEMORISE FOR RETRIEVAL TEST**



## Apply

Explain how the structure of an artery is related to its functions.

(3)

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**Describe two differences between the structure of a capillary and the structure of a vein**

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# Lungs and Ventilation

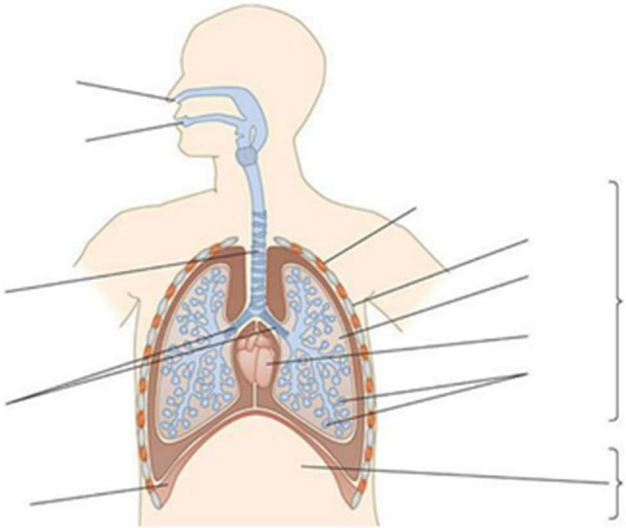
***Use the following links to support you with the questions***

*The Lungs: https://www.savemyexams.com/gcse/biology/aqa/18/revision-notes/2-organisation/2-2-organisation-the-cardiovascular--respiratory-system/2-2-1-the-lungs/*

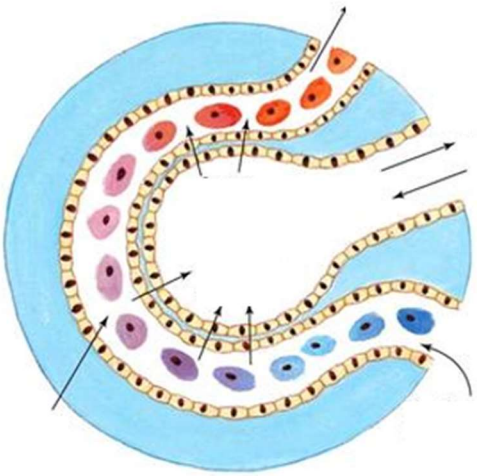
*Ventilation and Gas Exchange: https://www.youtube.com/watch?v=Y8R_fgJS9jA*

***Q1. Label the diagram below of the lungs and ventilation system***

**MEMORISE FOR RETRIEVAL TEST**



***Q2. Label the diagram of the alveolus and indicate the direction of the flow of gases.***



Labels

| | | |
|---|---|---|
| Capillary | Oxygenated blood | Deoxygenated blood |
| Alveolus (air sac) | Oxygen | Carbon dioxide |
| Oxygen in | Carbon dioxide out | Short diffusion distance |
| From pulmonary artery | To pulmonary vein | One cell thick |

***Q3. What are the three main features of the gas exchange system?***

_____

_____

_____

_____

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_____

***Q4. Complete the flowchart showing inspiration and expiration***

**MEMORISE FOR RETRIEVAL TEST**

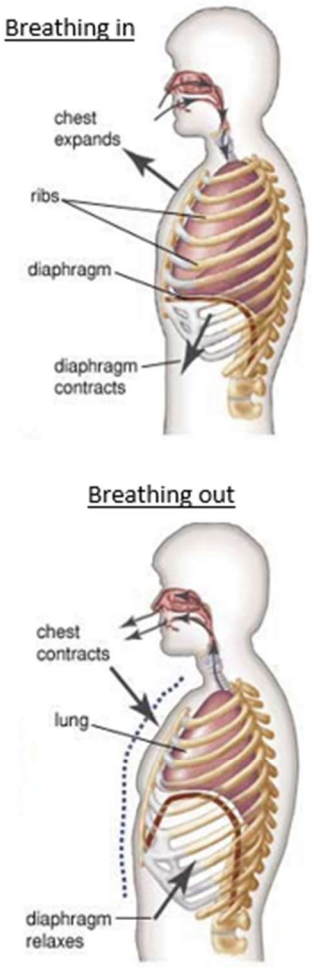
Breathing in (inhalation)

_____ contracts and moves downwards

_____ move upwards and outwards

Air pressure in the lungs _____

Air automatically rushes into the _____




Breathing out (exhalation)

_____ relaxes and moves upwards

_____ move downwards and in

Air pressure in the lungs _____

Air automatically rushes out of the _____

| lungs | lungs |
|---|---|
| decreases | increases |
| ribs | ribs |
| diaphragm | diaphragm |

## Apply

Describe and explain how the lungs of a mammal are adapted for rapid gas exchange.

**(5)**

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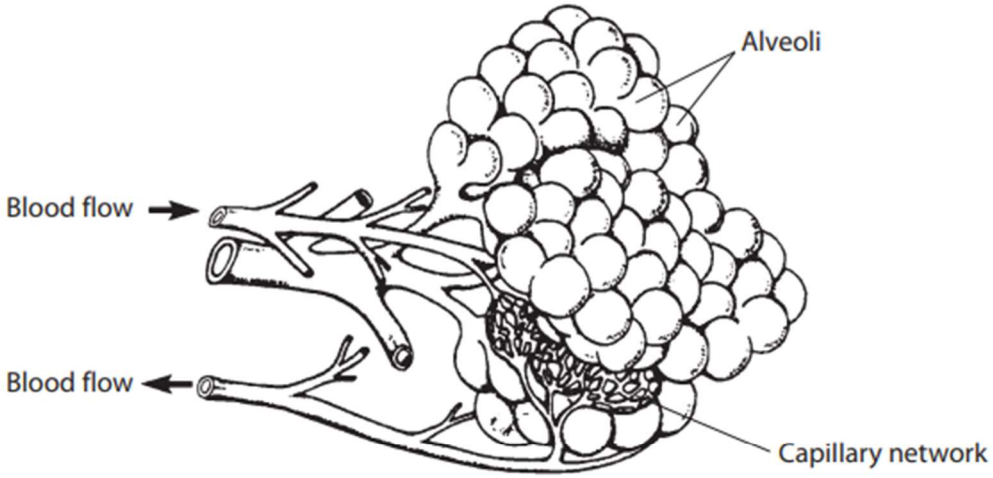
The lungs in a mammal are adapted for efficient gas exchange.

(a) The diagram below illustrates a small part of the lung responsible for gas exchange.




(i) On the diagram, add a line labelled P to a branch of the pulmonary vein.

**(1)**

(ii) Give **one** difference between the structure of a capillary and the structure of a vein.

**(1)**

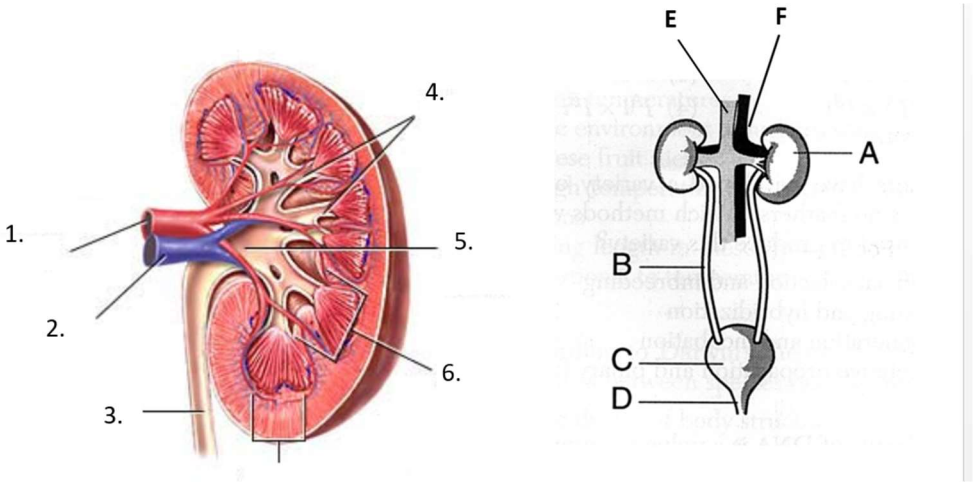
# Urinary System

***Use the following links to support you with the questions***

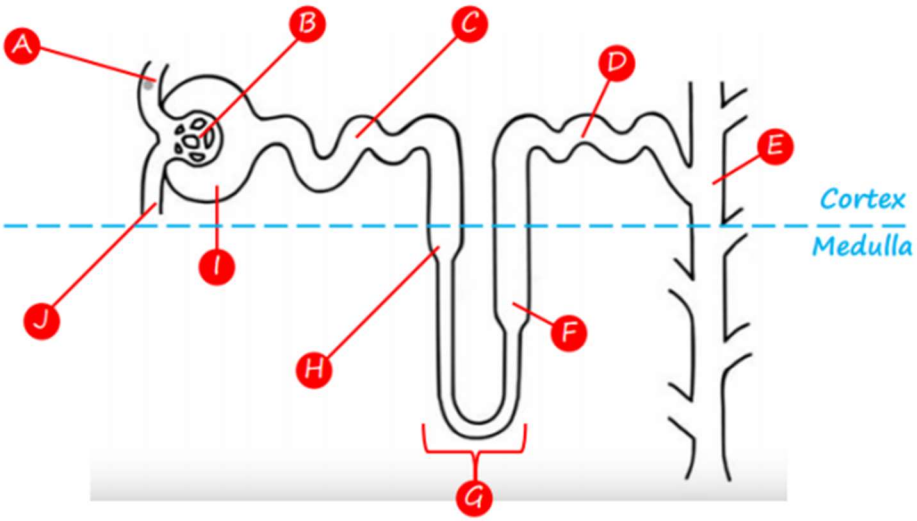
*The Kidney: https://www.savemyexams.com/igcse/biology/cie/23/revision-notes/13-excretion-in-humans/13-1-excretion-in-humans/13-1-2-the-kidney/*

*The Nephron: https://www.youtube.com/watch?v=tx9hYFeEd1E*

***Q1. Label the structures and diagrams below***




***Q2. Label the diagram of the nephron***



## Apply

(a) Explain what is meant by the term *homeostasis*.

[2]

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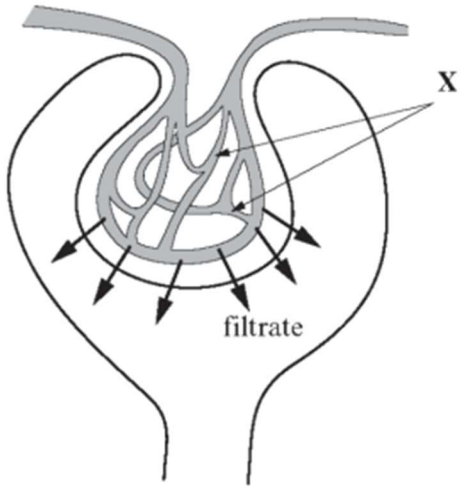
The diagram shows part of a kidney tubule or nephron.




*(a)* (i) Name the network of capillaries labelled **X**. [1]

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(ii) Apart from water and glucose, name **two** substances which will be present in the filtrate. [1]

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(iii) Name the process that separates these molecules from the blood plasma. [1]

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# Cell Transport

***Use the following links to support you with the questions***

*Cell Membrane Transport: https://www.youtube.com/watch?v=J5pWH1r3pqU*

*The Cell Membrane: https://www.savemyexams.com/a-level/biology/cie/22/revision-notes/4-cell-membranes--transport/4-1-fluid-mosaic-membranes/4-1-3-the-cell-surface-membrane/*

## Surface Area to Volume Ratio

***Q1. Complete the table below***

| Length of each side of cube (L) cm | Area of each face of cube ($L^2$) $cm^2$ | Surface area of the whole cube ($L^2$) × 6 $cm^2$ | Volume of the cube ($L^3$) $cm^3$ | Surface area to volume ratio $\frac{\text{surface area cm}^2}{\text{volume cm}^3}$ |
|---|---|---|---|---|
| *2* | | | | |
| *4* | | | | |

***Q2. Now work out what the surface area to volume ratio of a 10 cm ´ 10 cm cube is.***

| Length of each side of cube (L) cm | Area of each face of cube ($L^2$) $cm^2$ | Surface area of the whole cube ($L^2$) × 6 $cm^2$ | Volume of the cube ($L^3$) $cm^3$ | Surface area to volume ratio $\frac{\text{surface area cm}^2}{\text{volume cm}^3}$ |
|---|---|---|---|---|
| *10* | | | | |

***Q3. Complete the following sentences.***

The ……. the animal, the ……. the surface area : volume (SA/V) ratio.

Animals often have ……. surface areas in hot climates, and ……. surface areas in cold climates.

***Q4. Draw a diagram of the cell surface membrane, including phospholipid bilayer and channel proteins***

***Q5. Describe the different types of Passive Transport***

| | |
|---|---|
| Diffusion | |
| Facilitated Diffusion | |
| Osmosis | |

***Q6. Describe the process of Active Transport with the aid of a diagram***

_____

_____

_____

_____

_____

_____

***Q7. Describe the process of endocytosis and exocytosis***

## Apply

Q5. The fluid mosaic model has been developed from the knowledge of the structure and properties of cell membranes. It can explain how molecules can enter and leave a cell.

(a) Describe the structure of a cell membrane. (You may use a labelled diagram to support your answer).

**(5)**

(b) Suggest **two** properties of molecules that enable them to enter a cell by diffusion.

**(2)**

1 .....

2 .....

(c) Facilitated diffusion and active transport are two ways in which molecules are transported across cell membranes.

Describe **one** similarity and **one** difference between facilitated diffusion and active transport.

(i) Similarity

**(1)**

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(ii) Difference

**(1)**

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# PHYSICS –

## NOTES (recall)

Watch the following videos and complete the notes on energy:

You don't need to include any derivations of formulae.

**Conservation of energy (link)**

State the law of conservation of energy

_____

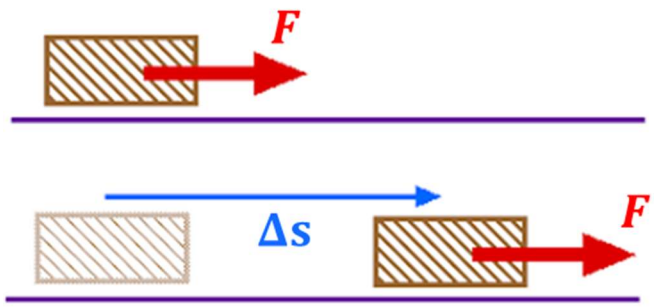
_____

_____

**Mechanical work & energy (link)**

1. State the unit of energy _____

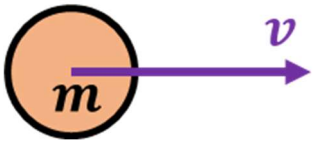
2. An object is pushed with a force, $F$, in the same direction as its displacement, $\Delta s$.
   State the equation for the work done:



**Kinetic energy (link)**

1. What do we associate **kinetic** energy with? _____

2. An object of mass, $m$, is moving at a velocity, $v$.
   State the equation for the kinetic energy of the object:

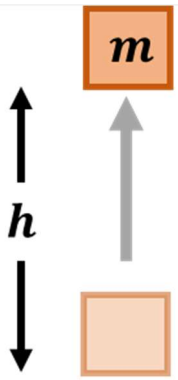



**Gravitational potential energy (link)**

1. How could you alter the gravitational potential energy of an object?

_____

2. An object of mass, $m$, is lifted a distance, $h$, in a uniform gravitational field, $g$.
   State the equation for the gravitational potential energy of the object:

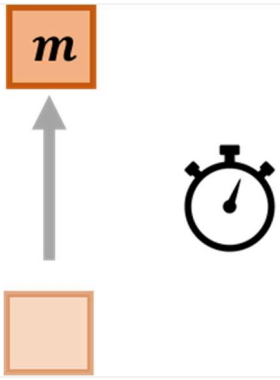



**Power (link)**

1. How could you be more powerful climbing a flight of stairs?

_____

2. Work, $W$, is done on an object moving shifting, $E$, between energy stores in a time, $t$.
   State the equation for the power transferred to the object:

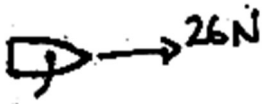



**Efficiency (link)**

1. State the equation for the efficiency of an object.

## APPLY - QUESTIONS (to be completed on separate paper)

**1.** A toy boat moves $4.00\ \text{m}$ in the direction of the applied force of $26\ \text{N}$ on the sails. Calculate the work done on the boat.




**2.** Calculate the gravitational potential energy stored raising a $60\ \text{kg}$ child to the top of a $2.0\ \text{m}$ slide.


**3.** A spring with a constant of $25\ \text{N/m}$ is extended by $50\ \text{cm}$. Calculate the stored elastic potential energy in the spring.

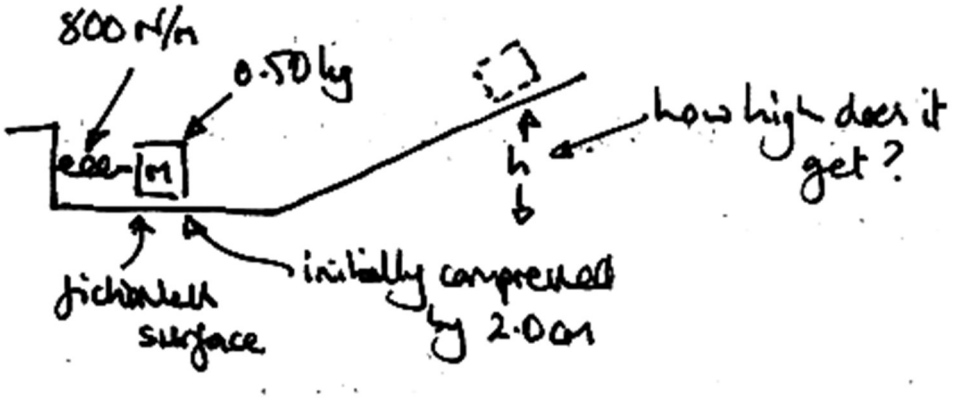
**4.** Calculate the kinetic energy of a $80\ \text{kg}$ student sprinting at $8.0\ \text{m/s}$.

**5.** A $4.0\ \text{kg}$ ball has $50\ \text{J}$ of kinetic energy. How fast is it moving?

**6.** The child in question 2 'loses' $10\ \%$ of their gravitational potential energy store to frictional forces going down the slide. Calculate the speed of the child at the bottom of the slide.

**7.** A $10\ \text{g}$ spring with a spring constant of $20\ \text{N/m}$ is extended by $10\ \text{cm}$ then released horizontally on a frictionless surface. Calculate the speed of the spring after release.

**8.** **(Challenge)** A $0.50\ \text{kg}$ mass is launched from a frictionless surface by a spring with a spring constant of $800\ \text{N/m}$ which is initially compressed by $2.0\ \text{cm}$. How high does the mass get up a slope as shown? Provide the vertical displacement.




**9.** A kettle transfers 1,500 J of energy, 1,200 J to a thermal energy store in the water and 300 J to the air as sound. How efficient is the kettle? **[2 marks]** [grade 3]

**10.** Playing on an Xbox 360 uses 102 J of electrical energy each second. 9 J of this energy is transferred to a thermal energy store. How efficient is the Xbox? **[3]** [grade 4]

**11.** A pendulum with a store of 100 J of gravitational potential energy transfers 99.5 J to a kinetic energy store on its first swing.

a. How much energy is being wasted due to friction by transfer to a thermal energy store? **[1]**

b. How efficient is the pendulum? **[2]** [grade 4]

**PTO**

## NOTES (preview)

Watch the following videos and complete the notes on materials:

You don't need to include any derivations of formulae.

**Hooke's law (link)**

1. Define tension

_____

2. What happens to objects under tension?

_____

3. Define compression

_____

4. What happens to objects under compression?

_____

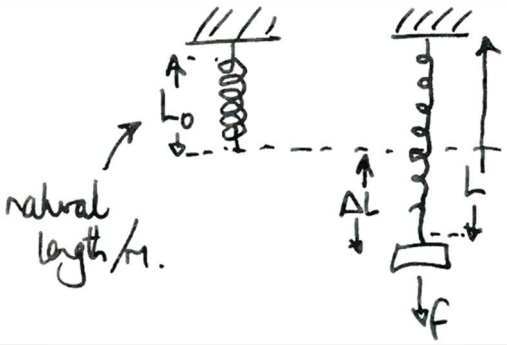
5. What is the additional length, $\Delta L$, ($x$ in the video) called when a spring is stretched past its original (natural length?)

_____

6. What does the spring constant aka the stiffness, $k$, tell us?

_____

7. State the equation for Hooke's law:



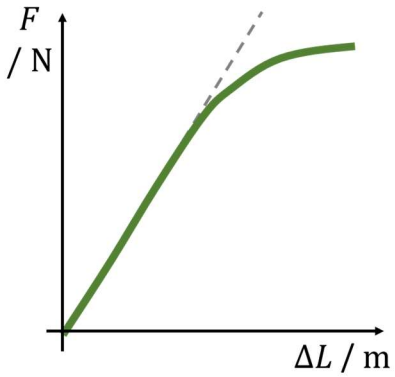

8. What does the gradient of the linear part of the curve represent?

_____

_____

9. Name the point at which the graph is no longer linear.

_____



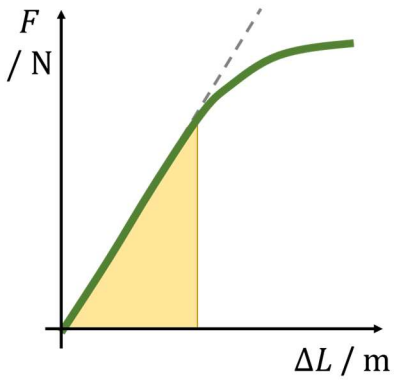
**Hooke's law energy (link)**

1. What does the area under the linear part of the curve represent?

_____

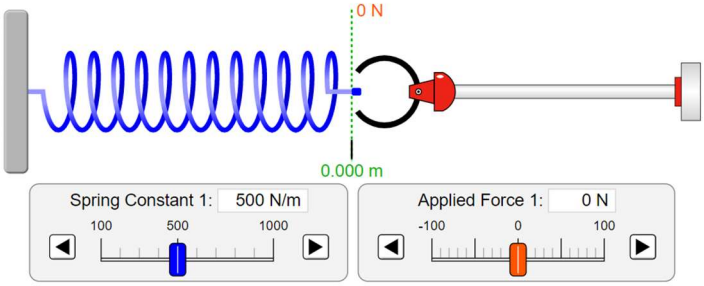
_____

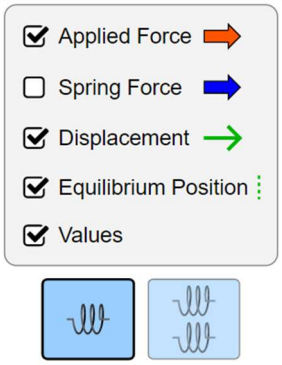
2. State the equation(s) that there area represents.




**Hooke's law simulation (link)**

Set up the simulation as shown in the images provided




**SIMULATION**

1. With the spring constant set at 500 N/m apply a tension force of 50 N. Record your extension.

_____

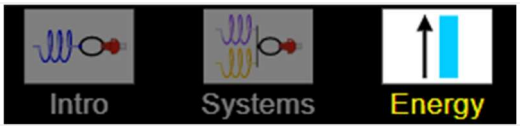
2. Use Hooke's law to predict the extension when 100 N are applied.

_____

3. Apply a force of 100 N in the simulation. Record the extension.

_____

Stretch. Try adjusting the parameters of the simulation including viewing the elastic potential energy stored on the 3rd tab. Describe your findings:




_____

_____

_____

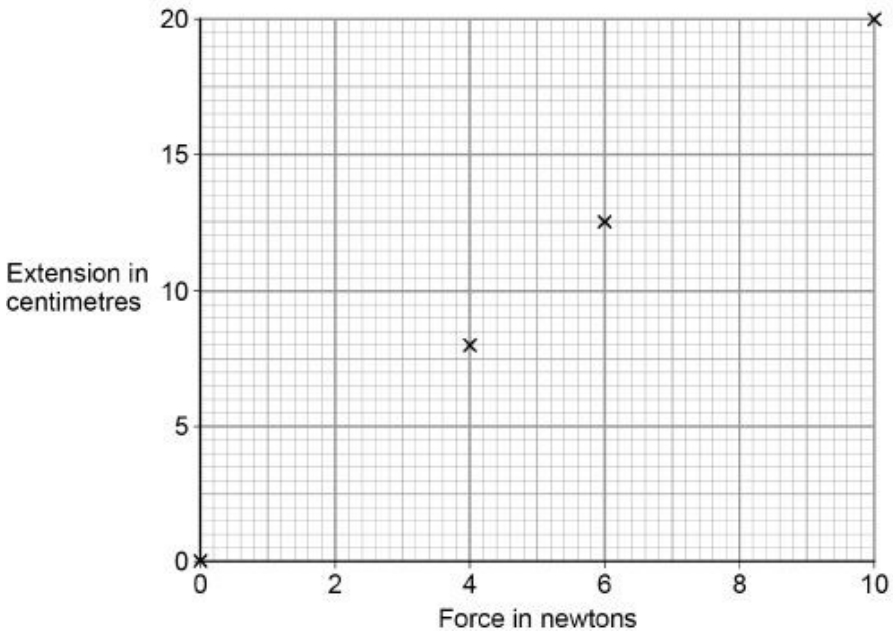
## APPLY - QUESTIONS (to be completed on separate paper)

**Q1.** A student carried out an investigation to determine the spring constant of a spring.

The table below gives the data obtained by the student.

| Force in N | Extension in cm |
|---|---|
| 0 | 0.0 |
| 2 | 3.5 |
| 4 | 8.0 |
| 6 | 12.5 |
| 8 | 16.0 |
| 10 | 20.0 |

The diagram below shows some of the data obtained by the student.




(c) Complete the diagram above by plotting the missing data from the table above.

Draw the line of best fit.

The table above is repeated here to help you answer this question.

**(2)**

(d) Write down the equation that links extension, force and spring constant.

_____

**(1)**

(e) Calculate the spring constant of the spring that the student used.

Give your answer in newtons per metre.

_____

_____

_____

_____

Spring constant = _____ N/m

**(4)**

(f) Hooke's Law states that:
'The extension of an elastic object is directly proportional to the force applied, provided the limit of proportionality is not exceeded.'

The student concluded that over the range of force used, the spring obeyed Hooke's Law.

Explain how the data supports the student's conclusion.

_____

_____

_____

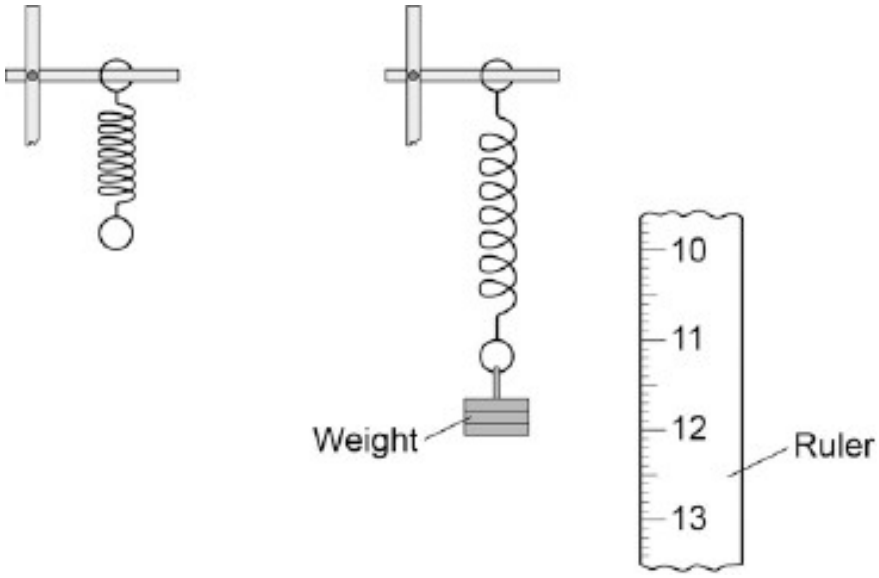
_____

**(2)**
**(Total 9 marks)**

**Q2.** A student suspended a spring from a laboratory stand and then hung a weight from the spring.

**Figure 1** shows the spring before and after the weight is added.

**Figure 1**




(a) Measure the extension of the spring shown in **Figure 1**.

Extension = _____ mm

**(1)**

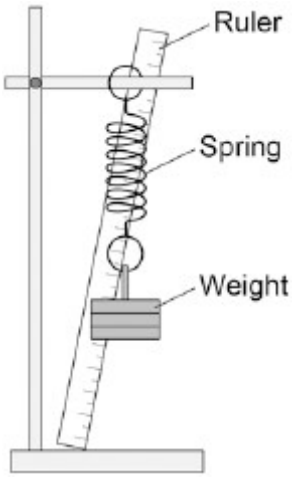
(b) The student used the spring, a set of weights and a ruler to investigate how the extension of the spring depended on the weight hanging from the spring.

Before starting the investigation the student wrote the following prediction:

The extension of the spring will be directly proportional to the weight hanging from the spring.

**Figure 2** shows how the student arranged the apparatus.

**Figure 2**




Before taking any measurements, the student adjusted the ruler to make it vertical.

Explain why adjusting the ruler was important.

_____

_____

_____

_____

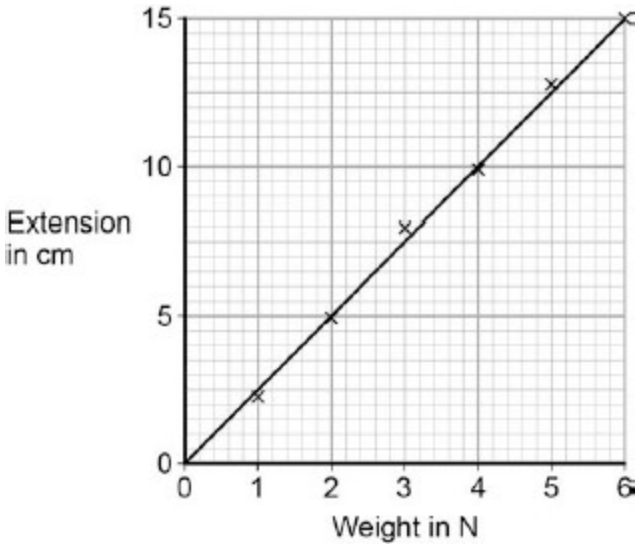
**(2)**

**PTO**

(c) The student measured the extension of the spring using a range of weights.

The student's data is shown plotted as a graph in **Figure 3**.

**Figure 3**




What range of weight did the student use?

_____

**(1)**

(d) Why does the data plotted in **Figure 3** support the student's prediction?

_____

_____

**(1)**

(e) Describe **one** technique that you could have used to improve the accuracy of the measurements taken by the student.

_____

_____

_____

_____

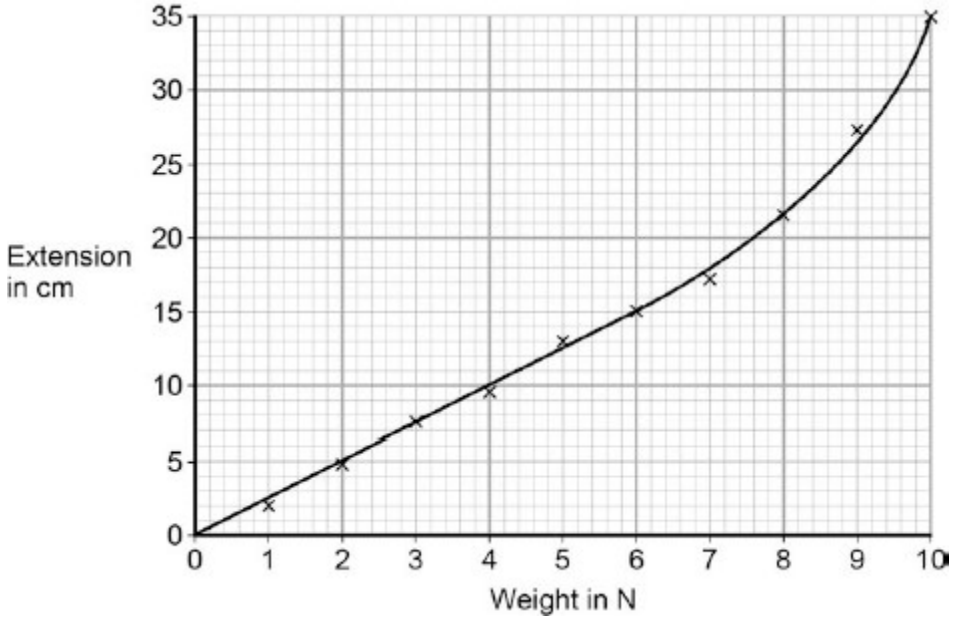
**(2)**

**PTO**

(f) The student continued the investigation by increasing the range of weights added to the spring.

All of the data is shown plotted as a graph in **Figure 4**.

**Figure 4**




At the end of the investigation, all of the weights were removed from the spring.

What can you conclude from **Figure 4** about the deformation of the spring?

_____

_____

Give the reason for your conclusion.

_____

_____

**(2)**

**(Total 9 marks)**

# CHEMISTRY

## Electrolysis

**Give the definition of the following terms: (https://www.bbc.co.uk/bitesize/guides/zcsyw6f/revision/1)**

i. **Electrolysis**

_____

_____

ii. **Electrolyte**

_____

_____

iii. **Electrode**

_____

_____

iv. **Reduction**

_____

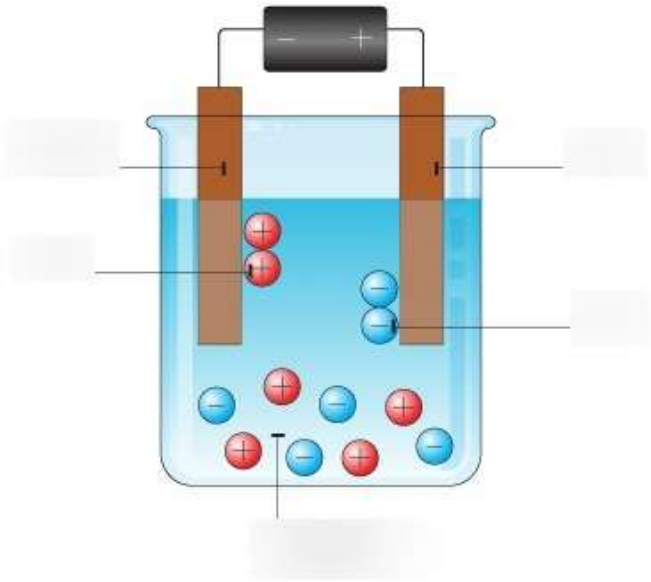
_____

v. **Oxidation**

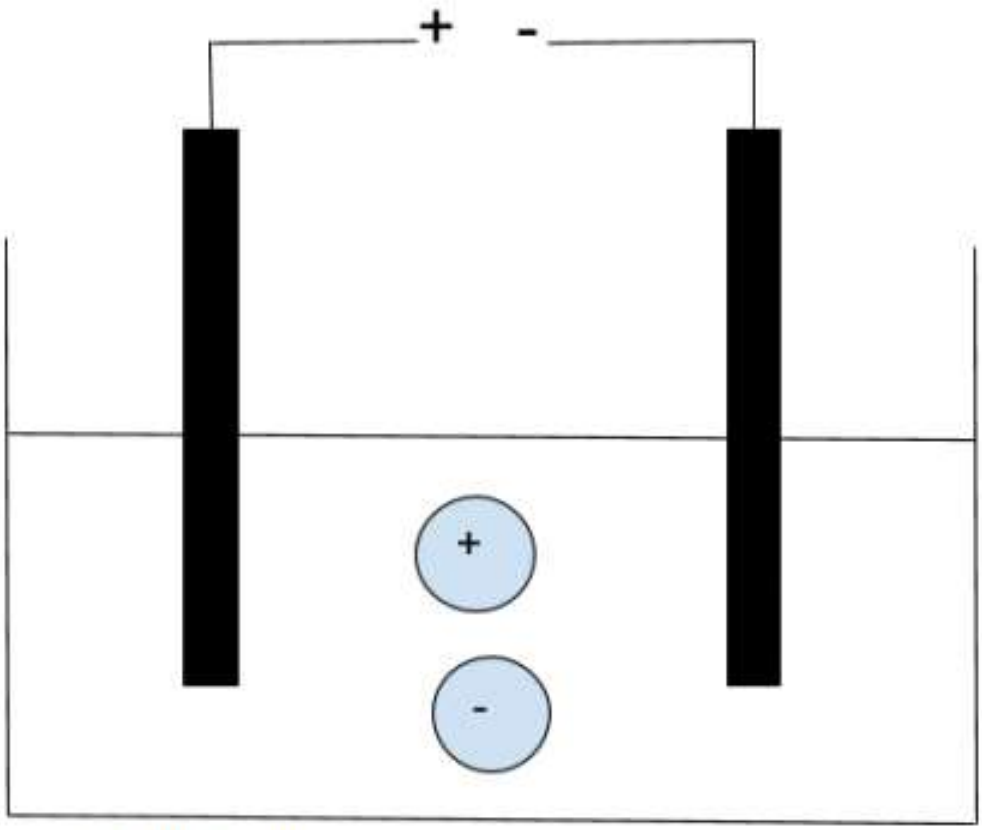
_____

_____

**Label the diagram (https://www.sciencephoto.com/media/1156157/view/electrolysis-illustration)**



1. Complete the diagram with the following labels: anode, cathode, electrode, electrolyte, anion and cation




2. Describe an ionic bond.

.....

.....

3. Why can't a solid ionic substance conduct electricity?

.....

.....

4. Why can molten and solutions of ionic substances conduct electricity?

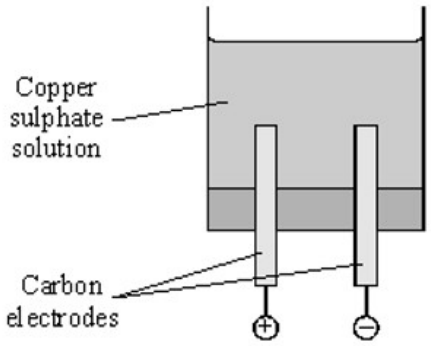
.....

.....

Complete the table

| Substance electrolysed | What is formed at the cathode | What is formed at the anode |
|---|---|---|
| molten lead iodide | | |
| | Sodium | chlorine |
| Copper sulfate solution | | |
| calcium bromide solution | | |
| molten aluminium oxide | | |

**Q1.** An investigation into the *electrolyte* copper sulphate solution was carried out as shown.




(a) What does *electrolyte* mean?

.....

.....

.....

**(2)**

(b) These were the observations.

| | |
|---|---|
| Negative electrode | solid formed |
| Positive electrode | gas given off |

(i) Name the solid formed.

.....

**(1)**

(ii) Name the gas given off.

.....

**(1)**

(c) How could a sample of gas be collected at the positive electrode?

.....

.....

**(2)**

(d) Suggest why the blue colour of copper sulphate becomes paler during the investigation.

.....

.....

**(2)**

**(Total 8 marks)**

## Ionic half equations

A half-equation shows you what happens at one of the electrodes during electrolysis.

Electrons are shown as $e^-$.

A half-equation is balanced by adding, or taking away, a number of electrons equal to the total number of charges on the ions in the equation.

When positive metal ions (cations) arrive at the negative electrode (the cathode), they gain electrons to form neutral metal atoms. This is called reduction. For example:

$$Pb^{2+} + 2e^- \rightarrow Pb$$

## Q1.

A student makes a hypothesis:

'When different salt solutions are electrolysed with inert electrodes, the product at the negative electrode is always a metal'.

(a) Describe how you would test this hypothesis in the laboratory.

You should:

- draw a labelled diagram of the apparatus
- give the independent variable
- describe what you would see at the negative electrode if the hypothesis is true.

Diagram

Independent variable _____

_____

Observation _____

_____

**(5)**

(b) The student's hypothesis is only partially correct.

Explain why the product at the negative electrode is not always a metal.

_____

_____

_____

_____

**(2)**

(c) Predict the product at the positive electrode in the electrolysis of:

- sodium chloride solution
- copper sulfate solution.

Sodium chloride solution _____

Copper sulfate solution _____

**(2)**

# Organic chemistry

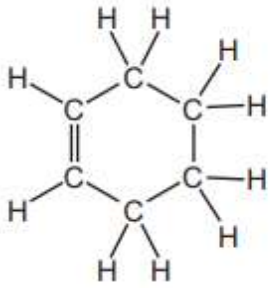
**Use the links to help you with this section:**

1. https://www.bbc.co.uk/bitesize/guides/zshvw6f/revision/2
2. https://www.bbc.co.uk/bitesize/guides/z3v4xfr/revision/1
3. https://www.bbc.co.uk/bitesize/guides/z3v4xfr/revision/3

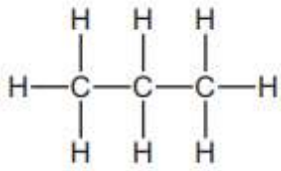
| Name | Molecular Formula | Structure |
|---|---|---|
| Methane | | |
| Ethane | | |
| Propene | | |
| Butane | | |
| Pentene | | |
| Hexane | | |

**4** The structures of some organic compounds are shown.

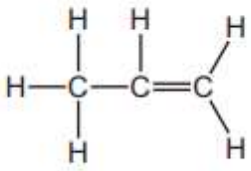
**P**



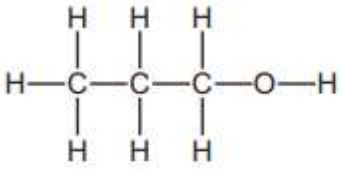
**Q**



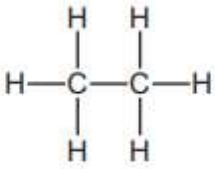
**R**



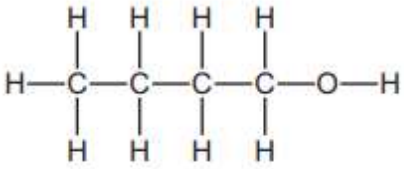
**S**



**T**



**U**



**(a)** **(i)** Which **two** of these compounds are alcohols?

Explain your answer.

.....

..... [2]

**(b)** Methanol and ethanol are alcohols in the same homologous series.

Complete the following sentence about a homologous series using words from the list.

| | | | |
|---|---|---|---|
| **alcohols** | **chemical** | **compounds** | **elements** |
| **functional** | **mixtures** | **physical** | |

A homologous series is a family of similar ..... with similar

..... properties due to the same ..... group. [3]

# Nomenclature

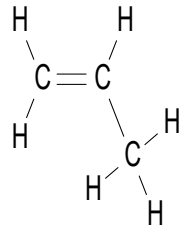
**Use the following resources to help you with this section:**

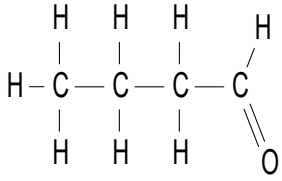
https://chemrevise.org/wp-content/uploads/2021/02/3.1-revision-guide-introduction-organic-aqa.pdf (page 3)

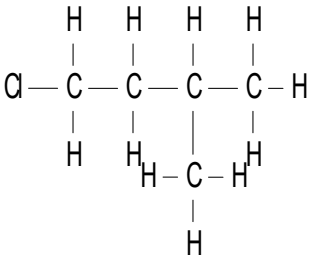
For each of the molecules below:

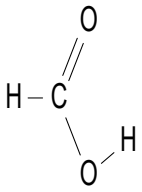
a) state the name of the molecule

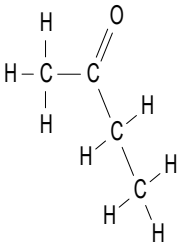
b) state the functional group(s) present

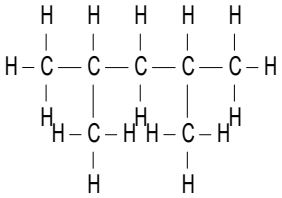


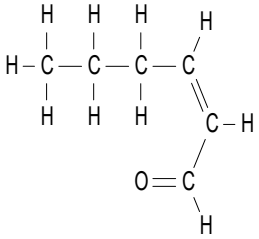


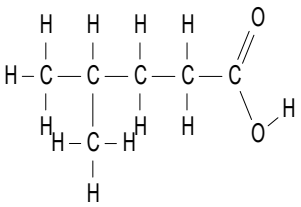












# Part 2 – Highly Recommended

## BIOLOGY

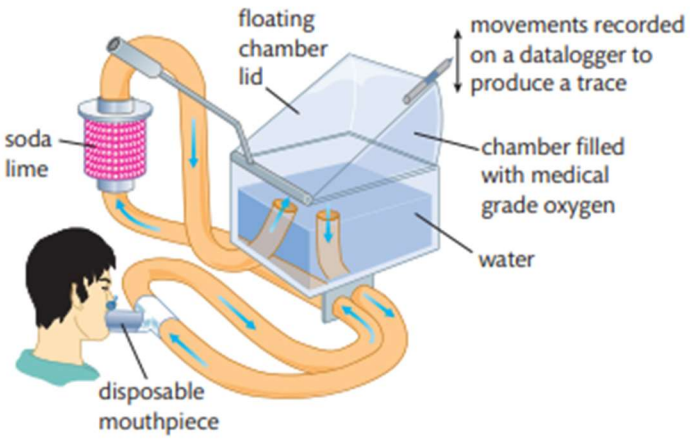
***Use the following links to support you with the questions***

*Spirometry: https://www.youtube.com/watch?v=GDRfYJjICxI*

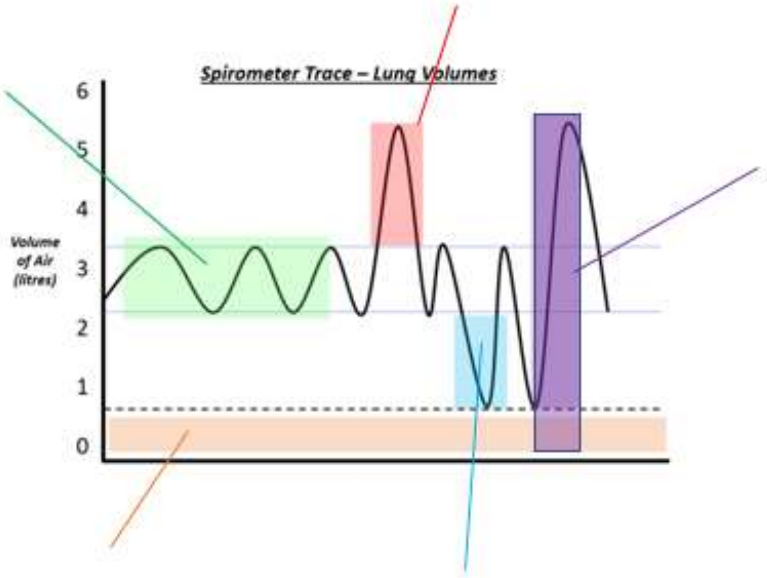
*The Kidney: https://www.savemyexams.com/igcse/biology/cie/23/revision-notes/13-excretion-in-humans/13-1-excretion-in-humans/13-1-2-the-kidney/*

*The Heart: https://www.savemyexams.com/gcse/biology/aqa/18/revision-notes/2-organisation/2-2-organisation-the-cardiovascular--respiratory-system/2-2-2-the-heart/*

***Q1. Describe the function of a Spirometer***




***Q2. Label the Spirometer Trace.***



***Q3. Complete the table below with the correct definitions***

| | |
|---|---|
| **Tidal Volume** | |
| **Inspiratory Reserve Volume** | |
| **Expiratory Reserve Volume** | |
| **Total Lung Capacity** | |
| **Residual Volume** | |

***Q3. Complete the paragraph below***

The kidney is a vital organ in the body and is responsible for excretion. It also plays an important role in homeostasis.

(a) Complete the passage, using the most suitable term in each case. The blood in the glomerulus has a high ..... pressure, which forces small molecules, such as glucose and ..... , out of the glomerulus and into the lumen of the Bowman's capsule. This process is known as ..... . In the proximal convoluted tubule, the glucose, most of the ..... and some of the salts are reabsorbed into blood ..... that surround the nephron at this point. [5]

(b) One aspect of the kidney's homeostatic role is the ability of anti-diuretic hormone (ADH) to increase the number of aquaporins in the plasma membranes of the cells lining the collecting duct. This increases the amount of water reabsorbed. ADH is released in response to a decrease in the water potential of the blood plasma.

(i) State precisely where the cells that detect a decrease in the water potential of the blood plasma are found.

_____

(ii) Name the cells that detect this decrease.

_____

***Q4. Calculate the cardiac output for an individual who has a heart rate of 70bpm and stroke volume of 132 ml***

_____

***Q5. Draw a flowchart below of the cardiac cycle***

## Apply

Q1. The atrio-ventricular node (AVN), bundle of His and Purkinje fibres are specialised cardiac muscle tissues which are involved in the control of heartbeat.

(a) State the function of the following structures in the functioning of the heart.

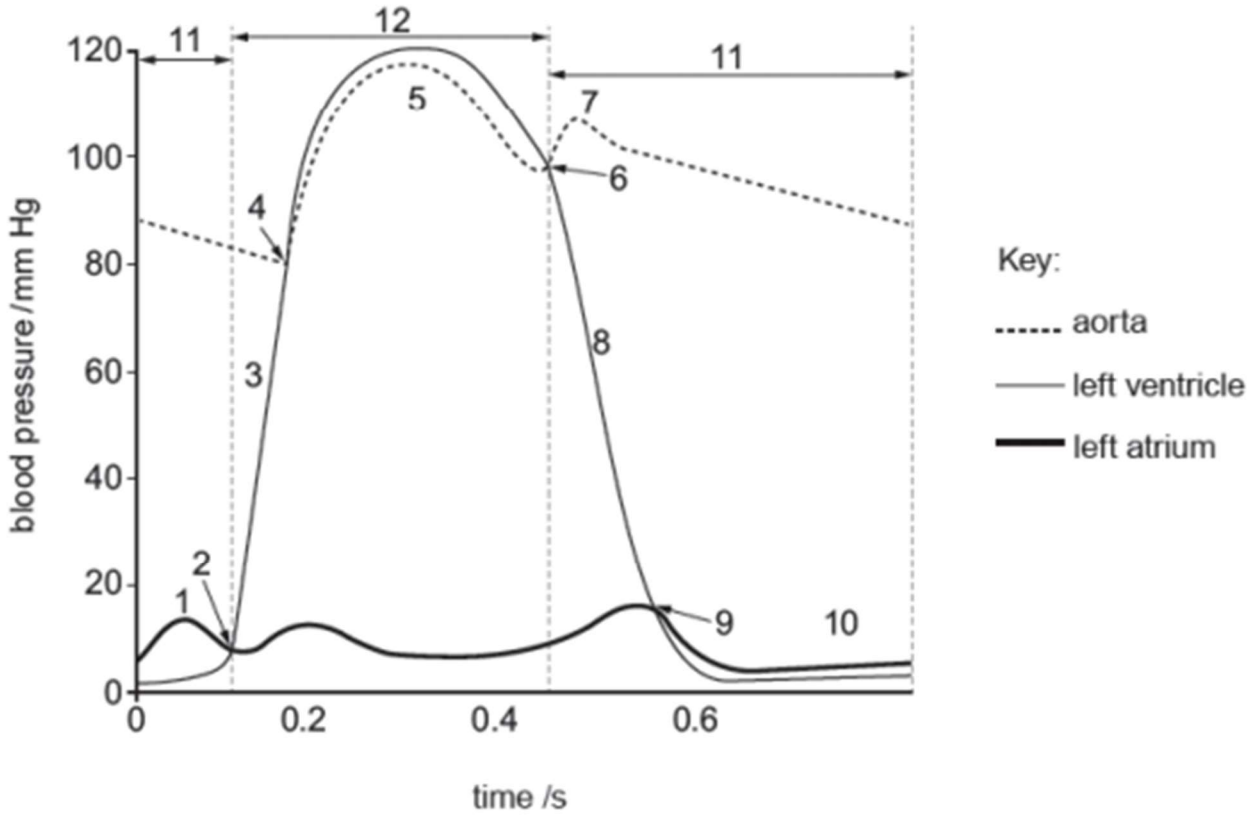
(i) atrio-ventricular node (AVN)

_____
_____
_____
_____
_____
_____

(ii) bundle of His and Purkinje fibres

_____
_____
_____
_____
_____
_____

The graph below shows the pressure changes in the left ventricle, left atrium and aorta during one cardiac cycle.




(b) The following statements list events or phases that occur during a cardiac cycle. State the numbers indicated on the graph above that correspond to each of the following statements. **PTO**

(i) ventricular diastole (ventricles are relaxing

(ii) recoil of aorta

(iii) atrial systole

(iv) closing of semi-lunar valves

(v) opening of semi-lunar valves

(vi) atrio-ventricular valves close

(vii) ventricular systole (ventricles are contracting)

(viii) passive filling of atrium by venous return

Q2. Each kidney contains approximately one million nephrons. Each section of a kidney nephron is adapted to perform its function effectively. Describe the features of the glomerulus and Bowman's capsule that allow them to perform their function effectively

Q3. (a) Describe how muscles in the thorax (chest) cause air to enter the lungs during breathing.

(b) An athlete exercised at different rates on an exercise bicycle.

The table shows the effects of exercise rate on his breathing rate and tidal volume

| Exercise rate / arbitrary units | Breathing rate / breaths minute$^{-1}$ | Tidal volume / dm$^3$ |
|---|---|---|
| 0 | 14.0 | 0.74 |
| 30 | 15.1 | 1.43 |
| 60 | 15.3 | 1.86 |
| 90 | 14.5 | 2.34 |
| 120 | 15.1 | 2.76 |
| 150 | 14.8 | 3.25 |
| 180 | 21.5 | 3.21 |
| 210 | 25.7 | 3.23 |

(i) The athlete cycled at the particular exercise rate for 5 minutes before the relevant readings were taken. Explain why the readings were taken only after the athlete had been cycling for 5 minutes.

_____

_____

_____

_____

_____

_____

_____

(ii) Calculate the total volume of air taken into the lungs in one minute at an exercise rate of 120 arbitrary units.

(iii) Give two conclusions that can be drawn from the figures in the table.

_____

_____

_____

_____

_____

_____

_____

# CHEMISTRY

# Reactions of organic compounds: Free radical substitution and Electrophilic addition

https://chemrevise.org/wp-content/uploads/2023/10/3.2-revision-guide-alkanes-aqa.pdf
**(page 4-5)**

## Q1.

There are many uses of halogenated organic compounds despite environmental concerns.

(a) Bromotrifluoromethane is used in fire extinguishers in aircraft.
Bromotrifluoromethane is formed when trifluoromethane reacts with bromine.

$$CHF_3 + Br_2 \longrightarrow CBrF_3 + HBr$$

The reaction is a free-radical substitution reaction similar to the reaction of methane with chlorine.

(i) Write an equation for each of the following steps in the mechanism for the reaction of $CHF_3$ with $Br_2$

Initiation step

_____

First propagation step

_____

Second propagation step

_____

A termination step

_____

**(4)**

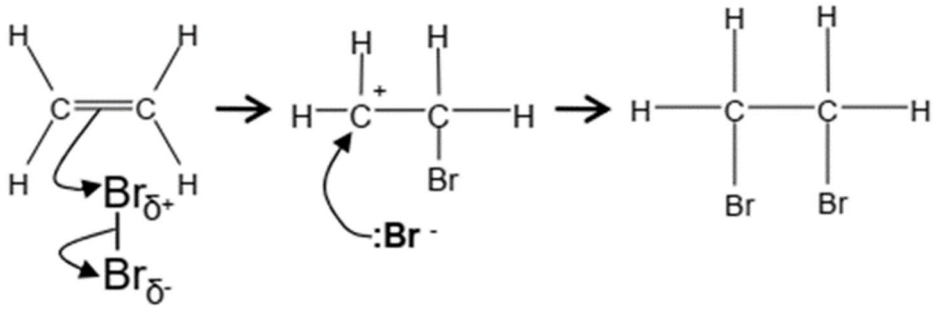
(ii) State **one** condition necessary for the initiation of this reaction.

_____

**(1)**

# Example of the electrophilic addition mechanism

## Electrophilic addition of ethene to form 1,2-dibromoethane




**Answer the following questions using the link:**

**https://chemrevise.files.wordpress.com/2023/02/3.4-revision-guide-alkenes-aqa.pdf (page 2-3)**

1. **Explain why alkenes tend to react with electrophiles.**

_____

_____

_____

2. **Draw out the mechanisms using curly arrows for the following reactions:**

i. **ethene with bromine ($Br_2$)**

ii. **but-2-ene with hydrogen bromide (HBr)**

iii) **ethene with concentrated sulphuric acid ($H_2SO_4$)**

# PHYSICS –

## NOTES (preview)

Watch the following videos and complete the notes on materials:

You don't need to include any derivations of formulae.

**Stress and strain (link)**

1. State an equation for the stress, $\sigma$, and describe what it represents.

_____

2. State the unit of stress. _____

3. State an equation for the strain, $\varepsilon$, and describe what it represents.

_____

4. State the unit of strain. _____

5. Young's modulus is

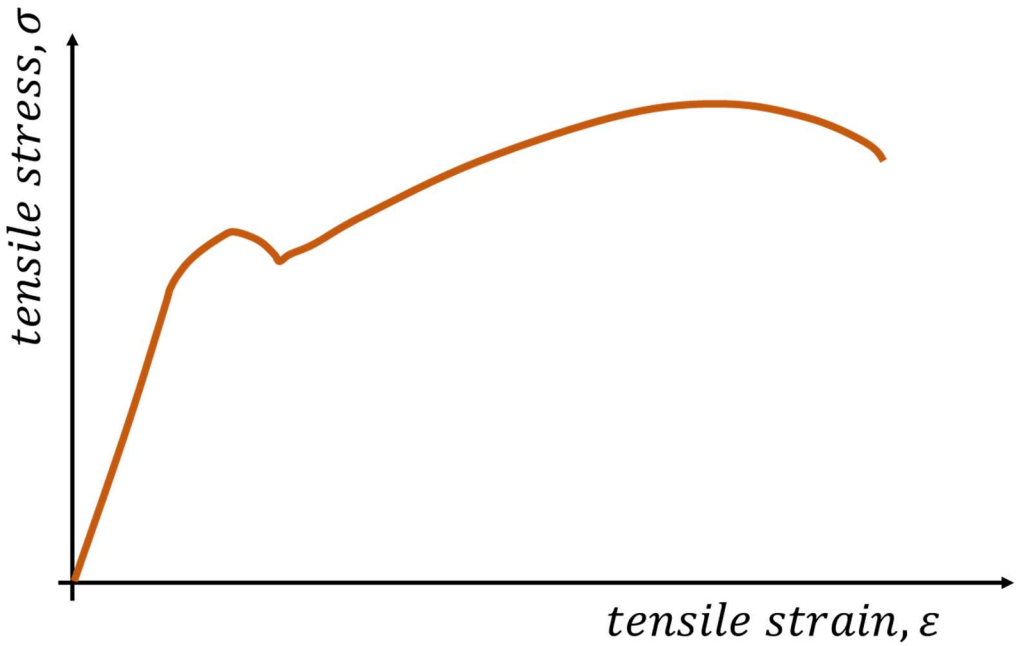
$$E = \frac{\sigma}{\varepsilon} = \frac{\text{stress}}{\text{strain}}$$

6. State the unit of Young's modulus. _____

7. Complete the sentence by selecting the appropriate words.

Youngs' elastic modulus, $E$, depends only upon the material / dimensions of the object under tension or compression. The larger the value of Young's modulus, the more / less stress is required to stain the material by a given amount. Materials with a high Young's modulus are stiff / flexible.

**Stress-strain graphs (link)**




1. Annotate points on the graph according to the video.

2. (stretch) Describe what happens at each point.

**Ductile and brittle materials (link)**

1. Describe what is meant by a brittle material.

_____

_____

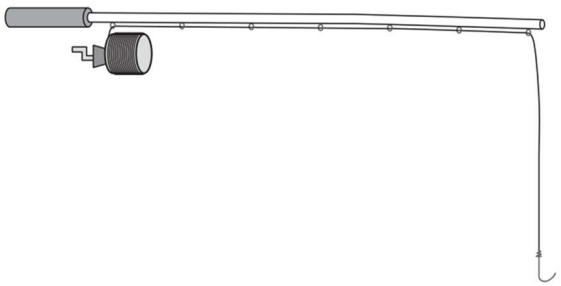
2. Describe what is meant by a ductile material.

_____

_____

## APPLY - QUESTIONS

**1.** Copper fishing lines are used for deep water fishing. A fish becomes caught on the hook and the copper line extends. Calculate the extension produced.



- Cross-sectional area of copper line = $1.30 \times 10^{-7}\ \mathrm{m}^2$
- Load on line = $65\ \mathrm{N}$
- Original length of line = $20.0\ \mathrm{m}$
- Young's modulus of copper = $129\ \mathrm{GPa}$

**Steps:**

**a.** Calculate the stress.

**b.** Calculate the strain using Young's modulus equation.

**c.** Calculate the extension using the strain equation.

**2.** A wire of a length $1.00\ \mathrm{m}$ and diameter of $0.40\ \mathrm{mm}$ is hung from a ceiling.
Find the extension caused in the wire, by attaching a weight of $100\ \mathrm{N}$ (2 s.f.), if the material of the wire has the Young's modulus of $E = 200\ \mathrm{GPa}$ (3 s.f.).

**Steps:**

**a.** Calculate the cross-sectional area in $\mathrm{m}^3$.

**b.** Calculate the stress in $\mathrm{Pa}$.

**c.** Calculate the strain using Young's modulus equation.

**d.** Calculate the extension using the strain equation in $\mathrm{m}$.