Welcome to IGCSE Science! Here are some useful links and the plans for Autumn term!

Specification: Edexcel International Advanced Level (pearson.com)

Past papers: Edexcel International Science (Double Award) (2017) | Pearson qualifications

Please note this is a large document and does not require printing unless you would like a hard copy of everything. Only print the pages that you want to use to write on. If there is any printing required for the lesson activities it will be listed in the equipment and labelled. I hope this makes things easier for you!

Week beginning	Topic	Activity
09/09/2024	living things	Nothing required for lesson. **After lesson task**: Explain why bacteria are classified as living but viruses are not. Complete worksheet
16/09/2024	Building blocks of life	Nothing required for lesson. **After lesson task**: Draw a labelled diagram of each type of biological molecule you have learnt about.
23/09/2024	Chemical reactions	Nothing required for lesson. **After lesson task**: Complete worksheet.
30/09/2024	Chemical models and bonding	During the lesson you will be asked to use random objects to model our substances and chemical reactions, it may be handy to have some small items, sweets or pasta shapes handy to do this with. **After lesson task:** Explain the models you have made and evaluate them.
07/10/2024	Reproduction types	You will need some paper and colouring pens for the lesson. **After lesson task:** Summarise the different types of reproduction and research an organisms of your choice to find out more about how it reproduces. Amazonian molly fish and strawberry plants are good ones to do.
14/10/2024	How do we get variation within a species, Darwin and Mendel	Nothing required for the lesson, **After lesson task:** Choose a characteristic of your choice and carry out some monohybrid crosses using punnet squares. Translate your outcomes into pedigree diagrams (I will show you how to do this in the lesson)

21/10/2024	Density	Nothing required for the lesson. **After lesson task** Find the density of some random objects using water displacement to find the volume and kitchen scales to find the mass. Write up your results. Complete density worksheet
28/10/2024	Ideal gases and gas laws	You will need freshly made bread dough or cake mix ready to cook, a ruler or measuring jug if it is runny, pencil and paper and a preheated oven. **After lesson task** write up your findings from our cooking experiment.
04/11/2024	Moments	You will need some objects that can balance, like the pebbles people balance or games that involve balancing like jenga, or you can just use random objects and have a go! Blue tac, string, tape and a ruler. **After the lesson:** Write up what we found out or take some photos/do drawings of your balancing objects and explain why they do/do not balance easily.
11/11/2024	Momentum	You will need some balls or marbles of different masses and a flat surface. **After lesson task:** Explain the application of the topic of momentum to a sport or activity of your choice, bowling or football would be good ones to do.
18/11/2024	Building blocks of life	We should never eat chemoicals but for the lesson today get someone to set up a taste test of some similar looking foods of give you them with your eyes closed during the lesson after we have made predictions. For example you could use a small amount of sugar, salt, crushed up sweets or sweets of different flavours (but dont look atthem if they are different colours) you could do different types of chocolate too. **After lesson task:** Explain how to test for diffferent chemicals and explain why we cant taste them like we did with our food items.
25/11/2024	Gases in the atmosphere	Nothing needed for lesson
02/12/2024	The Atmosphere	Nothing needed for lesson

09/12/2024	The universe	For the lesson you will need a soft surface like a pillow or cushion and some marbles or small balls. **After lesson task** make a model or draw a picture of our solar system and explain the motion of the planets, moons, asteroids and comets.
16/12/2024	Planetary motion and orbits	Nothing needed for lesson

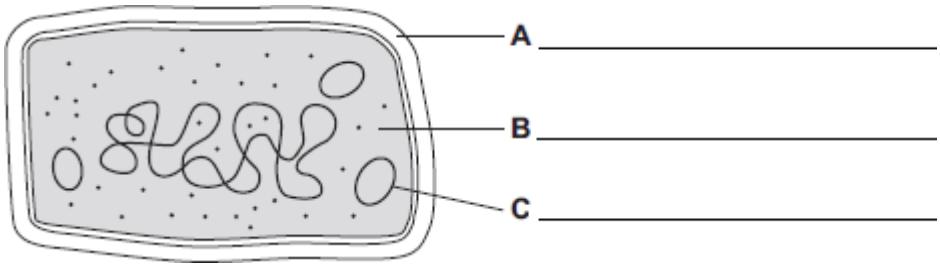
After Lesson Activities: Exam Questions

I have grouped the topics for you to have a go at some exam questions once we have completed the topics. Have a go at some or all of them when you feel ready.

Exam Questions for End of October

Q1.

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



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

cell membrane	**cell wall**	**chloroplast**	**cytoplasm**	**plasmid**

(3)

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

_____

(1)

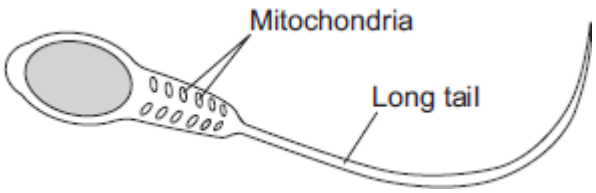
(iii) Name **one** structure that is found in a plant cell but is **not** found in a bacterial or an animal cell.

_____

(1)

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

The diagram shows the structure of a human sperm cell.



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

Long tail _____

_____

_____

Mitochondria _____

_____

_____

(4)

(Total 9 marks)

Q2.

Scientists have removed microorganisms from inside rocks in caves in Mexico.

The microorganisms have been trapped there for between 10 000 and 50 000 years.

The caves are dark, very hot, humid and acidic.

(a) Why are these microorganisms called extremophiles?

Tick **two** boxes.

They are thousands of years old ☐

They survive in high humidity ☐

They survive in high temperatures ☐

They survive in the dark ☐

They survive inside rocks ☐

They survive where it is acidic ☐

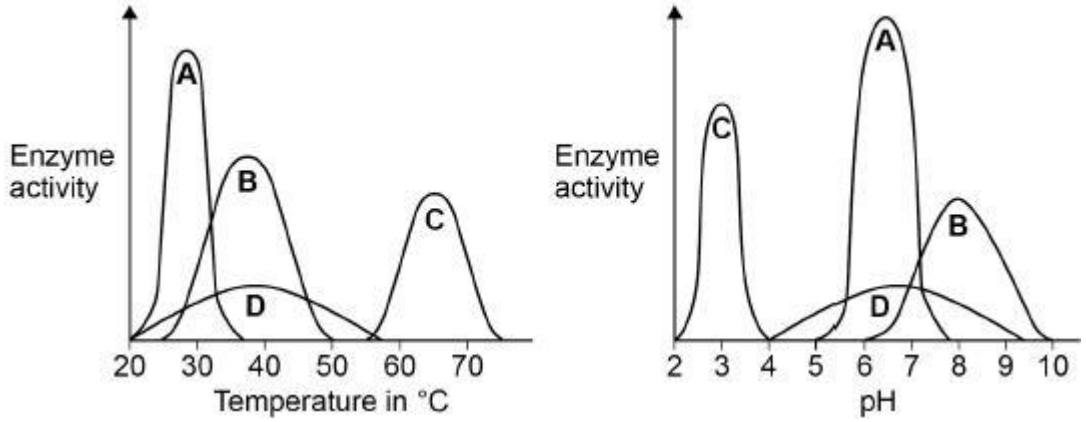
(2)

The microorganisms have been inactive for thousands of years but the scientists have reactivated them.

The diagram below shows the results of enzyme analysis on four enzymes, **A**, **B**, **C** and **D**.

Three of the enzymes were from microorganisms found in the soil near the caves.

One of the enzymes was from a reactivated microorganism from the caves.



(b) Which enzyme comes from the microorganism from the caves?

Tick **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(c) Give the reasons for your answer to part **(b)**

_____

_____

_____

(1)

(d) Carl Woese developed the 'three-domain system' of classification.

Describe the 'three-domain system' of classification.

_____

_____

_____

_____

_____

_____

(3)

(e) Most of the microorganisms from the caves were classified as belonging to the Archaea domain of the 'three-domain system'.

Suggest why.

_____

_____

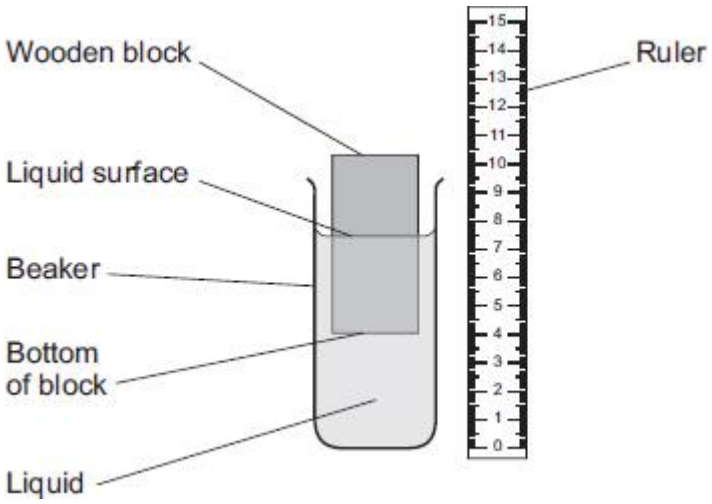
(1)

(Total 8 marks)

Q3.

A student investigated how the density of a liquid affects the position of a wooden block floating in the liquid.

The figure below shows the apparatus.



This is the method used.

1. Put the wooden block in the beaker of liquid.

2. Allow the wooden block to come to rest so that it is floating in the liquid.

3. Measure the distance between the liquid surface and the bottom of the block.

4. Repeat steps 1 to 3 with liquids of different densities.

(a) Give the independent variable in the investigation.

_____

_____

(1)

(b) Give **one** control variable for the investigation.

_____

_____

(1)

(c) Give **one** possible source of error when the student measured the distance between the liquid surface and the bottom of the block.

_____

_____

(1)

(d) The table below shows the results.

Liquid	**Density of liquid in g/cm^3**	**Distance between liquid surface and bottom of the block in cm**
A	1.4	5.5
B	1.2	6.4
C	1.0	7.7
D	0.9	8.5

Give **one** conclusion from the results.

_____

_____

(1)

Use the Physics Equations Sheet to answer parts (e) and (f).

(e) Which equation links density (ρ), mass (m) and volume (V)?

Tick (✓) **one** box.

$\rho = m \times V$ ☐

$\rho = \frac{m}{V}$ ☐

$\rho = m \times V^3$ ☐

$\rho = \frac{V}{m}$ ☐

(1)

(f) The density of the wooden block was 0.85 g/cm^3.

The mass of the wooden block was 30.6 g.

Calculate the volume of the wooden block in cm^3.

_____

_____

_____

_____

_____

Volume of wooden block = _____ cm^3

(3)

(g) Liquid **C** is water.

When liquid water is heated to its boiling point the water changes state.

What happens to the density of the liquid water as it changes state?

Tick (✓) **one** box.

The density decreases ☐

The density stays the same ☐

The density increases ☐

Give a reason for your answer.

_____

_____

(2)

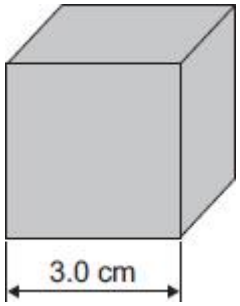
(Total 10 marks)

Q4.

A student investigated the mass, volume and density of some solid metal cubes.

Figure 1 shows one of the cubes. The length of one side is shown.

Figure 1



(a) Name a piece of equipment the student could use to measure the length of one side of the cube.

_____

(1)

(b) What is the volume of the cube in **Figure 1**?

Tick (✓) **one** box.

$6.0\ cm^3$ ☐

$9.0\ cm^3$ ☐

$27.0\ cm^3$ ☐

$54.0\ cm^3$ ☐

(1)

(c) A different cube has a mass of 13 g.

The volume of this cube is $8.0\ cm^3$.

Calculate the density of the cube.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Give your answer to 2 significant figures.

_____

_____

_____

Density (2 significant figures) = _____ g/cm^3

(3)

The student also investigated the density of a key.

Figure 2 shows the key.

Figure 2

(d) Which piece of equipment could be used to measure the mass of the key?

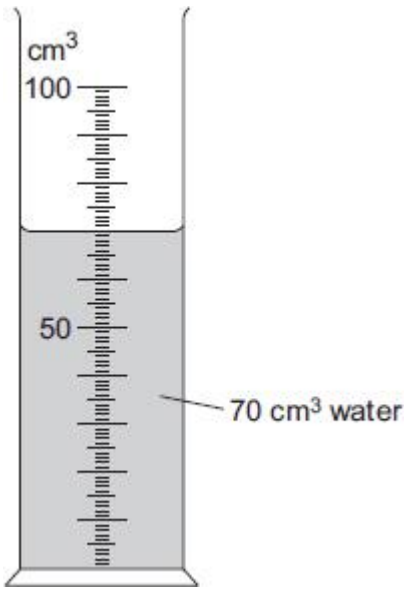
Tick (✓) **one** box.

Balance	☐
Stopwatch	☐
Thermometer	☐

(1)

(e) **Figure 3** shows a measuring cylinder containing water.

Figure 3



Describe how the equipment in **Figure 3** could be used to measure the volume of the key.

(2)

(Total 8 marks)

Q5.

Keys are usually made from metal.

The diagram below shows a metal key.

(a) Describe a method to determine the density of the metal the key is made from. You should include the measuring instruments you would use.

Use the Physics Equations Sheet.

(4)

(b) A manufacturer of keys buys metal as small solid cubes.

A solid metal cube has a density of 2.70×10^3 kg/m^3.

The cube has a mass of 0.0216 kg.

Calculate the surface area of the cube.

Use the Physics Equations Sheet.

Surface area = _____ m^2

(5)

(Total 9 marks)

Q6.

This question is about metals reacting with oxygen.

Calcium (Ca) reacts with oxygen (O_2) to produce calcium oxide (CaO).

(a) Balance the equation for the reaction.

$$\_\_\_\_\_ Ca + O_2 \rightarrow 2\ CaO$$

(1)

(b) 40 g of calcium reacts completely with oxygen to produce 56 g of calcium oxide.

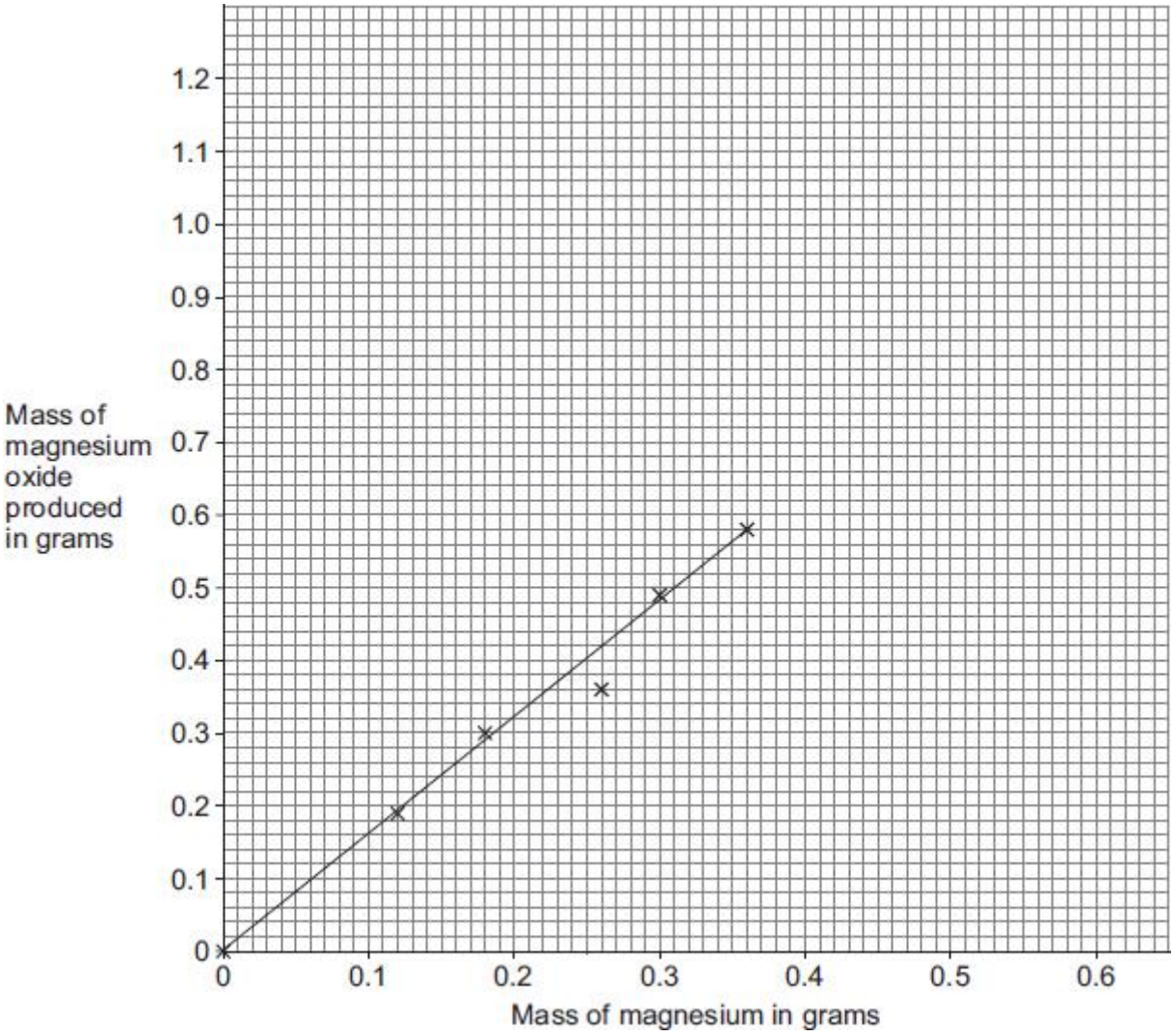
Calculate the maximum mass of calcium oxide that could be produced from 10 g of calcium.

Mass of calcium oxide = _____ g

(2)

A student reacted different masses of magnesium with oxygen and measured the mass of magnesium oxide produced.

The graph below shows the results.



(c) Why did the student ignore one of the points when drawing the line of best fit on the graph above?

_____

_____

(1)

(d) What trend is shown by the results on the graph above?

Complete the sentence.

As the mass of magnesium increases _____

_____

(1)

(e) Predict the mass of magnesium oxide produced from 0.5 g of magnesium.

You should extend the line of best fit on the graph above.

Mass of magnesium oxide = _____ g

(2)

A different student reacted copper with oxygen and measured the mass of copper oxide produced.

The student did repeat measurements for each mass of copper.

The table below shows the results when 0.42 g of copper was reacted.

Mass of copper in grams	**Mass of copper oxide produced in grams**				
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Mean**
0.42	0.51	0.47	0.48	0.50	**X**

(f) Calculate mean value **X** in above table.

_____

_____

_____

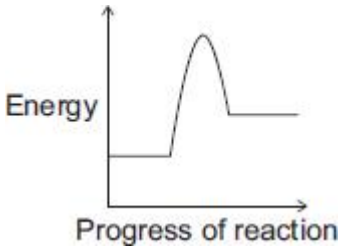
Mean value **X** = _____ g

(2)

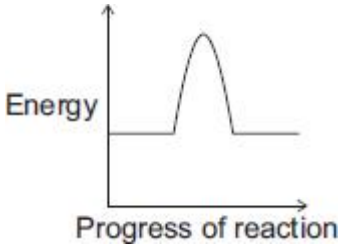
(g) The reaction between copper and oxygen is exothermic.

Which reaction profile represents this reaction?

Tick (✓) **one** box.



☐



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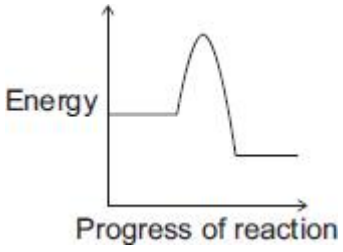


☐

(1)

(h) Complete the sentence.

The minimum amount of energy that particles must have to react is

called the _____ .

(1)

(Total 11 marks)

Q7.

Sodium is in Group 1 of the periodic table.

Sodium reacts with oxygen to produce sodium oxide.

(a) Balance the equation for the reaction.

_____ $Na + O_2 \rightarrow$ _____ Na_2O

(1)

(b) Explain what happens to sodium atoms and to oxygen atoms when sodium reacts with oxygen to produce sodium oxide (Na_2O).

Answer in terms of electrons.

_____

_____

_____

_____

_____

_____

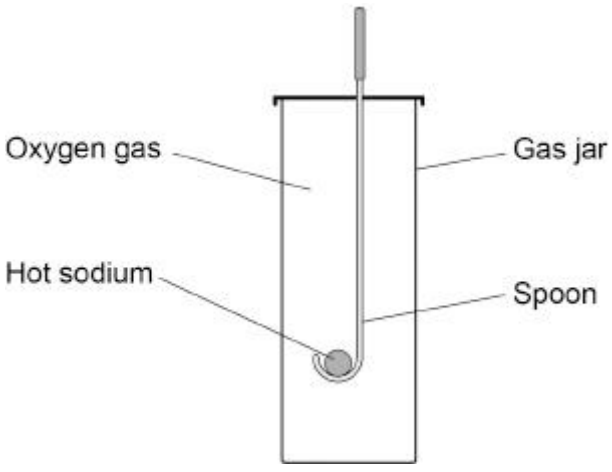
_____

_____

(4)

(c) Sodium burns in a gas jar of oxygen.

The figure below shows the apparatus.



Give **two** observations seen during the reaction.

1 _____

_____

2 _____

_____

(2)

(d) Describe **two** differences in the observations if potassium is used instead of sodium.

1 _____

_____

2 _____

_____

(2)

(Total 9 marks)

Q8.

The combustion of fuels is a source of atmospheric pollutants.

(a) Methane is a fuel.

Balance the equation for the combustion of methane.

$$CH_4 \_\_\_\_\_ + O_2 \rightarrow CO_2 + \_\_\_\_\_ H_2O$$

(1)

(b) Many fuels are mixtures.

Petrol and diesel are mixtures of hydrocarbons.

The table below shows properties of petrol and of diesel.

	Petrol	**Diesel**
Range of number of carbon atoms in a hydrocarbon molecule	4 to 12	12 to 20
Range of boiling points in °C	40 to 205	250 to 350

Compare the properties of petrol and diesel.

Use the table above.

_____

_____

_____

_____

(2)

(c) The gases released when a fuel is burned in car engines may include:

- oxides of nitrogen
- carbon monoxide
- water vapour.

Which chemical element do all these gases contain?

Tick (✓) **one** box.

Carbon ☐

Hydrogen ☐

Nitrogen ☐

Oxygen ☐

(1)

(d) When diesel burns in car engines, oxides of nitrogen are produced.

Where does the nitrogen come from?

_____

_____

(1)

(e) When diesel burns, particulates may be produced.

What environmental effect do particulates from burning diesel cause?

_____

_____

(1)

(f) Carbon monoxide may be produced when diesel burns.

Give **one** reason why carbon monoxide is difficult to detect.

_____

_____

(1)

(g) Explain why water vapour and **not** liquid water is produced when diesel burns.

(2)

(h) Sulfur is a common impurity in diesel.

Explain why this causes an environmental problem.

(3)

(Total 12 marks)

Q1.

(a) (i) **A** − (cell) wall

1

B − cytoplasm

1

C − plasmid

1

(ii) bacterium cell has cell wall / no nucleus / no mitochondria / plasmids present

accept its DNA / genetic material is not enclosed / it has no nuclear membrane

it = bacterium cell

accept converse for animal cell

ignore flagella

1

(iii) any **one** from:

- chloroplast

  ignore chlorophyll
- (permanent) vacuole

1

(b) (Long tail) moves the sperm / allows the sperm to swim

1

towards the egg

allow correct reference to other named parts of the female reproductive system

1

(Mitochondria) release <u>energy</u> (for movement / swimming)

allow supply / produce / provide

1

in respiration

1

[9]

Q2.

(a) they survive in high temperatures

1

they survive where it is acidic

1

(b) C

1

(c) because it has (high / optimum) activity at high temperature or 65 °C **and / or**

low pH or pH 3 or high acidity

*allow it is the only enzyme that is active between 55 °C and 75 °C **and / or** below pH4*

1

*mark dependent on C correct for part **(b)***

(d) any **three** from:

- based on DNA / chemical evidence

(the three domains are)

- (Archaea) − primitive / simple bacteria
- Prokaryota / Bacteria − true / modern bacteria
- Eukaryota − includes (protists, fungi,) plants and animals

allow Eukaryota − includes organisms with cells having a nucleus

*if no other mark awarded allow for **1** mark*
mention of Archaea, Prokaryota / Bacteria and Eukaryota
or
three correct descriptions

3

(e) (these microorganisms) live in extreme conditions

allow (most Archaea) are extremophiles

1

[8]

Q3.

(a) the density of the liquids

1

(b) any **one** from:

- volume / depth of liquid
- temperature of the liquid
- the block used

ignore shape of block

1

(c) any **one** from:

ignore human error

- difficult to line up ruler and wooden block

allow there is a gap between ruler and beaker / block

- parallax error

allow description of eye position when reading ruler

- block may move
- refraction of light
- liquid surface not level

1

(d) the lower the density of the liquid the greater the distance between liquid surface and bottom of the block

allow the greater the density of the liquid the smaller the distance of the block below the

surface

1

(e) $\rho = \frac{m}{v}$

1

(f) $0.85 = \frac{30.6}{\text{volume}}$

1

$\text{volume} = \frac{30.6}{0.85}$

1

36 (cm^3)

1

(g) the density decreases

If incorrect box ticked no marks can be awarded

1

because the water particles / molecules are further apart

1

[10]

Q4.

(a) any **one** from:

- metre rule

  allow ruler

- Vernier callipers

  allow micrometer

  allow tape measure

1

(b) 27.0 cm^3

1

(c) density = $\frac{13}{8.0}$

1

density = 1.625

allow 1.63

1

density = 1.6

allow a correctly calculated answer to 2 significant figures from an incorrect calculation which uses the values in the question

1

(d) balance

1

(e) add key and record / measure / note level of water

1

subtract original volume
or
subtract 70 cm^3

allow measure the increase / rise in water level
allow fill measuring cylinder to top and add key (1)
allow collect water that overflows and record volume (1))

1

[8]

Q5.

(a) **Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

3–4

Level 1: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

1–2

No relevant content

0

Indicative content

method to measure mass
- measure mass on top pan balance
- tare / zero top pan balance first

method to measure volume
- fill eureka / displacement can with water
- until water overflows and discard water that overflows
- place object in
- lower in gently (to avoid splashing water)
- collect overflow and measure volume displaced
- measure volume with measuring cylinder
- appropriate volume / size measuring cylinder
- read level with water level on measuring cylinder
- measure level with bottom of meniscus

or
- part fill a measuring cylinder with water and record volume
- appropriate volume / size measuring cylinder
- read level with water level on measuring cylinder
- measure level with bottom of meniscus
- place object in
- lower in gently (to avoid splashing water)
- record new water level
- calculate increase in volume
- density = $\frac{\text{mass}}{\text{volume}}$

Level 2 responses must include sufficient detail to accurately determine density

(b) $2.70 \times 10^3 = \frac{0.0216}{V}$

allow $2700 = \frac{0.0216}{V}$

1

$V = \frac{0.0216}{2.70 \times 10^{3}}$

allow $V = \frac{0.0216}{2700}$

1

$V = 8.0 \times 10^{-6}$ (m^3)

allow V = 0.000 008 (m^3)

1

cube root = 0.02 (m)

allow 2.0 cm

allow use of an incorrectly calculated value of V

1

$0.02 \times 0.02 \times 6 = 2.4 \times 10^{-3}$ (m^2)

allow 0.002 4 (m^2)

allow 24 cm^2

allow a correct surface area using an incorrectly calculated value of V

1

[9]

Q6.

(a) $2\ Ca + O_2 \rightarrow 2\ CaO$

allow multiples

1

(b) (mass =) $\frac{10}{40} \times 56$

1

= 14 (g)

1

(c) (the ignored point is) anomalous

allow the point does not fit the pattern

1

(d) (as the mass of magnesium increases) the mass of magnesium oxide (produced) increases

1

(e) **View with the figure**

line of best fit extended to 0.5 g

1

0.8 (g)

allow a tolerance of ± ½ a small square

allow a mass value correctly read from an incorrectly drawn

extension of the line of best fit

1

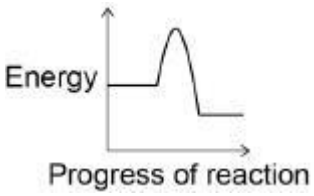
(f) $(\mathbf{X} =) \frac{0.51 + 0.47 + 0.48 + 0.50}{4}$

1

= 0.49 (g)

1

(g)



1

(h) activation energy

1

[11]

Q7.

(a) $4\ Na + O_2 \rightarrow 2\ Na_2O$

allow multiples

1

(b) sodium atom loses one electron

1

(and) oxygen atom gains two electrons

1

(so) two sodium atoms to one oxygen atom

1

any **one** from:
- (to form) Na^+ **and** O^{2-}
- (to form) sodium ion(s) **and** oxide ion(s)
- (to form) ions with full outer shells / levels.

1

(c) yellow flame

allow orange flame

1

any **one** from:
- sodium melts
- white smoke / solid / powder

1

(d) (potassium)
(burns with a) lilac flame

allow (burns with a) different colour flame

1

burns faster

allow more vigorous reaction

1

[9]

Q8.

(a) $CH_4 + \mathbf{2}\ O_2 \rightarrow CO_2 + \mathbf{2}\ H_2O$

1

(b) hydrocarbon molecules in petrol have fewer carbon atoms than those in diesel

1

petrol has a lower boiling point (range) than diesel

1

allow converse throughout
allow petrol is more flammable than diesel
allow petrol is less viscous than diesel

(c) oxygen

1

(d) air

allow the atmosphere
allow from volcanoes

1

(e) global dimming

1

(f) (carbon monoxide is) colourless
or
(carbon monoxide is) odourless

ignore clear

1

(g) (diesel) burns at a high temperature
or
(diesel) burns at a temperature greater than 100 °C

1

(which is) above the boiling point of water

1

(h) sulfur dioxide (is produced when diesel is burnt)

1

(which causes) acid rain

1

(which results in)
any **one** from:
- damage to buildings / statues / bridges
- damage to trees / plants
- damage to aquatic life
- acidification of lakes / rivers / soil
- respiratory problems

allow (which affects) asthma

1

[12]

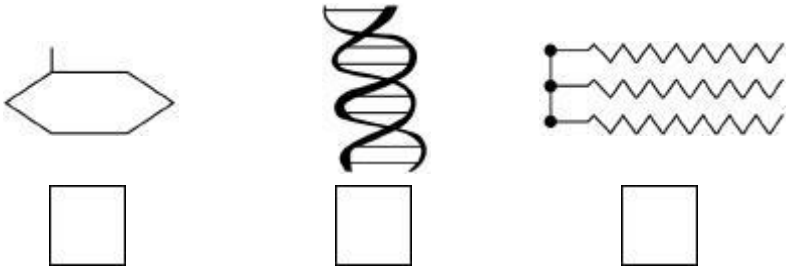
Exam Questions for end of December

Q1.

This question is about DNA and genes.

(a) Which diagram represents a DNA molecule?

Tick (✓) **one** box.



(1)

(b) Describe the structure of a DNA molecule.

_____

_____

(1)

(c) A gene is a small section of DNA on a chromosome.

Complete the sentences.

A gene codes for a particular sequence of _____.

This sequence makes a specific _____.

(2)

(d) What is meant by the term genome?

_____

_____

(1)

(e) The complete human genome is now known.

Which important scientific advance was made using knowledge of the human genome?

Tick (✓) **one** box.

Discovering antibiotic resistant bacteria ☐

Finding more foods to eat from tropical forests ☐

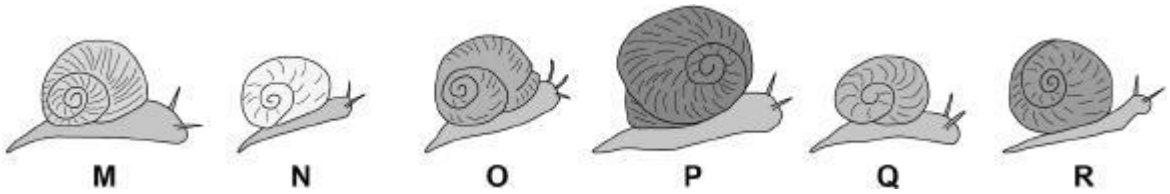
Tracing how aboriginal people spread across Australia ☐

Working out when the last ice age ended ☐

(1)

A student found six different snails of one species in his garden.

The diagram below shows the snails.



(f) All the snails are different.

What scientific term describes differences in characteristics between individuals of a species?

_____

(1)

(g) A change in DNA has caused snail **P** to be very different from the other five snails.

Suggest why there might be an increasing number of snails similar to snail **P** in each future generation.

_____

_____

_____

_____

(2)

(Total 9 marks)

Q2.

The genetic material in a cell is made of DNA.

(a) A DNA molecule is made from two strands twisted around each other.

What scientific term describes the structure of DNA?

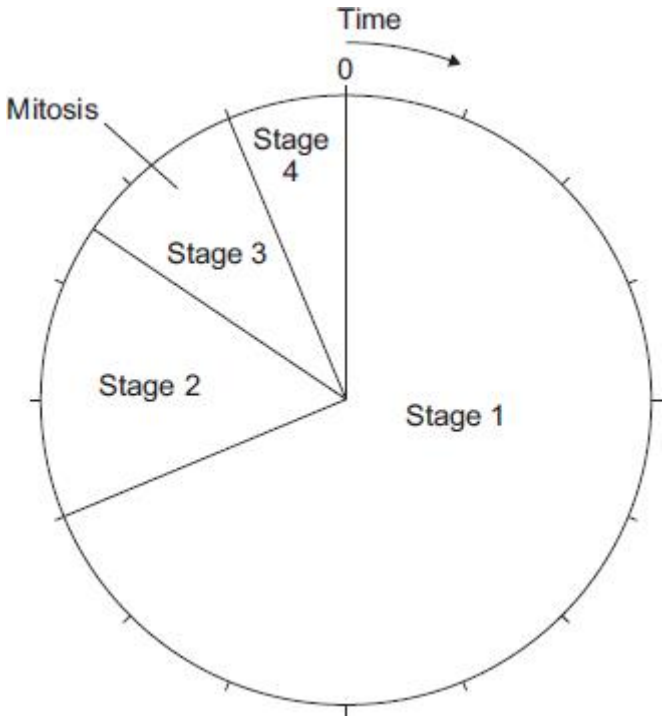
_____

(1)

Cells divide in a series of stages called the cell cycle.

Figure 1 shows a cell cycle for a human cell.

Figure 1



(b) What happens during the mitosis stage of the cell cycle?

Tick (✓) **one** box.

Chromosomes move to opposite ends of the cell. ☐

Copies of the organelles are made. ☐

The cell increases in size. ☐

(1)

(c) Before a cell divides by mitosis, the mass of DNA in the cell is 6 picograms.

What mass of DNA will be in each of the new cells at the end of cell division?

Tick (✓) **one** box.

3 picograms ☐

6 picograms ☐

12 picograms ☐

(1)

(d) One cell takes 16 hours to divide and form two new cells.

Estimate the total number of cells produced from one cell at the end of 48 hours.

Use the following steps.

Calculate the number of divisions in 48 hours

_____

_____

Calculate the number of cells after 48 hours

_____

_____

Number of cells = _____

(1)

(e) Give **one** factor that can cause a mutation in DNA.

Do **not** refer to ionising radiation in your answer.

_____

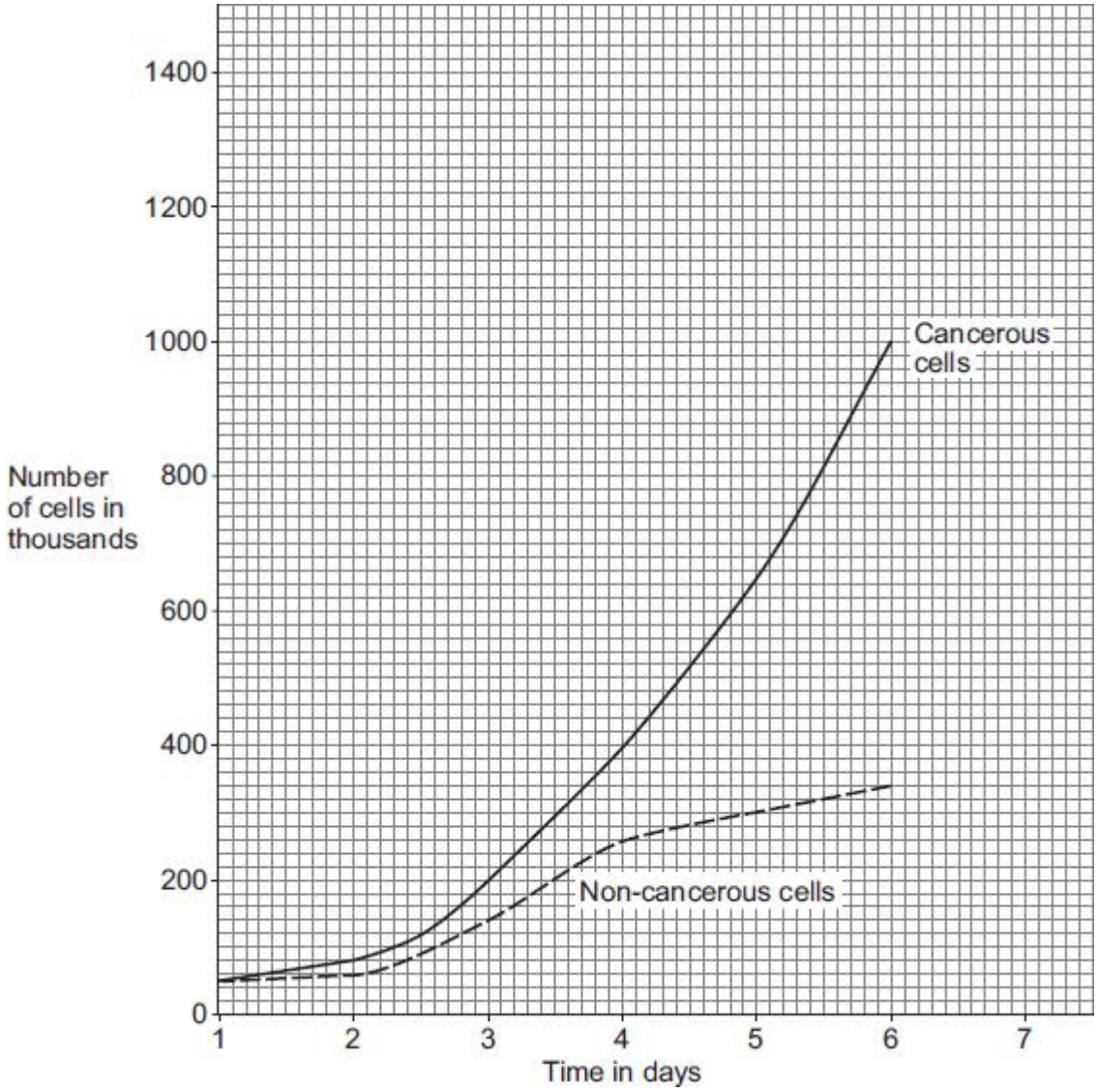
_____

(3)

A mutation in DNA may cause cells to become cancerous.

Figure 2 shows the change in the number of cancerous cells and non-cancerous cells during 6 days.

Figure 2



(f) Describe **three** patterns shown in **Figure 2**.

Use data from **Figure 2**.

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

(3)

(g) Predict the number of non-cancerous cells on day 7 if the pattern from day 4 continued.

You should extend the line for non-cancerous cells on the graph in **Figure 2**.

Number of cells = _____ thousand

(2)

(Total 12 marks)

Q3.

The genetic material in cells is made of DNA.

(a) Which **two** of the following describe the structure of DNA?

Tick **two** boxes.

A double helix ☐

A monomer ☐

A polymer ☐

A protein ☐

A single strand ☐

(2)

(b) Complete the sentences.

Choose answers from the box.

clone	**disorder**	**gene**
genome	**mutation**	

A small section of DNA which codes for one protein is called a _____ .

All the genetic material of an organism is called its _____ .

(2)

(c) Gametes (sex cells) contain half the amount of DNA compared to body cells.

Give the names of the **two** types of gametes in humans.

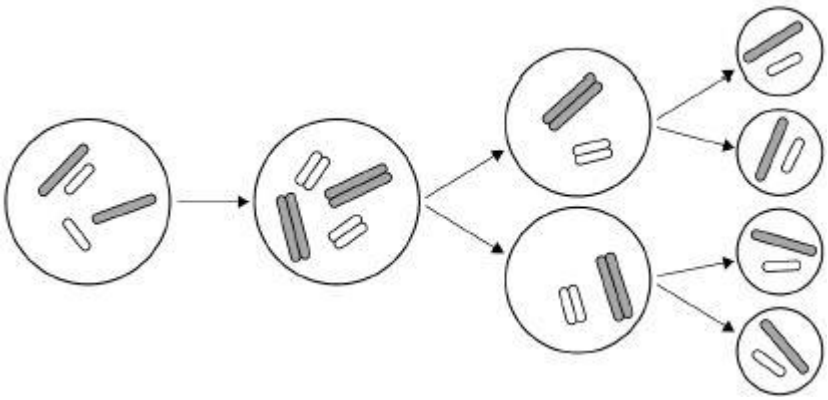
_____ and _____

(1)

(d) What is the process called when the gametes join?

(1)

(e) The diagram below shows cell division by meiosis to form gametes.



Which **two** features in the diagram above show that this cell division is meiosis and **not** mitosis?

Tick **two** boxes.

The cell divides twice	☐
The chromosomes pull apart into the new cells	☐
The cytoplasm divides into new cells	☐
The DNA is copied	☐
The new cells have half the number of chromosomes	☐

(2)

(Total 8 marks)

Q4.

Keys are usually made from metal.

The diagram below shows a metal key.

(a) Describe a method to determine the density of the metal the key is made from. You should include the measuring instruments you would use.

Use the Physics Equations Sheet.

(4)

(b) A manufacturer of keys buys metal as small solid cubes.

A solid metal cube has a density of 2.70×10^3 kg/m^3.

The cube has a mass of 0.0216 kg.

Calculate the surface area of the cube.

Use the Physics Equations Sheet.

Surface area = _____ m^2

(5)

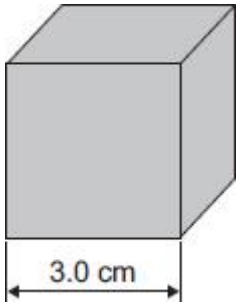
(Total 9 marks)

Q5.

A student investigated the mass, volume and density of some solid metal cubes.

Figure 1 shows one of the cubes. The length of one side is shown.

Figure 1



(a) Name a piece of equipment the student could use to measure the length of one side of the cube.

_____

(1)

(b) What is the volume of the cube in **Figure 1**?

Tick (✓) **one** box.

6.0 cm^3 ☐

9.0 cm^3 ☐

27.0 cm^3 ☐

54.0 cm^3 ☐

(1)

(c) A different cube has a mass of 13 g.

The volume of this cube is 8.0 cm^3.

Calculate the density of the cube.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Give your answer to 2 significant figures.

_____

_____

_____

_____

_____

Density (2 significant figures) = _____ g/cm^3

(3)

The student also investigated the density of a key.

Figure 2 shows the key.

Figure 2

(d) Which piece of equipment could be used to measure the mass of the key?

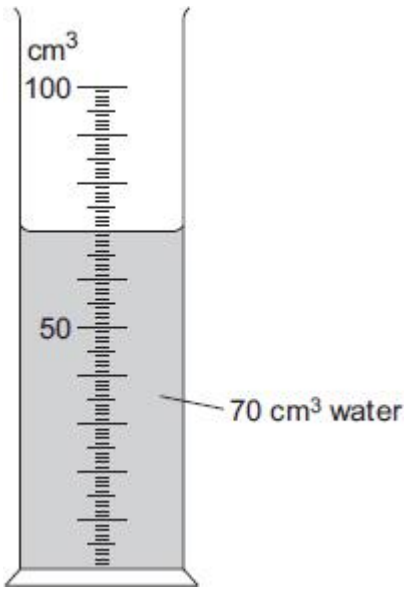
Tick (✓) **one** box.

Balance	☐
Stopwatch	☐
Thermometer	☐

(1)

(e) **Figure 3** shows a measuring cylinder containing water.

Figure 3



Describe how the equipment in **Figure 3** could be used to measure the volume of the key.

_____

_____

_____

_____

(2)

(Total 8 marks)

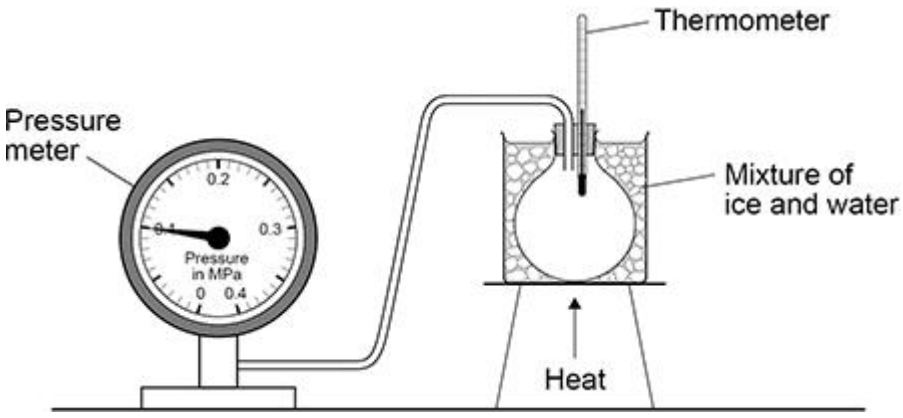
Q6.

A student investigated how the pressure of a gas depends on its temperature.

The volume of the gas did **not** change.

Figure 1 shows the equipment used.

Figure 1



(a) Pressure is sometimes measured in units called atmospheres.

1 atmosphere is 10^5 pascals (Pa).

What is 1 atmosphere in kilopascals (kPa)?

_____

_____

1 atmosphere = _____ kPa

(1)

(b) The student took four pressure readings for each temperature.

The table below shows the pressure readings when the temperature was 50.0 °C

Temperature in °C	**Pressure in MPa**			
	1	**2**	**3**	**4**
50.0	0.115	0.120	0.121	0.116

Calculate the uncertainty in the mean pressure.

_____

_____

_____

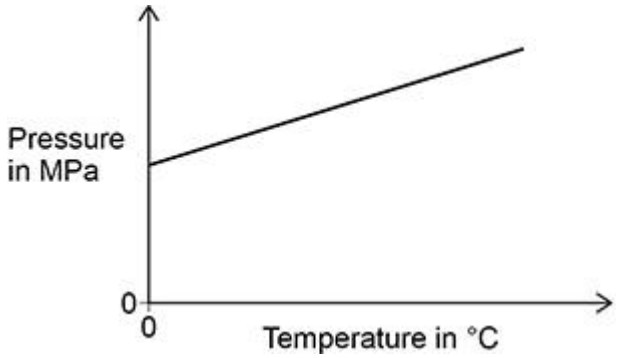
_____

Uncertainty = ± _____ MPa

(2)

(c) **Figure 2** shows a sketch graph of the results.

Figure 2



The student said that as the temperature increases the pressure increases.

Give a better description of the relationship between temperature and pressure.

_____

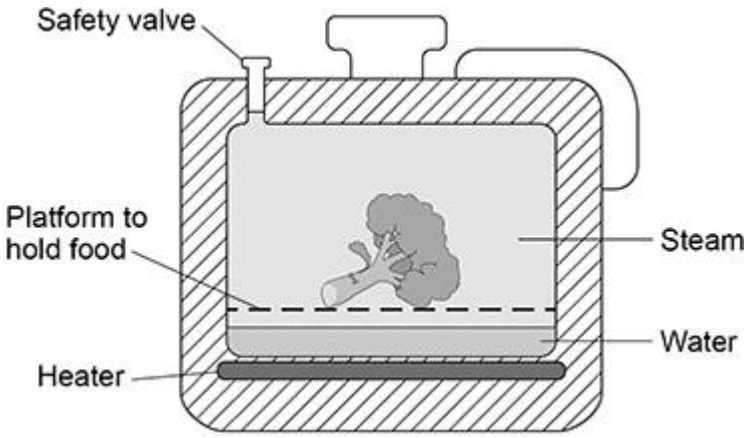
_____

(1)

A pressure cooker is a sealed pot that uses steam to cook food.

Figure 3 shows a pressure cooker.

Figure 3



(d) When the water in the pressure cooker starts to boil:

- the amount of steam in the pressure cooker increases
- the temperature of the steam increases above 100 °C

Explain why these changes make the pressure in the cooker increase.

(5)

(e) If the pressure inside the pressure cooker becomes greater than 200 kPa then some of the steam is released through the safety valve.

The released steam expands as it moves into the atmosphere.

Explain how a change in density of the steam is caused by a change in the arrangement of particles in the steam as it is released.

(3)

(Total 12 marks)

Q7.

Density can be explained using the particle model.

(a) What is the unit of density (ρ)?

Tick **one** box.

joules, J ☐

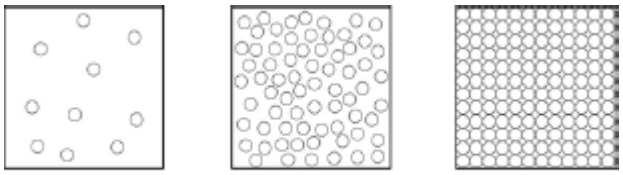
joules per kilogram, J / kg ☐

kilograms, kg ☐

kilograms per metre cubed, kg / m^3 ☐

(1)

(b) The figure below shows particles of the same substance in three states of matter.



Use the figure above to explain why the solid has the highest density.

_____

_____

_____

_____

(2)

(c) Complete the sentences.

Use answers from the box.

downwards	**kinetic**	**nuclear**	**potential**	**randomly**	**slowly**

The particles in a gas are constantly moving.

The particles move _____

When the temperature of the particles in a gas is increased

the particles have more _____energy .

(2)

(d) A gas is put into a closed container.

The container and the gas inside it are heated.

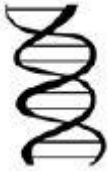
What will happen to the pressure inside the container?

(1)

(Total 6 marks)

Q1.

(a)



1

(b) any **one** from:

- 2 strands / chains that are twisted / coiled / spiralled

allow cross links between 2 strands / chains

- double helix
- (long) polymer

allow reference to nucleotides or sugars, phosphates and bases

1

(c)

in this order only

amino acids

1

protein

allow polypeptide

1

(d) all the genetic material (of an organism)

allow DNA / genes for genetic material
ignore chromosomes

1

(e) tracing how aboriginal people spread across Australia

1

(f) variation

ignore genetic/environmental

1

(g) stronger / larger (shell)

1

(so) more likely to (survive and) breed
or
(so) more likely to (survive and) pass on genes

OR

(better) camouflaged (1)

(so) less likely to be eaten and will breed more (1)

1

[9]

Q2.

(a) double helix

ignore polymer

1

(b) chromosomes move to opposite ends of the cell

1

(c) 6 picograms

1

(d) $\frac{48}{16}$

1

= 3 (divisions)

1

= 8 (cells)

or

alternative route
after 16 hours = 2 cells (1)
after 32 hours = 4 cells (1)
after 48 hours = 8 cells (1)

1

(e) any **one** from:
- viruses
- carcinogens

allow named example such as tobacco / cigarettes / smoking / benzene / asbestos / vinyl chloride

ignore references to genetics

1

ignore ionising radiation or named example

(f) any **three** from:
- the number of cancerous cells increase up to day 6

or
the number of non-cancerous cells increase up to day 6

cancerous cells
- the number of cancerous cells increase up to 1000 (thousand cells)
- the number of cancerous cells increase slowly up to day 2
- the cancerous cells increase rapidly from day 2
- the increase in the number of cancerous cells is greater (than the number of non-cancerous cells)

allow the number of non-cancerous cells remains constant up to day 2

non-cancerous cells
- the number of non-cancerous cells increase slowly up to day 2
- the number of non-cancerous cells increase up to 340 (thousand cells)
- the number of non-cancerous cells increase rapidly between day 2 and day 4
- the number of non-cancerous cells increase more slowly after day 4

*if no other marks awarded allow **for 1** mark:*

number of (cancerous / noncancerous) cells increase

or

there is a positive correlation

3

*for **3** marks reference to both cell types required.*

(g) acceptable extrapolation

1

correct value from extrapolation if no extrapolation

allow value in range 380 to 400 (thousand)

allow a tolerance of +/- ½ a small square

1

[12]

Q3.

(a) a double helix

1

a polymer

1

(b) gene

1

genome

1

in this order only

(c) sperm **and** egg(s) / ova / ovum

in either order

1

(d) fertilisation

1

(e) the cell divides twice

1

the new cells have half the number of chromosomes

1

[8]

Q4.

(a) **Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

3–4

Level 1: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

1–2

No relevant content

0

Indicative content

method to measure mass
- measure mass on top pan balance
- tare / zero top pan balance first

method to measure volume
- fill eureka / displacement can with water
- until water overflows and discard water that overflows
- place object in
- lower in gently (to avoid splashing water)
- collect overflow and measure volume displaced
- measure volume with measuring cylinder
- appropriate volume / size measuring cylinder
- read level with water level on measuring cylinder
- measure level with bottom of meniscus

or
- part fill a measuring cylinder with water and record volume
- appropriate volume / size measuring cylinder
- read level with water level on measuring cylinder
- measure level with bottom of meniscus
- place object in
- lower in gently (to avoid splashing water)
- record new water level
- calculate increase in volume
- density = $\frac{\text{mass}}{\text{volume}}$

Level 2 responses must include sufficient detail to accurately determine density

(b) $2.70 \times 10^3 = \frac{0.0216}{V}$

allow $2700 = \frac{0.0216}{V}$

1

$V = \frac{0.0216}{2.70 \times 10^3}$

allow $V = \frac{0.0216}{2700}$

1

$V = 8.0 \times 10^{-6}$ (m^3)

allow V = 0.000 008 (m^3)

1

cube root = 0.02 (m)

allow 2.0 cm

allow use of an incorrectly calculated value of V

1

$0.02 \times 0.02 \times 6 = 2.4 \times 10^{-3}$ (m^2)

allow 0.002 4 (m^2)

allow 24 cm^2

allow a correct surface area using an incorrectly calculated value of V

1

[9]

Q5.

(a) any **one** from:

- metre rule

allow ruler

- Vernier callipers

allow micrometer

allow tape measure

1

(b) 27.0 cm^3

1

(c) density = $\frac{13}{8.0}$

1

density = 1.625

allow 1.63

1

density = 1.6

allow a correctly calculated answer to 2 significant figures from an incorrect calculation which uses the values in the question

1

(d) balance

1

(e) add key and record / measure / note level of water

1

subtract original volume

or

subtract 70 cm^3

allow measure the increase / rise in water level

allow fill measuring cylinder to top and add key (1)

allow collect water that overflows and record volume (1))

1

[8]

Q6.

(a) 100 (kPa)

allow 10^2 (kPa)

1

(b) range = 0.006 (MPa)

allow mean = 0.118

1

uncertainty = ± 0.003 (MPa)

*an answer of uncertainty = 0.118 (MPa) scores **0** marks*

1

(c) the relationship is linear

allow the relationship obeys y = mx + c

allow the gradient (of the graph) is constant

*do **not** accept (directly) proportional*

1

(d) (as the amount of steam increases) the number of particles increases

1

and (as the temperature increases) particles move faster

allow (as the temperature increases) the (average) kinetic energy of the particles increases

1

particles collide with the wall of the cooker

if MP3 is not awarded no subsequent marks may be awarded

1

these collisions are more frequent

1

and each collision exerts more force

1

particles refers to particles in the steam throughout

(e) the particles spread out

*do **not** allow particles expand*

1

so the steam / gas takes up a greater <u>volume</u>

allow there is less gas in the same <u>volume</u>

1

and density = $\frac{\text{mass}}{\text{volume}}$ so the density decreases

*do **not** allow density of particles decreases*

1

[12]

Q7.

(a) kilograms per metre cubed, kg / m^3

1

(b) (solid has) more particles

allow atoms for particles

1

in the same volume **or** in a given volume

allow description of a given area

1

(c) randomly

this order only

1

kinetic

1

(d) (pressure) rises

1