

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE
B721/02

GATEWAY SCIENCE
ADDITIONAL SCIENCE B
Additional Science modules
B3, C3, P3 (Higher Tier)

WEDNESDAY 14 JUNE 2017: Morning

DURATION: 1 hour 15 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR SUPPLIED MATERIALS:
A copy of the Periodic Table

OTHER MATERIALS REQUIRED:
Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF



INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer ALL the questions.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

The quality of written communication is assessed in questions marked with a pencil ().

A list of equations can be found on pages 4–5.

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 75.

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EQUATIONS

energy = mass × specific heat capacity × temperature change

energy = mass × specific latent heat

efficiency = $\frac{\text{useful energy output (× 100\%)}}{\text{total energy input}}$

wave speed = frequency × wavelength

power = voltage × current

energy supplied = power × time

average speed = $\frac{\text{distance}}{\text{time}}$

distance = average speed × time

$s = \frac{(u + v)}{2} \times t$

acceleration = $\frac{\text{change in speed}}{\text{time taken}}$

force = mass × acceleration

weight = mass × gravitational field strength

work done = force × distance

power = $\frac{\text{work done}}{\text{time}}$

power = force × speed

$KE = \frac{1}{2}mv^2$

momentum = mass × velocity

$$\text{force} = \frac{\text{change in momentum}}{\text{time}}$$

$$\text{GPE} = mgh$$

$$mgh = \frac{1}{2}mv^2$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

Answer ALL the questions.

SECTION A – Module B3

1 This question is about the circulatory system.

Look at the graphs opposite.

They show changes as blood flows through different sections of the circulatory system.

(a) In the capillaries materials are exchanged between the blood and surrounding tissues.

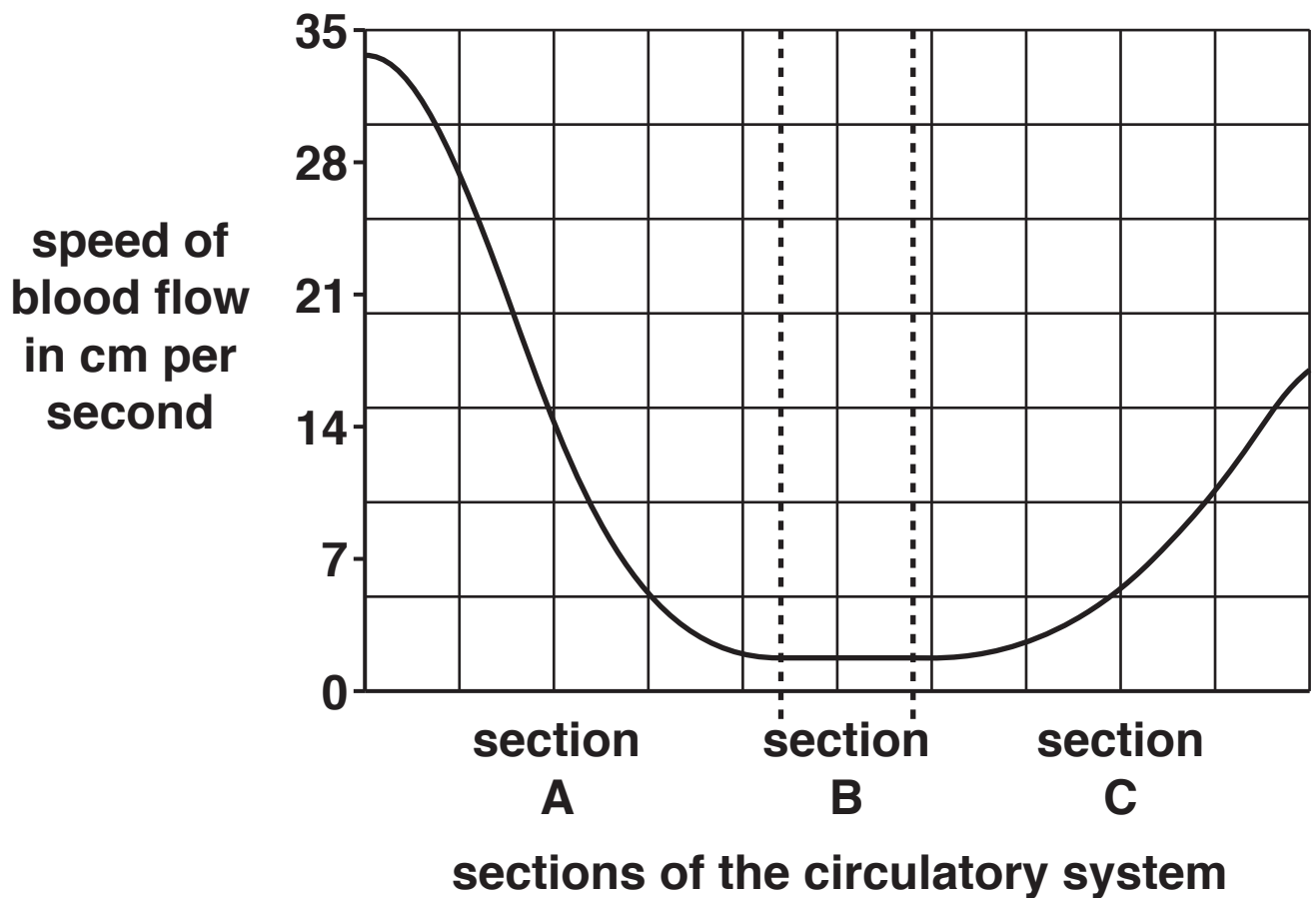
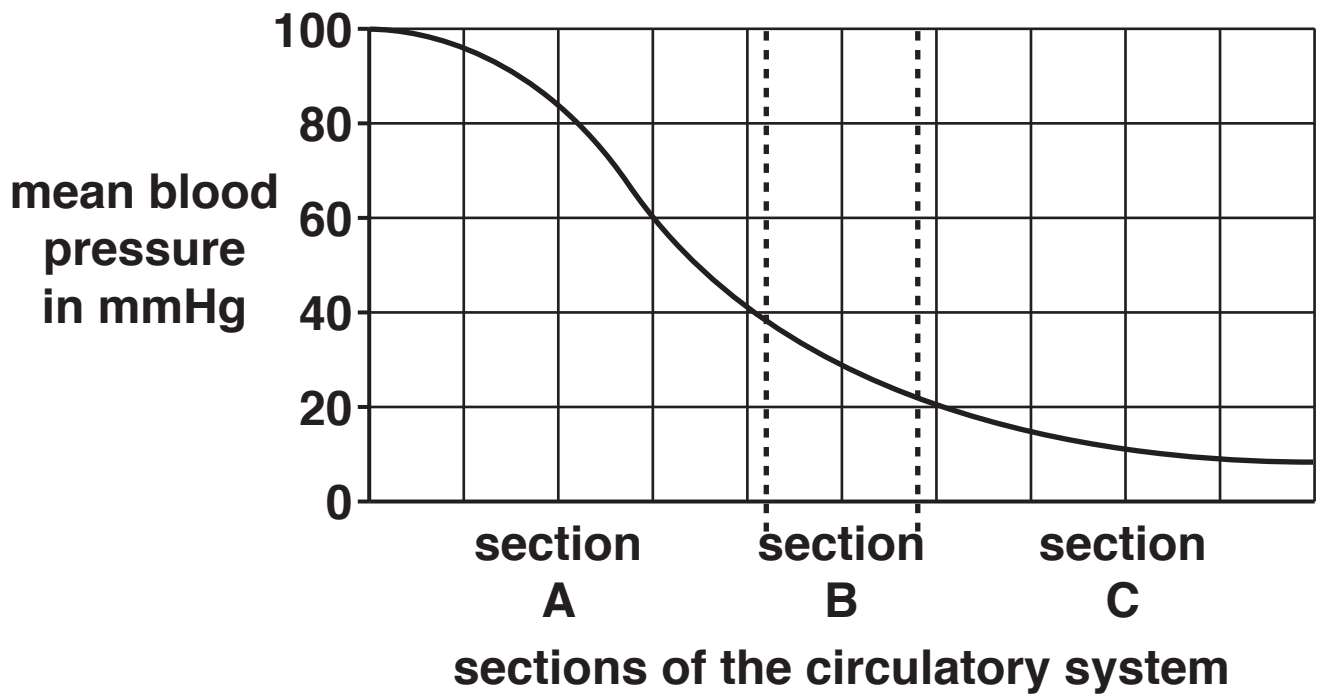
This involves liquid being squeezed through the walls of the capillaries.

There needs to be enough time for this exchange to happen.

In which section is blood travelling through the CAPILLARIES?

Choose from A, B or C and explain your answer.

[2]



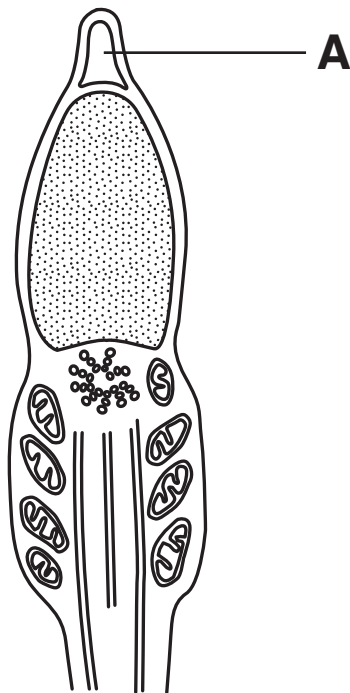
(b) Explain how the structure of the blood vessels in sections A and C would be different.

[2]

BLANK PAGE

2 (a) Look at the diagram.

It shows the head and middle sections of a sperm cell.



- (i) Enzymes released to digest the egg membrane are produced in part A.**

What is the name of part A?

Put a tick (✓) in the box next to the correct answer.

acrosome

☐

chromosome

☐

gene

☐

nucleus

☐

vein

☐

[1]

(ii) Sperm cells are haploid.

The diploid number for a chicken is 78.

How many chromosomes are in the nucleus of a chicken sperm cell?

_____ **[1]**

(iii) Sperm cells are produced by meiosis.

Meiosis involves two cell divisions.

During meiosis haploid sperm cells are made from diploid cells.

Explain how HAPLOID cells are formed in meiosis.

_____ **[2]**

- (b) Scientists can genetically engineer the DNA of animals.**

Chickens can be made to produce anti-cancer proteins in their eggs.

Goats can be made to produce anti-clotting proteins in their milk.

Scientists can quickly make medicines from these chickens and goats.

- (i) Some people agree with these genetically engineered chickens and goats but other people are against them.**

Suggest one reason why they may AGREE and one reason why they may be AGAINST them.

[2]

- (ii) The process of breeding these genetically engineered chickens and goats involves the use of cloning.**

Describe one OTHER possible use of cloning animals.

[1]

(c) Gene therapy involving gametes is controversial.

Some people think that it is unethical and goes against religious beliefs.

Suggest two OTHER reasons why it is controversial.

[2]

(d) Garden centres take cuttings of their plants to produce new plants to sell.

Cuttings are clones.

Write about the ADVANTAGES and DISADVANTAGES of taking cuttings to produce new plants.

[3]

3 Scientists measured the growth in humans and a species of tree over 80 years.

A sample size of five was used to calculate the mean height.

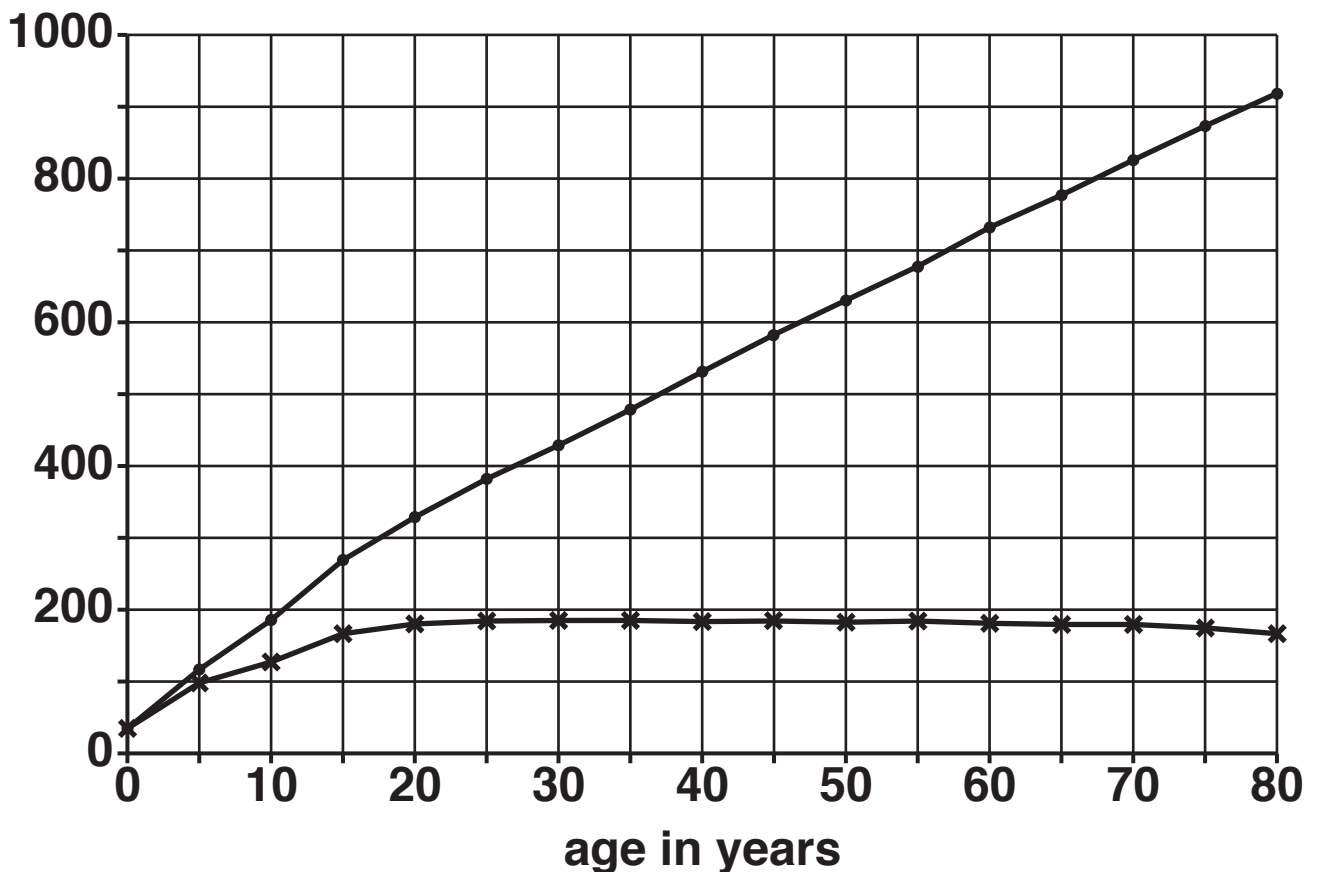
This was done every five years up to 80 years.

Look at the graph, it shows their results.

KEY

* human — tree

mean height in cm



(a) Growth can be measured by:

length or height

wet mass

dry mass.

Write about the advantages and disadvantages of each method, stating which is normally the BEST one to use.

Explain why measuring growth by height was used in THIS example.



The quality of written communication will be assessed in your answer to this question.

[6]

(b) Look at the graph opposite.

It shows the percentage of the total gain in growth from birth to 20 years of age of three different areas of the human body A, B and C.

(i) The table below shows the rate of increase over the first six years for areas B and C.

Area	Rate of increase in percent per year
A	
B	7.5
C	1.7

Calculate the rate of increase over the first SIX years for area A.

answer = _____ percent per year [1]

(ii) Write A, B and C in the correct boxes to show which areas of the body each line on the graph represents.

brain

☐

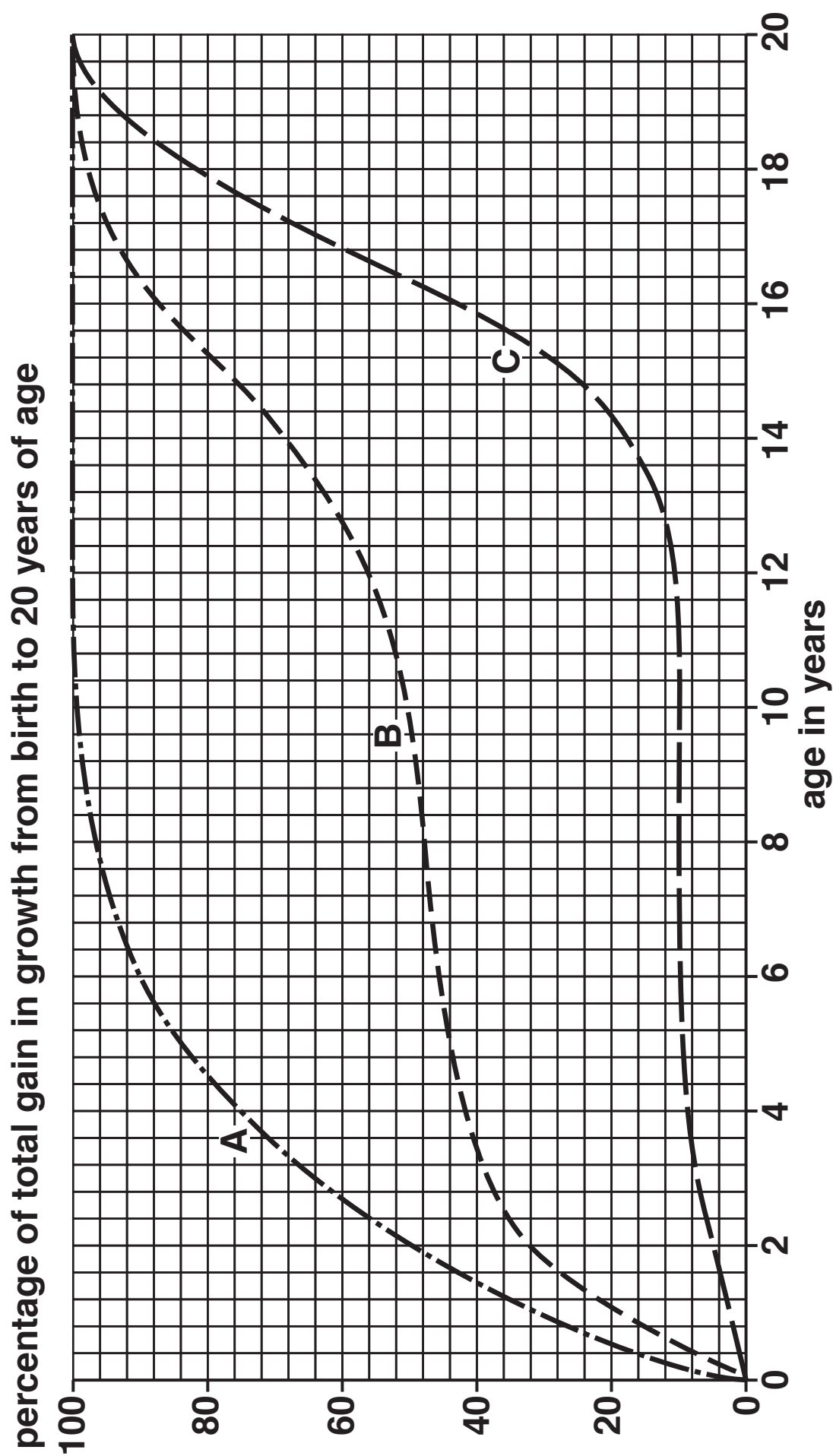
reproductive system

☐

whole body mass

☐

[2]



SECTION B – Module C3

4 Magnesium, Mg, reacts with hydrochloric acid, HCl.

Hydrogen, H₂, and magnesium chloride, MgCl₂, are made.

(a) Write the BALANCED SYMBOL equation for the reaction.

_____ [2]

(b) Peter adds 0.10 g of magnesium powder to 25.0 dm³ of dilute hydrochloric acid.

The mean (average) rate of this reaction is 50 cm³ of hydrogen per minute.

(i) Estimate the total volume of hydrogen made in the first 3 minutes.

volume of hydrogen = _____ cm³ [1]

- (ii) Peter repeats this experiment but uses magnesium lumps instead of powder.

The average rate of reaction is 10 cm^3 of hydrogen per minute.

Use the reacting particle model to explain why.

[2]

- 5 Hydrogen peroxide solution, H_2O_2 , breaks down to make water, H_2O , and oxygen, O_2 .



(a) Mass is conserved during a chemical reaction.

- (i) Calculate the relative formula masses, M_r , of hydrogen peroxide, water and oxygen.

The relative atomic mass of H = 1 and of O = 16.

M_r of hydrogen peroxide _____

M_r of water _____

M_r of oxygen _____ [1]

- (ii) Use these relative formula masses to show that mass is conserved during the chemical reaction. Show your working in the space below. [1]

(b) What mass of oxygen, O_2 , can be made from 680 g of hydrogen peroxide, H_2O_2 ?

The relative atomic mass of H = 1 and of O = 16.

[2]

mass of oxygen = _____ g

6 Pharmaceutical drugs are often made in a BATCH process.

Chemicals such as ammonia are made in a CONTINUOUS process.

(a) Explain why batch processes are often used to make pharmaceutical drugs.

[1]

(b) New pharmaceutical drugs are often expensive to make and develop.

Explain why.

[2]

- (c) One way to test if a pharmaceutical drug is pure is to find its melting point.

Sarah finds the melting point of five different samples of a pharmaceutical drug.

Look at her results.

Sample	Melting point in °C
A	152
B	153–158
C	155
D	155–157
E	157–160

Sarah knows that a pure sample of the pharmaceutical drug has a melting point of 157°C.

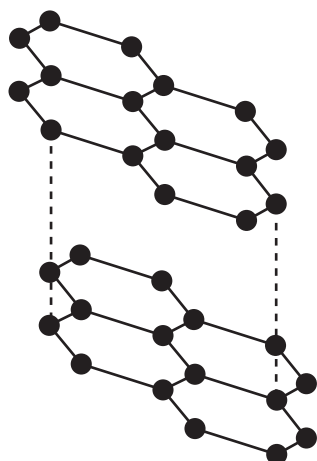
Sarah concludes that sample E is the purest sample of the drug.

Do the results support her conclusion?

Explain your answer using evidence from the table.

[2]

7 Graphite is a form of carbon that is used as a lubricant.



Explain in terms of structure and bonding, why graphite conducts electricity and has a high melting point.

Explain, in terms of properties, why graphite is used as a lubricant.



The quality of written communication will be assessed in your answer to this question. [6]

- 8 Magnesium carbonate breaks down to make magnesium oxide.**



- (a) Ali heats 90.0 g of magnesium carbonate and makes 27.0 g of magnesium oxide.**

He predicts he should make 42.9 g of magnesium oxide.

Calculate his percentage yield in the space below.

Write your answer to THREE significant figures.

percentage yield = _____ % [2]

- (b) The table shows the relative formula masses of the compounds in the equation.

Compound	Relative formula mass, M_r
MgCO_3	84
MgO	40
CO_2	44

Calculate the atom economy for the reaction to make magnesium oxide in the space below.

Carbon dioxide, CO_2 , is a waste product.

Write your answer to TWO significant figures. [2]

atom economy = _____ %

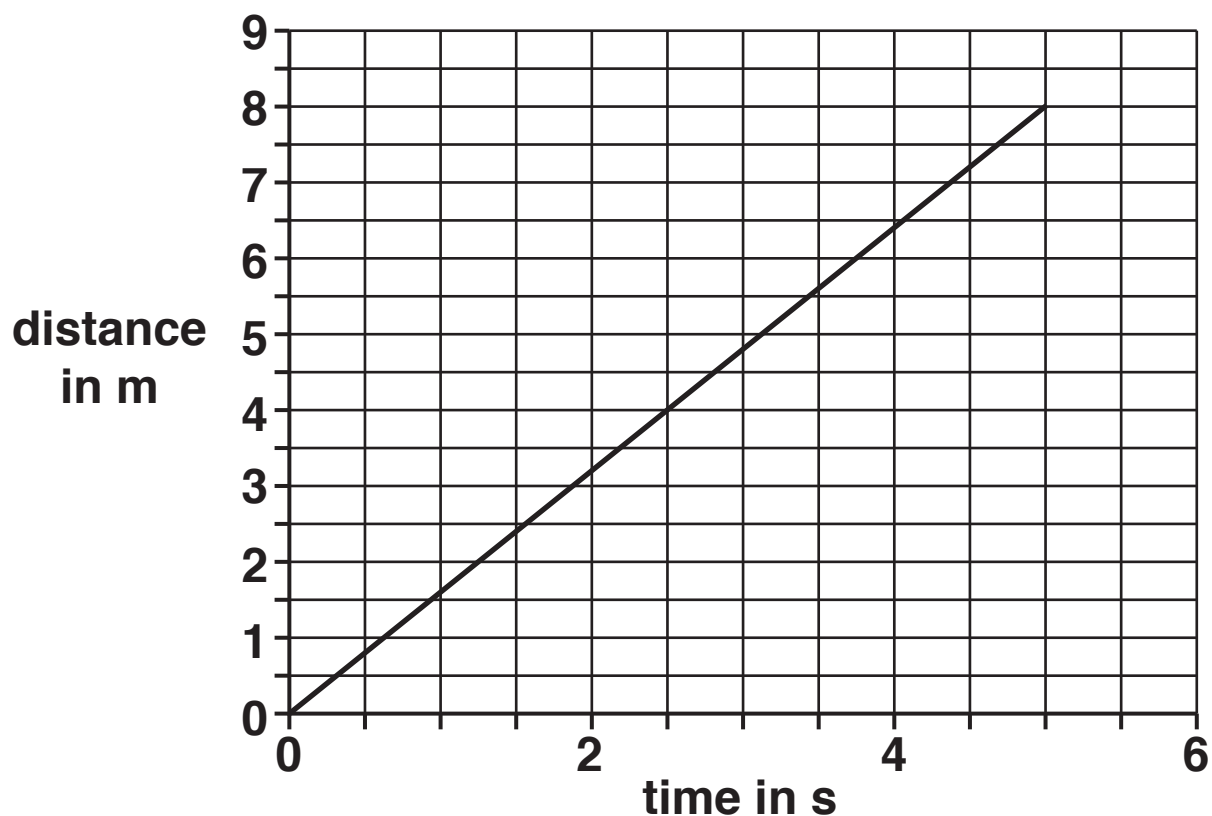
- (c) The reaction does NOT have a 100% atom economy.

Why do reactions in industrial processes need to have as high an atom economy as possible?

_____ [1]

SECTION C – Module P3

- 9 (a) Pedro draws a distance-time graph for a moving object.



What does the gradient of Pedro's graph show?

Choose from

acceleration

distance

speed

time

answer _____ [1]

(b) What can cause acceleration?

Put a tick (✓) next to the BEST answer.

A change in direction only.

☐

A change in speed only.

☐

**A change in speed, direction or
speed and direction.**

☐

A change in speed or direction.

☐

[1]

(c) Look at the diagram of car A and car B.

CAR A



speed of CAR A = 10 m/s

CAR B



speed of CAR B = 15 m/s

(i) What is the relative velocity of the cars?

Choose from

5 m/s

10 m/s

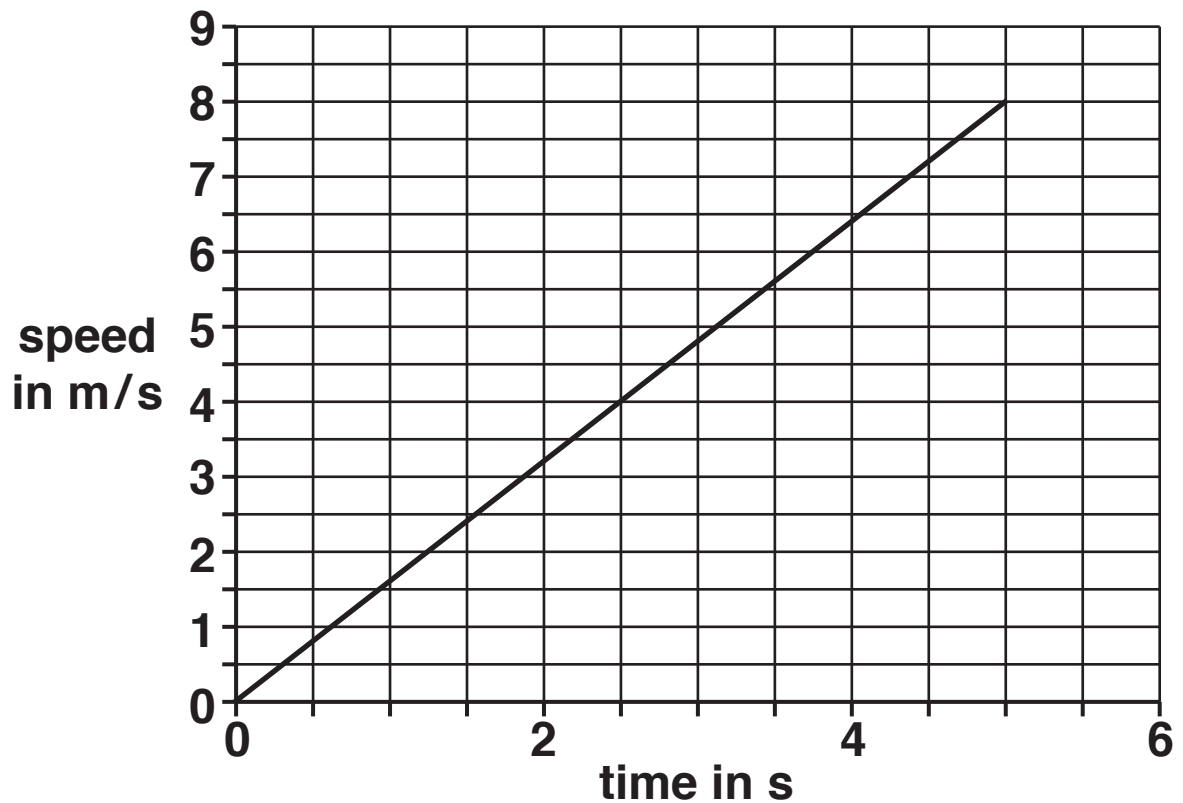
15 m/s

20 m/s

Answer _____

[1]

- (ii) Pedro draws a speed-time graph for a different car.



Use the graph to calculate the distance this car travels in 5 seconds.

answer = _____ m [2]

- (iii) The car decelerates at 4 m/s^2 from 5 seconds to 6 seconds.

Draw a line on the graph to show this deceleration. [1]

10 Sanjay learns about forces and planets.

He collects information about the weight of the same object on different planets.

Planet	Mass of object in kg	Weight and force to lift the object in N	Work done to lift the object in J
Mercury	1	3.8	76
Venus	1	8.8	176
Earth	1	10.0	200
Mars	1	3.9	78

- (a) The object has the same mass on each planet but has a different weight.

Why does the object have a different weight on each planet?

[1]

- (b) It takes different amounts of work to lift the object on different planets.**

The same object has been lifted the same distance on each planet.

Use the information in the table to calculate this distance using the space below. [2]

answer = _____ m

- (c) A different object has a weight of 175 N.**

Use the information in the table to calculate the mass of this object on MARS using the space below.

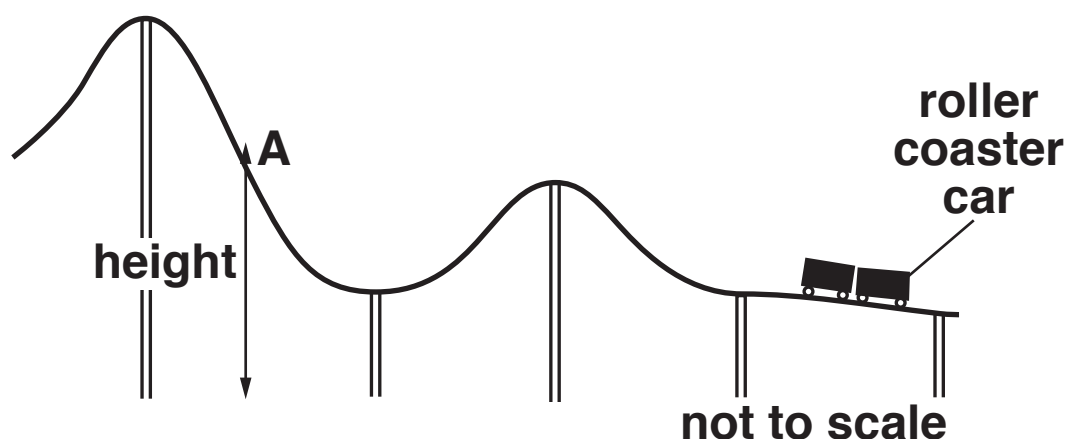
Give your answer to 2 significant figures. [3]

answer = _____ kg

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11 Kylie and Laura ride in a roller coaster car.

The diagram shows the girls in the roller coaster car at the end of the ride.



Laura has a mass of 80 kg.

Kylie has a mass of 40 kg.

Kylie's height above the ground at A is 31.25 m.

At A Kylie's kinetic energy (KE) is EQUAL to her gravitational potential energy (GPE).

$$g = 10 \text{ m/s}^2$$

Describe the difference between Kylie's KE and Laura's KE at A.

Use the information about Kylie to calculate her velocity at A.



The quality of written communication will be assessed in your answer to this question.

[6]

12 (a) Look at the diagram opposite.

George finds information on the internet about stopping distances.

- (i) The speed of a car increases from 30 mph to 60 mph.**

Use the data to describe what happens to the THINKING DISTANCE.

[2]

- (ii) A car travels at 70 mph on the motorway.**

It is 10 m behind the car in front of it.

Explain what happens if the car in front of it brakes suddenly.

Use data from the information in your answer.

[3]

Typical Stopping Distances


KEY



 thinking distance



 braking distance



average car length = 4 metres

20 mph  
6 metres 6 metres
= 12 metres (40 feet) or 3 car lengths

30 mph  
9 metres 14 metres
= 23 metres (75 feet) or 6 car lengths

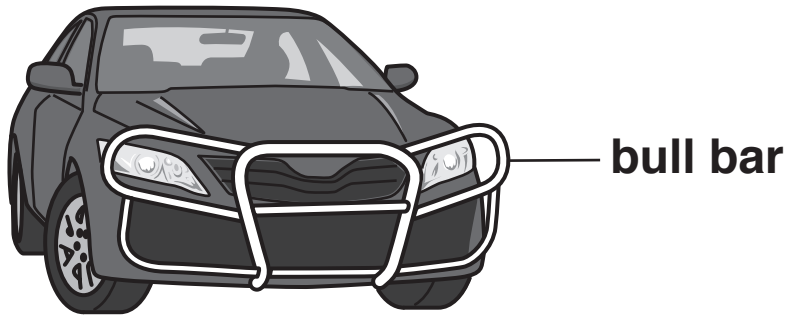
40 mph  
12 metres 24 metres
= 36 metres (120 feet) or 9 car lengths

50 mph  
15 metres 38 metres
= 53 metres (175 feet) or 13 car lengths

60 mph  
18 metres 55 metres
= 73 metres (240 feet) or 18 car lengths

70 mph  
21 metres 75 metres
= 96 metres (315 feet) or 24 car lengths

(b) Some cars are fitted with bull bars.



Describe the risks and benefits of fitting bull bars for DIFFERENT types of road users.

[2]

END OF QUESTION PAPER

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