



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

CANDIDATE  
NAME

CENTRE  
NUMBER

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**COMBINED SCIENCE**

**5129/21**

Paper 2

**October/November 2011**

**2 hours 15 minutes**

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.

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

**For Examiner's Use**

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This document consists of **19** printed pages and **1** blank page.



- 1 Three samples of human blood **A**, **B** and **C**, are mixed with three salt solutions of different concentrations.

The blood samples are then observed under the microscope.

The results are shown in Fig. 1.1

blood sample	observations
<b>A</b>	cells are small and wrinkled
<b>B</b>	cells are normal in size and shape
<b>C</b>	no cells can be seen

**Fig. 1.1**

- (a) What type of blood cell would be seen in the largest numbers in each of the samples **A** and **B**?

..... [1]

- (b) Which blood sample is mixed with the most concentrated salt solution?

..... [1]

- (c) Explain the observation for blood sample **C**.

.....  
.....  
.....  
.....  
..... [2]

2 A cyclist travels along a road.

Fig. 2.1 shows how the speed of the cyclist varies with time.

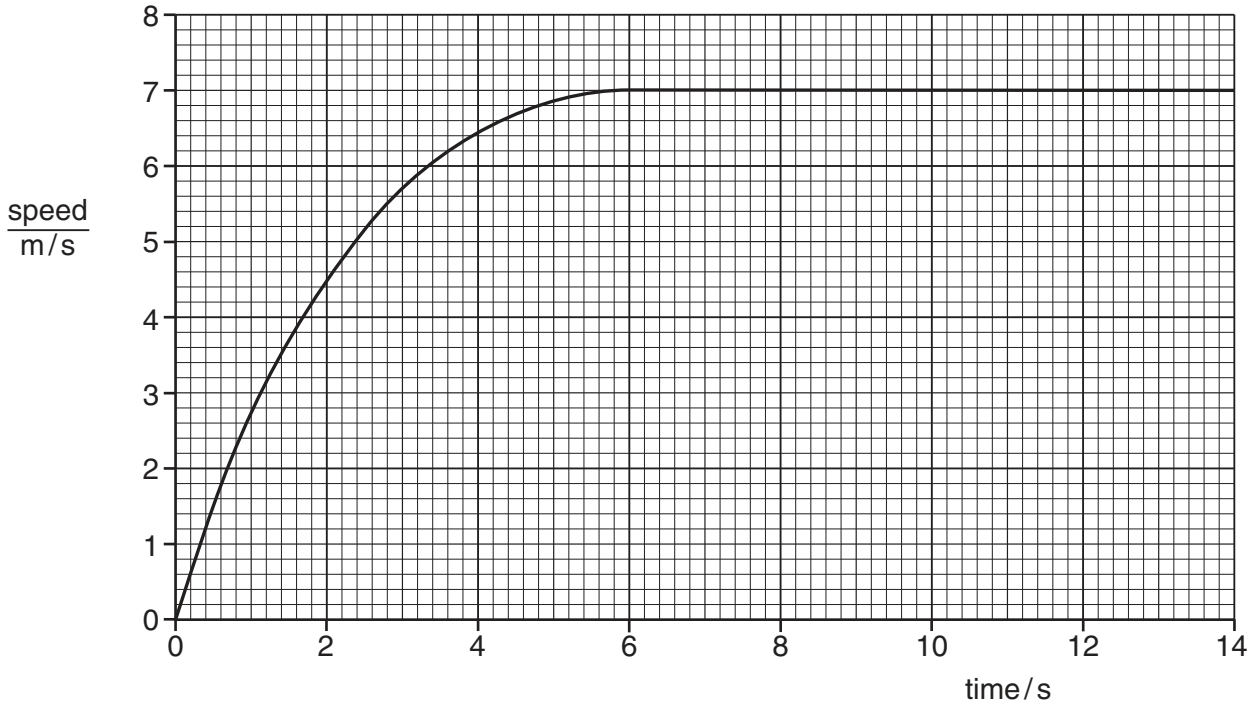


Fig. 2.1

(a) Explain the difference between speed and velocity.

..... [1]

(b) Use Fig. 2.1 for the following.

(i) Complete the following sentence.

The acceleration of the cyclist is zero from

..... seconds to ..... seconds. [1]

(ii) Calculate how far the cyclist travels between the times of 9 seconds and 13 seconds.

distance = ..... m [2]

(c) Further along the road, the cyclist stops the bicycle.

Complete the following sentence about energy.

As the cyclist uses the brakes, ..... energy is converted

into ..... energy. [2]

3 Methane is a hydrocarbon.

(a) State the name of the homologous series to which methane belongs.

.....

[1]

(b) Methane is used as a fuel.

The equation for the combustion of methane is



The relative molecular mass  $M_r$  of methane is 16.

[ $A_r$ : C, 12; O, 16]

Complete the following sentences.

16 g of methane reacts with ..... g of oxygen and produces ..... g of carbon dioxide.

1.6 g of methane reacts with ..... g of oxygen and produces ..... g of carbon dioxide.

0.4 g of methane produces ..... g of carbon dioxide.

[4]

(c) State the test for oxygen.

test .....

result .....

.....

[2]

4 Complete Fig. 4.1.

particle	relative mass	relative charge
proton	1	
neutron		
electron	negligible	-1

Fig. 4.1

[3]

5 Fig. 5.1 shows the structure of the heart in section as seen from the front.

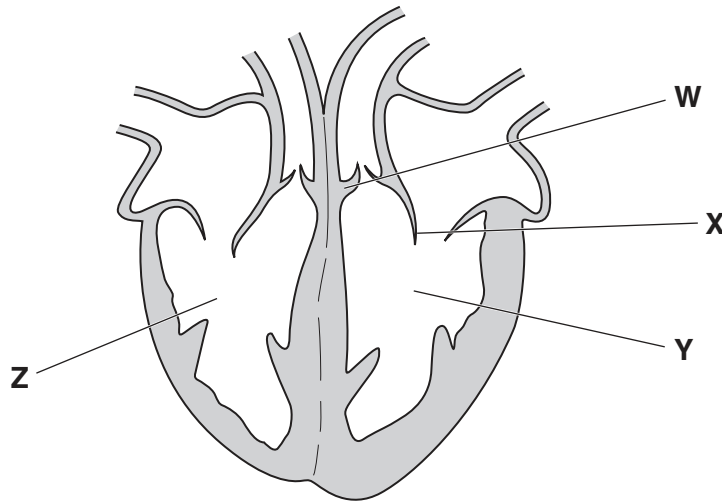
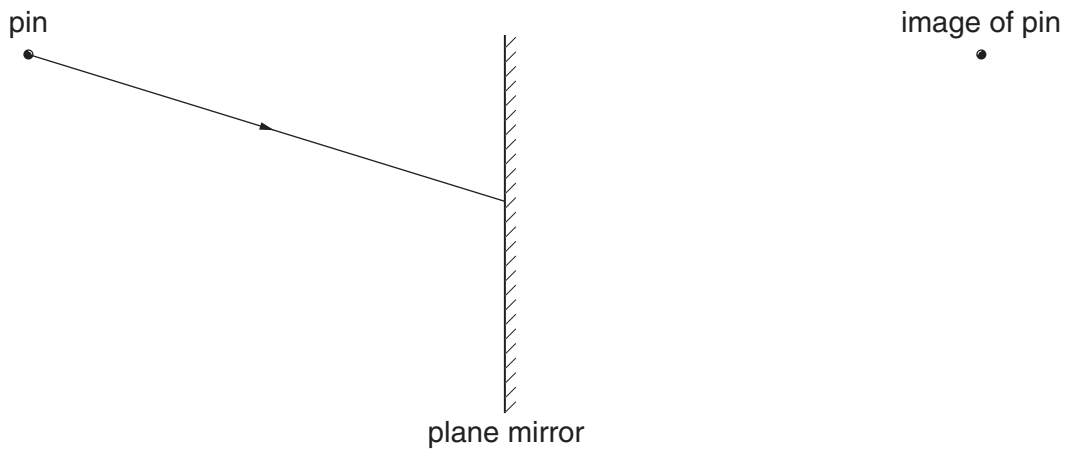


Fig. 5.1

- (a) What type of tissue is the heart mainly composed of?  
 ..... [1]
- (b) When the chamber labelled **Y** contracts, what happens to
- (i) valve **W**, ..... [1]
- (ii) valve **X**? ..... [1]
- (c) When chamber **Z** contracts, what effect does this have on the blood in that chamber?  
 .....  
 .....  
 .....  
 ..... [2]
- (d) How does the composition of the blood in chamber **Z** differ from that in chamber **Y**?  
 .....  
 .....  
 ..... [2]

- 6 A pupil places a pin in front of a plane mirror so that he can see an image of the pin. Light from the pin is incident on the plane mirror as shown in Fig. 6.1. The position of the image of the pin is also shown.



**Fig. 6.1**

- (a) On Fig. 6.1 draw
- (i) the normal where the ray is incident on the mirror, [1]
  - (ii) the reflected ray. [1]
- (b) The pin is moved to the right, towards the mirror.  
How does the position of the image of the pin move?  
.....[1]
- (c) Light is an example of a transverse wave.  
Name an example of a longitudinal wave.  
..... [1]

7 Chlorine is a diatomic gas in Group VII of the Periodic Table.

(a) Complete Fig. 7.1 to show the outer shell electrons in a molecule of chlorine.

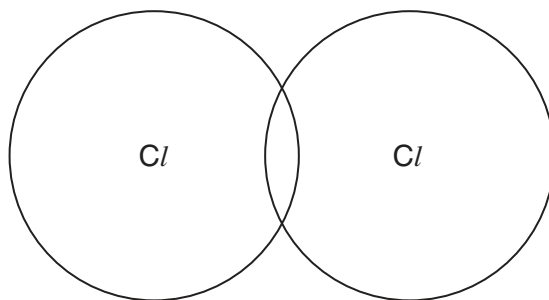


Fig. 7.1

[2]

(b) State how the boiling point of the elements in Group VII changes as the group is descended.

..... [1]

(c) State **one** industrial use of chlorine.

..... [1]

(d) Fig. 7.2 shows chlorine being bubbled into potassium iodide solution.

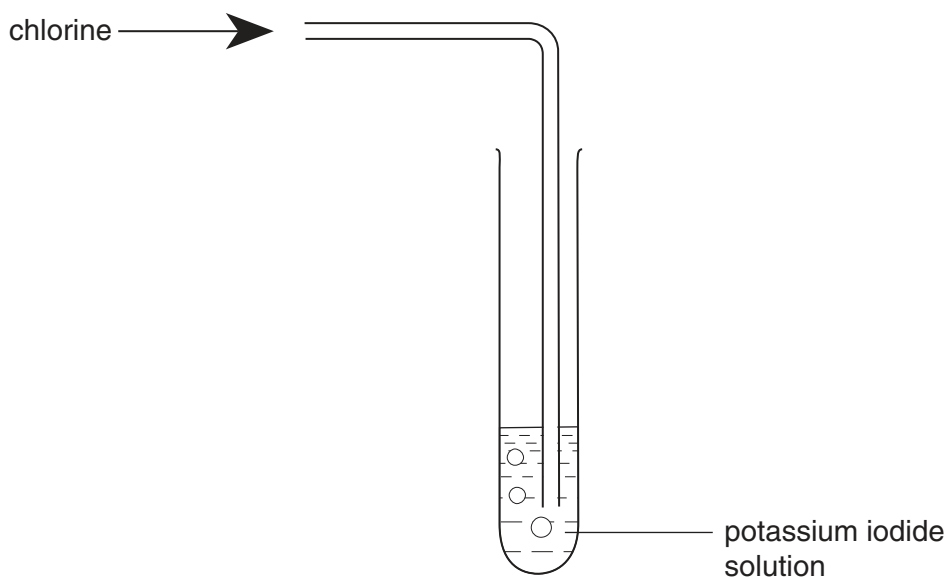


Fig. 7.2

State the names of the **two** products of the reaction between chlorine and potassium iodide.

..... and ..... [2]

8 (a) There are four types of birth control – natural, chemical, mechanical and surgical.

(i) On Fig. 8.1, draw a line to match each birth control method to its type. One has been done for you.

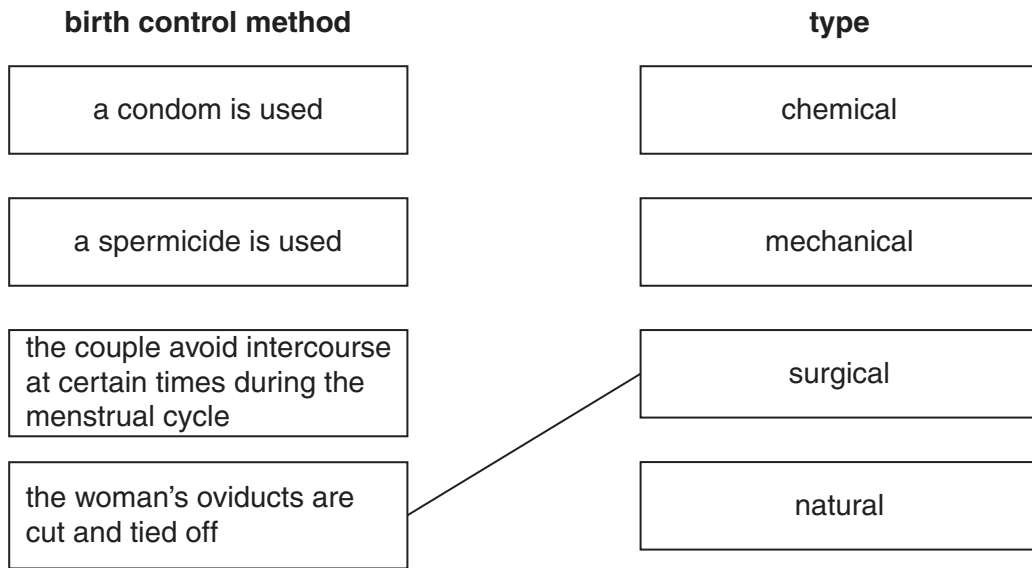


Fig. 8.1

[3]

(ii) Name a birth control method that depends on the use of hormones.

..... [1]

(iii) Which method of birth control helps to protect against HIV infection? Explain how.

method .....

explanation .....

..... [2]

(b) Describe **two** advantages for the baby of breast-feeding instead of bottle-feeding.

1. ....

.....

2. ....

..... [2]



9 A circuit contains a cell, a lamp, an ammeter and a variable resistor all connected in series.

(a) In the space below, draw a diagram of this circuit.

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[3]

(b) When the current in the lamp is 0.2 A, the potential difference across the lamp is 1.8 V.

Calculate

(i) the resistance of the lamp,

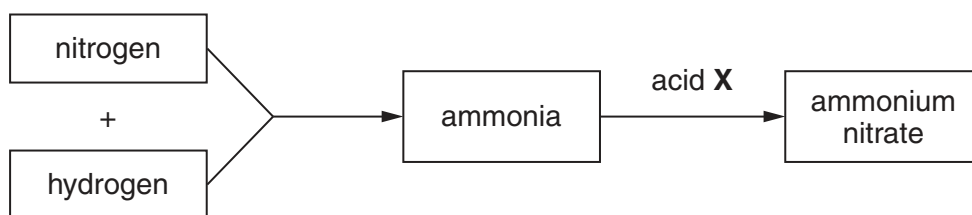
resistance = ..... unit ..... [3]

(ii) the power of the lamp.

power = ..... W [2]

10 Study the following reaction scheme.

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- (a) (i) Name the catalyst used to speed up the reaction between nitrogen and hydrogen in the manufacture of ammonia.

..... [1]

- (ii) Balance the equation for the formation of ammonia.



- (iii) Ammonia solution turns Universal Indicator blue. Suggest the pH of the solution.

..... [1]

- (b) Name acid X and state the type of reaction that occurs between acid X and ammonia.

acid X ..... [1]

type of reaction ..... [1]

11 (a) Define an *enzyme*.

.....  
.....  
.....[2]

(b) Fig. 11.1 shows the effect of pH on the activity of the enzyme amylase at two different temperatures.

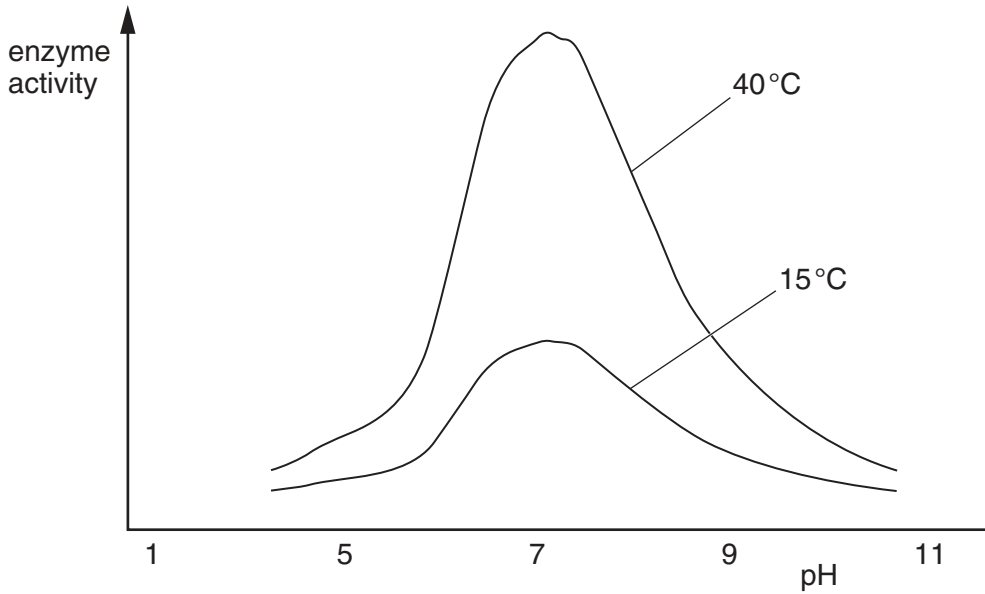


Fig. 11.1

Use Fig. 11.1 to describe how this enzyme's activity is affected by

- (i) temperature, .....
- .....
- .....
- (ii) pH. ....
- .....
- .....

[2]

(c) On Fig. 11.1, draw a line to show the effect of pH on the activity of the enzyme at 100°C. [1]

12 A copper saucepan containing cold water is heated as shown in Fig. 12.1.

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Use

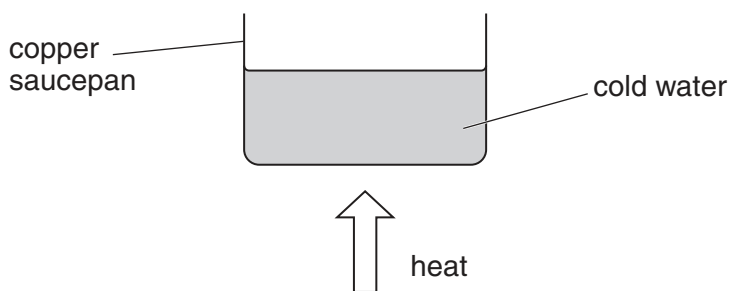


Fig. 12.1

(a) Name the process by which heat is transferred through the copper.

..... [1]

(b) The water at the bottom of the saucepan is heated.

Explain how the rest of the water becomes hot.

.....  
 .....  
 .....  
 ..... [3]

(c) The hot water is placed in a container that is then sealed with a cork. The water is required to stay warm for as long as possible.

State the advantage of

(i) using a plastic container rather than a metal container,

..... [1]

(ii) using a white, rather than black, outer surface for the container.

..... [1]

13 The following is a list of apparatus.

<b>balance</b>	<b>measuring cylinder</b>	<b>condenser</b>
<b>filter funnel</b>	<b>burette</b>	<b>pipette</b>
		<b>thermometer</b>

For  
Examiner's  
Use

(a) From the list, name one piece of apparatus which **must** be used when each of the following experiments is carried out.

Each piece of apparatus may be used once, more than once or not at all.

(i) distilling a mixture of ethanol and water ..... [1]

(ii) separating mud from muddy water ..... [1]

(iii) finding the volume of a liquid ..... [1]

(b) From the list, complete the following sentence.

During a titration experiment, an alkali is measured into a conical flask using a

..... and an acid is added to the alkali using a

..... [2]

14 Fig. 14.1 shows an alveolus in the lungs.

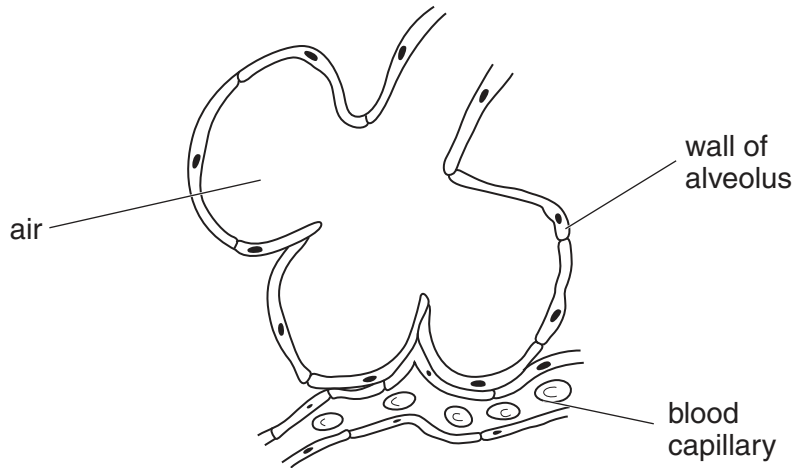


Fig. 14.1

(a) State **two** ways in which the structure of alveoli allows the efficient exchange of gases between blood and air.

- 1. ....
- .....
- 2. ....
- .....

[2]

(b) Name a substance that is excreted through the alveoli.

..... [1]

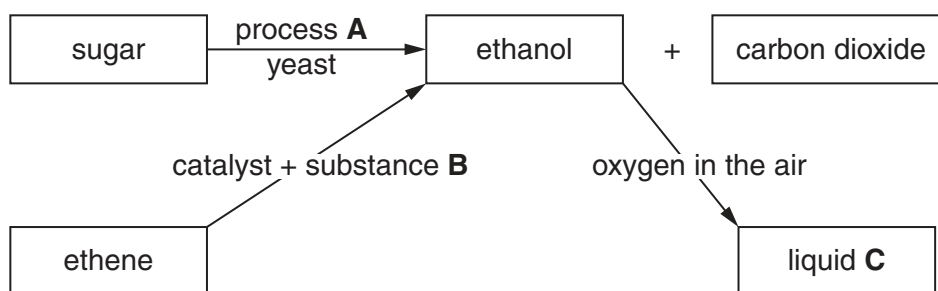
(c) Explain why air pollution by smoke or soot causes the alveoli to be less efficient for gas exchange.

- .....
- .....
- .....
- .....

[2]

15 Study the following reaction scheme.

For  
Examiner's  
Use



(a) Name

(i) process A, ..... [1]

(ii) substance B, ..... [1]

(iii) liquid C. .... [1]

(b) State the name of the substances, present in yeast, which cause process A to occur.

..... [1]

(c) Complete the following sentences.

Ethene is made into poly(ethene) by a process known as .....  
polymerisation.

The ethene molecules are known as the ..... units. [2]

16 (a) State a test to show the difference between magnetic and non-magnetic materials.

.....  
..... [1]

(b) Iron and steel are both magnetic materials.

Describe a difference between the magnetic properties of iron and steel.

.....  
..... [1]

17 A spacecraft has a mass of 50 000 kg and the accelerating force is 225 000 N.

(a) Calculate the acceleration of the spacecraft.

acceleration = ..... units ..... [3]

(b) The spacecraft is ejecting exhaust gases. The accelerating force does not change but the acceleration increases.

Explain why the acceleration increases.

.....  
..... [1]



18 Fig. 18.1 shows a food chain.



For  
Examiner's  
Use

Fig. 18.1

(a) A food chain shows the energy flow in an ecosystem.

In this food chain, how does the amount of energy in the cheetahs compare with the amount of energy in the grass?

.....  
.....[1]

(b) There are fewer cheetahs than wildebeest.

Use ideas of energy flow in food chains to explain why.

.....  
.....  
.....  
.....[2]

(c) What type of organisms, important in the ecosystem, are not shown in this food chain?

.....[1]

19 Fig. 19.1 shows the arrangement of the electrons in the atoms of six different elements, **R–W**.

The letters are not the chemical symbols of the elements.

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Use

atom	<b>R</b>	<b>S</b>	<b>T</b>	<b>U</b>	<b>V</b>	<b>W</b>
electron arrangement	2,8,6	2,8,4	2,6	2,8,8	2,7	2,2

**Fig. 19.1**

Use the letters in Fig. 19.1 to answer the following questions.

Each letter may be used once, more than once or not at all.

- (a) Which element has an atomic number 14? ..... [1]
- (b) Which element has a nucleon number 16 and has an isotope that contains 8 neutrons?  
..... [1]
- (c) Which **two** elements are in the same group of the Periodic Table?  
..... and ..... [2]
- (d) Which element does **not** form an acidic oxide? ..... [1]

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**DATA SHEET**  
**The Periodic Table of the Elements**

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\* 58–71 Lanthanoid series  
† 90–103 Actinoid series

**Key**

a	<b>X</b>
	b

a = relative atomic mass  
X = atomic symbol  
b = atomic (proton) number

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).