UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

5582760062

COMBINED SCIENCE **0653/32**

Paper 3 (Extended) **October/November 2011**

1 hour 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, tables 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 24.

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	
1	
2	
3	
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7	
8	
9	
Total	

This document consists of **22** printed pages and **2** blank pages.

For Examiner's Use

1 Coral reefs are found in shallow seawater. Limestone is a common type of rock found in the Earth's crust. Both coral reefs and limestone are made mainly of the ionic compound, calcium carbonate.

1 (a) A student uses the apparatus shown in Fig. 1.1 to test a rock sample to discover whether or not it is limestone. 0653/32/O/N/11

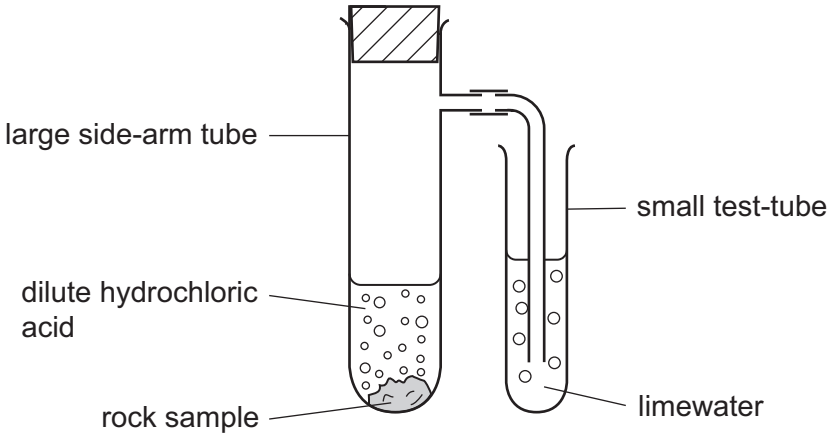

Fig. 1.1

The student observed that a gas was given off and that the limewater in the small test-tube became cloudy.

1 a (i) Name the gas that was given off. ..... [1]
0653/32/O/N/11

1 a (ii) Explain whether or not the student gained enough evidence from the result of his test to show that the rock sample is made of limestone. 0653/32/O/N/11

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..... [2]

1 (b) In recent years, the amount of carbon dioxide in the atmosphere has increased. This has contributed to a decrease in the average pH of seawater. 0653/32/O/N/11

During this period, many coral reefs have become weakened and damaged.

1 b (i) Explain why increased levels of carbon dioxide in the atmosphere could cause the average pH of the sea to decrease. 0653/32/O/N/11

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..... [2]

1 b (ii) Suggest why a decrease in the average pH of seawater could damage coral reefs.

0653/32/O/N/11

For Examiner's Use

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..... [1]

For Examiner's Use

2 Most cells obtain energy from carbohydrates and other nutrients by aerobic respiration.

0653/32/O/N/11

2 (a) Write the word equation for aerobic respiration.

.....

[2]

2 (b) Describe how oxygen is transported from the lungs to a cell in a human muscle.

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[2]

2 (c) When a person runs, muscles generate heat energy, which increases the body temperature. Body temperature can be lowered by sweating.

0653/32/O/N/11

The core temperature of an athlete was measured as she ran steadily for 120 minutes, drinking no fluids while running. She repeated the run the next day, but this time drank fluids throughout the run. The environmental temperature and humidity were the same on both days.

The results are shown in Fig. 2.1.

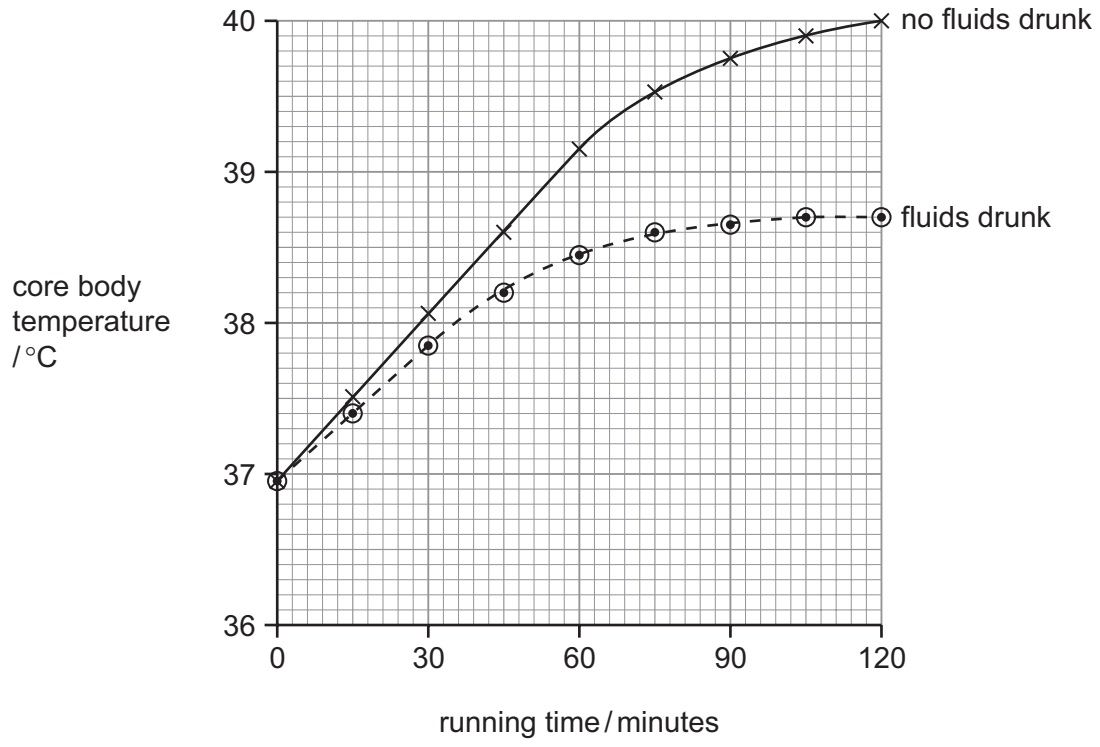

Fig. 2.1

For Examiner's Use

2 c (i) Explain how sweating can reduce body temperature. 0653/32/O/N/11

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..... [2]

2 c (ii) Compare the body temperature of the athlete when she ran without drinking fluids to her body temperature when she ran while drinking fluids. 0653/32/O/N/11

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..... [2]

2 c (iii) Suggest an explanation for the differences you have described in **(ii)**. 0653/32/O/N/11

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..... [2]

For Examiner's Use

3 Yaks are animals that live in the cold mountainous region of the Himalayas.

0653/32/O/N/11

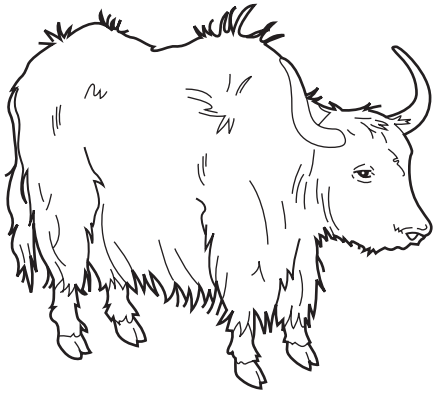

Fig. 3.1

Fig. 3.1 shows a yak.

3 (a) Explain how the long hair of the yak keeps it warm during the cold weather.

0653/32/O/N/11

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..... [2]

3 (b) Yak dung is commonly burned as a fuel in the Himalayas. However, it is slowly being replaced by kerosene.

0653/32/O/N/11

State and explain **one** environmental reason why yak dung is a better fuel to use than kerosene.

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..... [2]

For Examiner's Use

3 **(c)** Yaks communicate with each other using low frequency sounds that humans can hear.

3 c (i) Suggest a possible frequency for this sound. 0653/32/O/N/11

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[1]

3 c (ii) Explain what is happening when this sound travels through the air. You may use a diagram to help you answer this question. 0653/32/O/N/11

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[2]

4 Nordic gold is an alloy of four metals used to make coins. 0653/32/O/N/11

For Examiner's Use

Table 4.1 shows information about the metals contained in Nordic gold.

Table 4.1

metal	% by mass in Nordic gold	compound from which the metal is extracted
aluminium	5	Al_2O_3
copper	89	$CuFeS_2$
tin	1	SnO_2
zinc	5	ZnS

4 (a) In the right hand column, the elements present in compounds can be identified by their symbols. 0653/32/O/N/11

Name a metallic element present in one of the compounds in Table 4.1 which is **not** present in Nordic gold.

..... [1]

4 (b) The method used to extract a metal from its compound depends on the reactivity of the metal. 0653/32/O/N/11

4 b (i) Tin may be extracted from tin oxide, SnO_2, by heating a mixture of tin oxide and carbon. The other product of this reaction is carbon monoxide, CO. 0653/32/O/N/11

Construct a balanced, symbolic equation for this reaction.

..... [2]

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4 b (ii) When aluminium oxide is heated with carbon, no reaction occurs.

Explain why it is possible to extract tin but **not** aluminium by heating their oxides with carbon.

0653/32/O/N/11

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4 b (iii) Aluminium is extracted from the insoluble compound aluminium oxide by electrolysis. 0653/32/O/N/11

Outline the stages by which solid aluminium oxide, containing aluminium **ions**, is converted into metallic aluminium, made of aluminium **atoms**, using electrolysis.

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..... [3]

4 (c) (i) Calculate the formula mass of the compound, $CuFeS_2$. 0653/32/O/N/11

Show your working.

..... [1]

4 c (ii) A coin made of Nordic gold has a mass of 7.80 g. 0653/32/O/N/11

Calculate the mass of copper in the coin.

Show your working.

..... [1]

5 Fig. 5.1 shows a flower from a sugar cane plant. 0653/32/O/N/11

For Examiner's Use

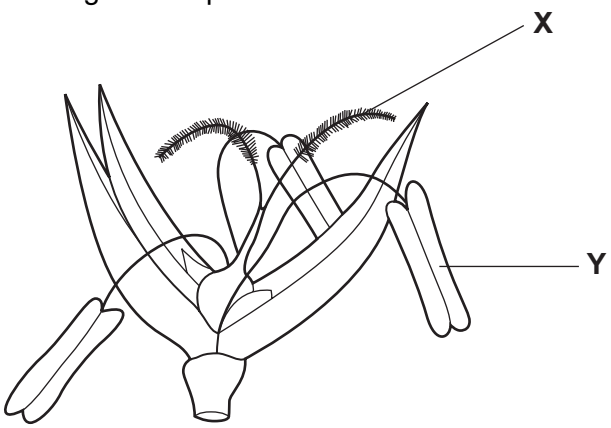

Fig. 5.1

5 (a) (i) Name the parts labelled **X** and **Y**. 0653/32/O/N/11

X .....

Y ..... [2]

5 a (ii) Describe **two** features of the sugar cane flower which indicate that it is wind-pollinated. 0653/32/O/N/11

1 .....

2 ..... [2]

5 a (iii) Flowers are involved in sexual reproduction. 0653/32/O/N/11

State **two** ways in which sexual reproduction differs from asexual reproduction.

1 .....

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2 .....

..... [2]

5 (b) In many parts of the world, fields of sugar cane are burned before harvesting. Burning the sugar cane plants releases nitrogen oxides into the air. 0653/32/O/N/11

Explain how this could harm the environment.

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..... [3]

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Please turn over for Question 6.

For Examiner's Use

6 Sea anemones are animals that live attached to rocks or the sea bed. Fig. 6.1 shows a section through a sea anemone.

0653/32/O/N/11

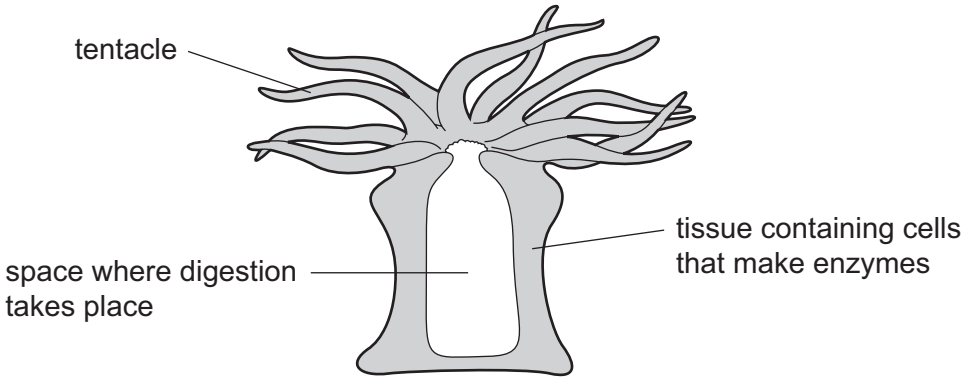

Fig. 6.1

6 (a) Explain the meaning of the term *tissue*. 0653/32/O/N/11

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..... [2]

6 (b) Sea anemones feed by capturing small animals with their tentacles. The tentacles push the small animal into the space in the middle of the body. The cells lining the space secrete enzymes, which digest the animal. 0653/32/O/N/11

6 b (i) One of the enzymes that is secreted is protease. This breaks down large molecules to small, soluble molecules. 0653/32/O/N/11

State the name of

the large molecules that are broken down by protease,

.....

the small, soluble molecules produced.

..... [2]

6 b (ii) Because sea anemones are small, they do not need a blood system to transport nutrients to all the different cells in their body.

Suggest how the small, soluble molecules produced by digestion can spread to all the cells in the sea anemone's body.

0653/32/O/N/11

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..... [2]

For Examiner's Use

6 (c) Sea anemones usually stay firmly fixed to rocks. Because sea anemones do not move around, some people think they are plants.

A student looks at a small part of a sea anemone through a microscope.

Suggest what the student would observe that would show that a sea anemone is an animal and not a plant.

0653/32/O/N/11

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..... [2]

7 Fig. 7.1 shows an electric hairdryer. 0653/32/O/N/11

For Examiner's Use

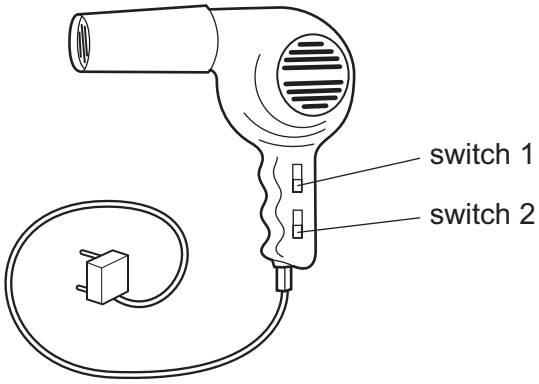

Fig. 7.1

7 **(a)** Fig. 7.2 shows the circuit diagram for the hairdryer. 0653/32/O/N/11

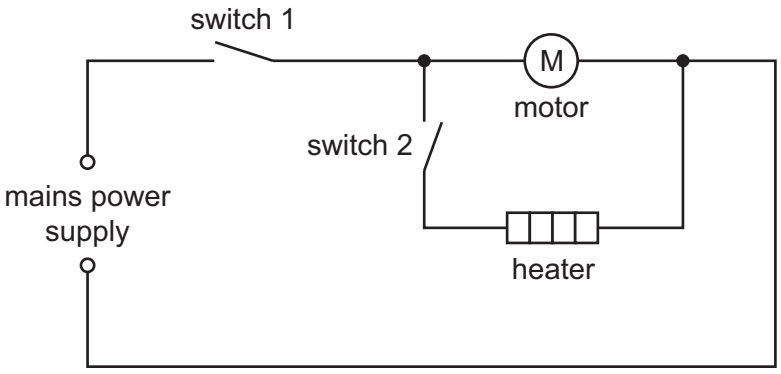

Fig. 7.2

7 **a (i)** State which of the switches must be closed (on) for the heater in the hairdryer to work. 0653/32/O/N/11

.....[1]

For Examiner's Use

7 a (ii) A student wanted to determine the resistance of the heater.

Fig. 7.3 shows the circuit he built to measure the current passing through the heater and the potential difference across the heater.

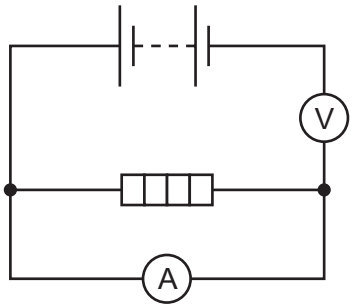

Fig. 7.3

His experiment did not work because his circuit was incorrect.

Draw the correct circuit in the space below.

[1]

7 (b) (i) The electricity used in the hairdryer was generated at a power station.

Power is transmitted from the power station over large distances.

0653/32/O/N/11

A high voltage is always used. Explain why.

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..... [1]

For Examiner's Use

7 b (ii) The high voltage is produced by a transformer.

Fig. 7.4 shows a diagram of a simple transformer.

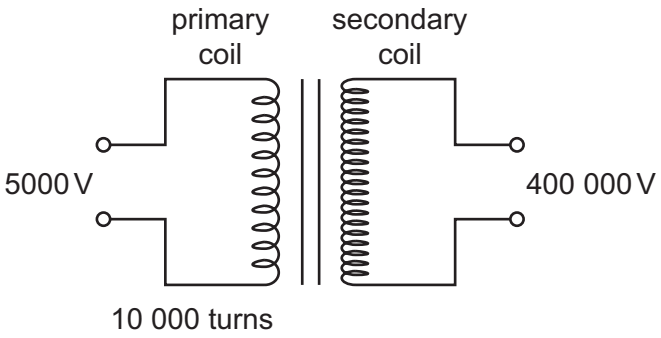

Fig. 7.4

Calculate the number of turns in the secondary coil.

State the formula that you use and show your working.

formula used

working

number of turns = ... [2]

7 b (iii) Explain how a transformer changes the voltage of an electrical supply. Your explanation should include the terms *induced voltage* and *magnetic field*.

0653/32/O/N/11

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For Examiner's Use

8 Hydrocarbons are compounds which contain only the elements hydrogen and carbon.

8 (a) The simplest hydrocarbon is methane, CH_4, which is an important fuel.

8 a (i) State **one** natural source of methane. 0653/32/O/N/11

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[1]

8 a (ii) A free (unbonded) carbon atom has four electrons in its outer shell.

State the number of electrons in the outer shell of a carbon atom in a methane molecule. Describe their arrangement.

You may wish to draw a diagram to help you answer this question.

0653/32/O/N/11

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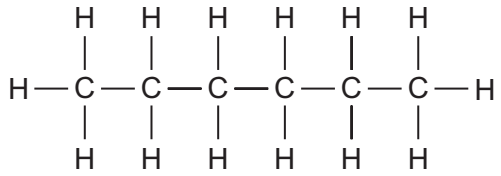
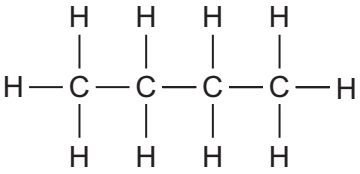
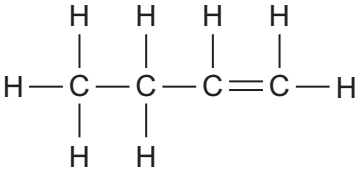
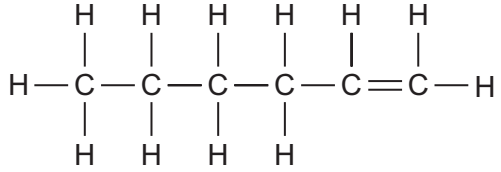
[2]

For Examiner's Use

8 (b) Table 8.1 shows the displayed formulae and boiling points of four hydrocarbons, **A**, **B**, **C** and **D**.

0653/32/O/N/11

Table 8.1

	displayed formula	boiling point / °C
A		69
B		−0.5
C		−6.3
D		63

8 b (i) Name a process which could be used to separate a mixture of the four compounds in Table 8.1.

0653/32/O/N/11

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[1]

8 b (ii) Use the information in Table 8.1 to suggest **one** way in which the boiling point of a hydrocarbon is affected by its molecular structure.

0653/32/O/N/11

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[2]

For Examiner's Use

8 b (iii) A bottle contains a colourless liquid which is thought to be either hydrocarbon **A** or **D**.

Describe a **chemical** test, and its result, which could be used to identify which hydrocarbon is in the bottle.

Explain your choice of test.

0653/32/O/N/11

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..... [3]

For Examiner's Use

9 (a) An aircraft has a mass of 400 000 kg. It has four engines each capable of producing a maximum force of 300 000 N.

0653/32/O/N/11

Calculate the maximum acceleration of the aircraft.

State the formula that you use and show your working.

formula

working

..... [3]

9 (b) Potato snacks are packed in airtight packets and filled with an unreactive gas at atmospheric pressure.

0653/32/O/N/11

9 b (i) Suggest why an unreactive gas is used, rather than air.

0653/32/O/N/11

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9 b (ii) A passenger has a packet of potato snacks in his hand luggage on the aircraft. During the flight, the aircraft cabin is at a pressure less than normal atmospheric pressure.

0653/32/O/N/11

The passenger notices that the packet has expanded.

Explain why this happens.

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..... [1]

For Examiner's Use

9 (c) A skydiver jumps from an aircraft and falls through the air. Eventually she reaches a constant terminal velocity. When she opens her parachute, her velocity decreases and she falls slowly to the ground. Fig. 9.1 shows how her velocity varies during the fall.

0653/32/O/N/11

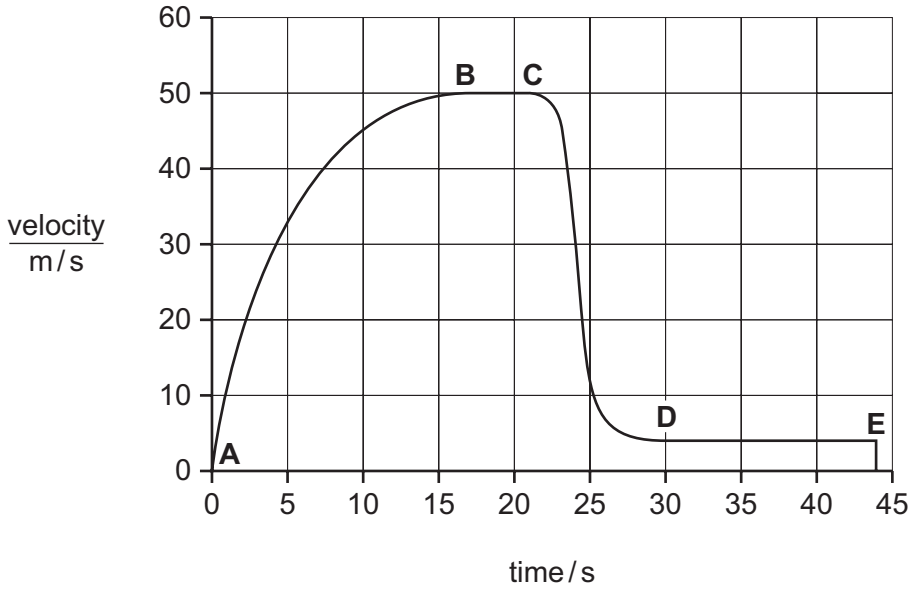

Fig 9.1

9 c (i) State the difference between speed and velocity. 0653/32/O/N/11

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..... [1]

9 c (ii) State **one** region on the graph when she is accelerating. 0653/32/O/N/11

..... [1]

9 c (iii) Is this acceleration constant over this region? 0653/32/O/N/11

Explain your answer.

..... [1]

9 c (iv) Give the letter of the point at which the parachute opens. 0653/32/O/N/11

..... [1]

9 c (v) State the terminal velocity before the parachute opens. 0653/32/O/N/11

..... [1]

9 c (vi) Explain why the skydiver reaches a terminal velocity. 0653/32/O/N/11

For Examiner's Use

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..... [2]

9 c (vii) Explain why the open parachute slows down the skydiver. 0653/32/O/N/11

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..... [1]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II									III	IV	V	VI	VII	0
															4 He Helium 2
					1 H Hydrogen 1										
7 Li Lithium 3	9 Be Beryllium 4									11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12									27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

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

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