	Centre Number	Candidate Number
Candidate Name _____		

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

Joint Examination for the School Certificate and General Certificate of Education Ordinary Level

ADDITIONAL COMBINED SCIENCE 5130/2

PAPER 2

OCTOBER/NOVEMBER SESSION 2001 2 hours 15 minutes

Additional materials:
Answer paper

TIME 2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page and on all separate answer paper used.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Section B

Answer **one** part of each of the three questions.

Write your answers on the separate answer paper provided.

At the end of the examination, fasten all separate answer paper securely to the question paper.

INFORMATION FOR CANDIDATES

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

A copy of the Periodic Table is printed on page 16.

FOR EXAMINER'S USE	
Section A	
10	
11	
12	
TOTAL	

This question paper consists of 16 printed pages.

[Turn over

Section A

Answer **all** the questions.

1 To investigate the water lost from a plant through the stomata of the leaves, a student set up the apparatus shown in Fig. 1.1.

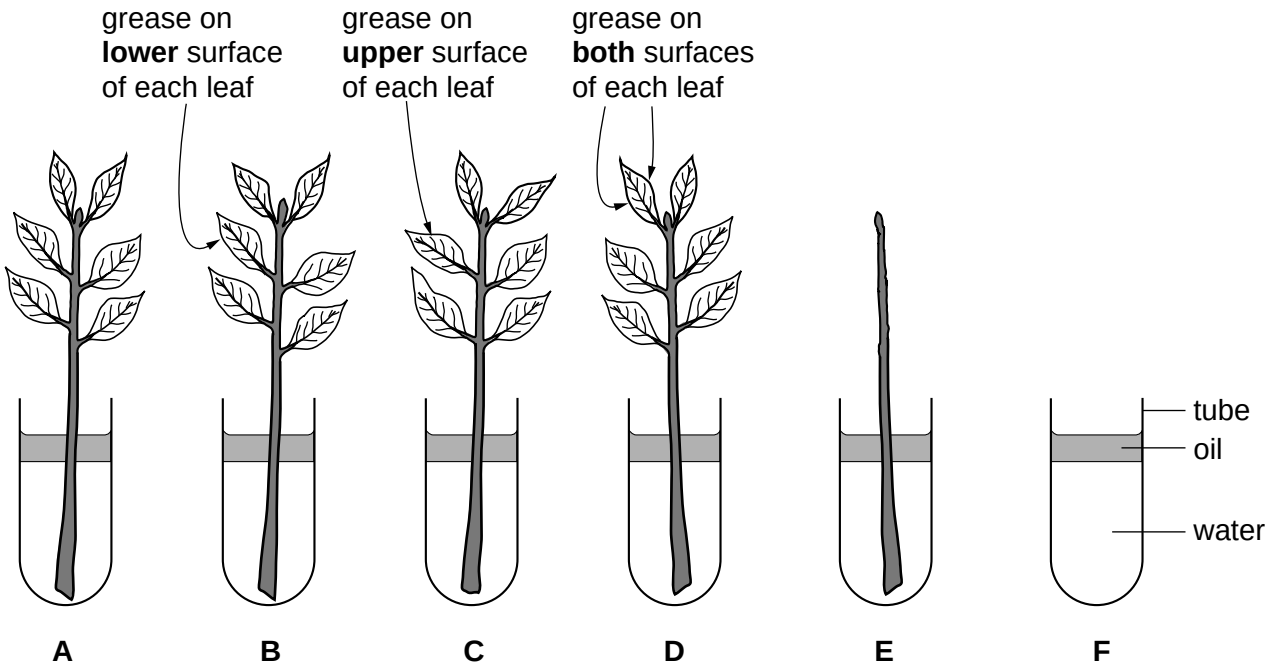

Fig. 1.1

The student measured the mass lost from each tube during a period of 24 hours.

The results are shown in Fig. 1.2.

tube	**A**	**B**	**C**	**D**	**E**	**F**
mass lost / g	1.1	0.3	0.8	0.1	0.1	0.0

Fig. 1.2

(a) (i) State **one** way in which the student made this a fair test.

.....[1]

(ii) What was the purpose of tube **F**?

.....

.....[1]

(iii) Why was oil placed on the water in each tube?

.....

.....[1]

(b) **(i)** What do the results suggest about the distribution of stomata on the leaves?

.....

.....[1]

(ii) What does the result for tube **E** show?

.....

.....[1]

(c) Suggest how the results will differ if the apparatus is placed in each of the following conditions.

(i) high temperature

.....

.....[1]

(ii) high humidity

.....

.....[1]

(d) Explain your answer to **(c)(ii)**.

.....

.....[1]

2 **(a)** The table in Fig. 2.1 gives information about six substances.

Fill in the four empty boxes in the table using words from this list.

atoms compound element ions mixture molecules

You may use each word **once, more than once** or **not at all**.

name of substance	type of substance	particles in substance
iron	element	atoms
wood	mixture	molecules
air		atoms and molecules
copper	element	
sodium chloride		ions
water	compound	

Fig. 2.1 [4]

(b) **(i)** Fig. 2.2 shows the arrangement of electrons in atoms of magnesium and oxygen.

Complete Fig. 2.2 to show the arrangement of electrons after these atoms have bonded to form magnesium oxide.

atom	electron arrangement before bonding	electron arrangement after bonding
magnesium	2,8,2	
oxygen	2,6	

Fig. 2.2 [2]

(ii) Name the type of bonding in magnesium oxide.

.....[1]

(iii) Write the formula for magnesium oxide.

.....[1]

3 Fig. 3.1 gives information about the electromagnetic spectrum.

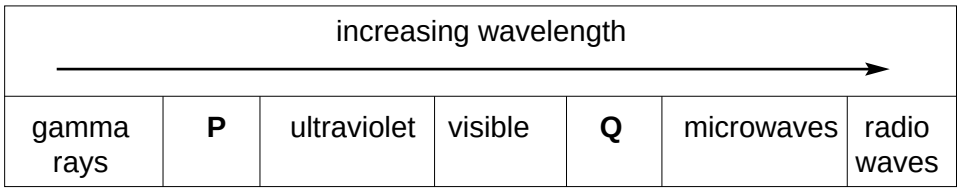

Fig. 3.1

(a) Name the waves at **P** and **Q**.

P .....

Q .....[2]

(b) **(i)** Which waves could be used for the treatment of cancer?

.....[1]

(ii) Which waves cause sunburn?

.....[1]

(c) The statements in Fig. 3.2 refer to the reflection of visible light in a plane mirror.

Indicate with a tick whether each statement is true or false.

	true	false
The image in the mirror is larger than the object.		
The image in the mirror is smaller than the object.		
The image in the mirror is a virtual image.		
The image in the mirror is upside down.		
The image in the mirror is reversed left to right.		
The image is as far behind the mirror as the object is in front.		

Fig. 3.2 [4]

[Turn over

4 When a person steps on a drawing pin, he quickly moves his foot away. This automatic response is a reflex action which involves a reflex arc, as shown in Fig. 4.1.

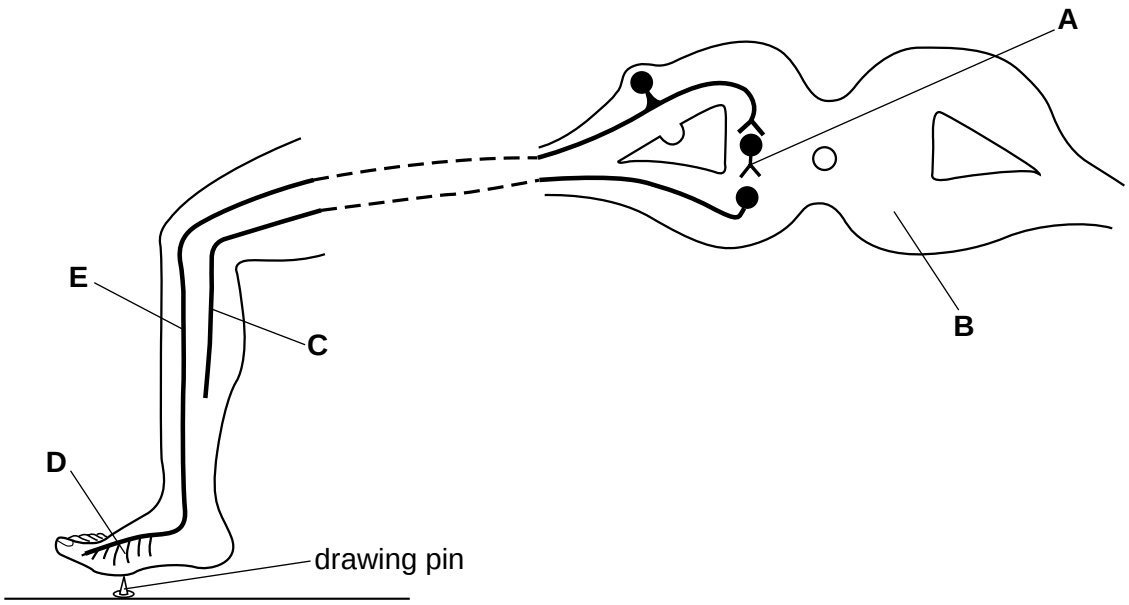

Fig. 4.1

(a) Write the letters from the labels in Fig. 4.1 in the correct spaces in Fig. 4.2. The first one has been completed for you.

motor neurone	**C**
receptor	
relay neurone	
sensory neurone	
spinal cord	

Fig. 4.2 [4]

(b) Describe how this automatic response works.

.....

.....

.....

.....

.....[5]

5 The apparatus shown in Fig. 5.1 is used for the electrolysis of acidified water.

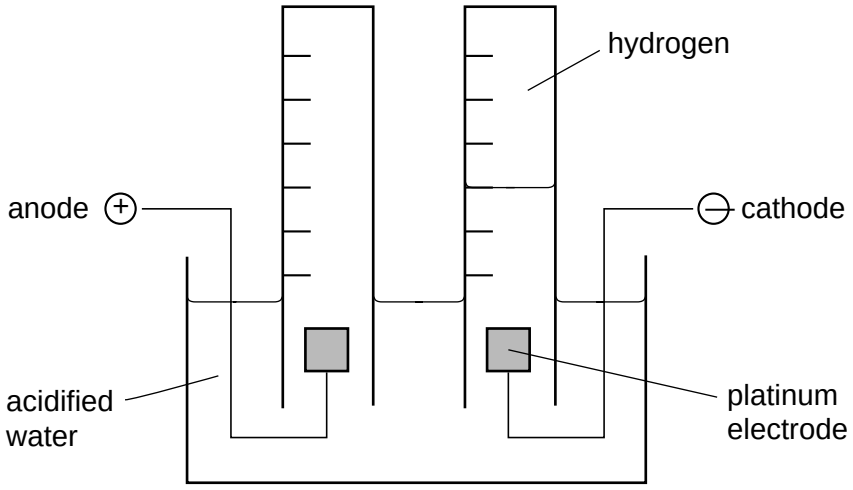

Fig. 5.1

(a) **(i)** Name the gas given off at the anode.

.....[1]

(ii) The volume of hydrogen given off at the cathode is shown in Fig. 5.1.

On Fig. 5.1, mark the volume of gas given off at the anode in the same time. [1]

(b) Construct an ionic equation for the reaction taking place at the cathode.

.....[2]

(c) The same apparatus is used for the electrolysis of concentrated aqueous sodium chloride. After a few minutes, a piece of Universal Indicator paper, dipped into the solution, turns blue.

(i) What does the Universal Indicator paper show about the solution?

.....[1]

(ii) Name the product, formed in the solution during this electrolysis, which causes the Universal Indicator paper to turn blue.

.....[1]

6 A teacher uses a Geiger counter to measure how much beta-radiation passes through different thicknesses of aluminium sheet.
Her results are shown in Fig. 6.1.

thickness of aluminium / mm		1.0	2.0	3.0	5.0	6.0	7.0	8.0
radiation passing through aluminium	total / counts per minute	564	316	185	96	82	65	65
	corrected total / counts per minute	499	251	120	31	17	0	0

Fig. 6.1

(a) Explain why the total radiation passing through the aluminium has been corrected.

.....

.....

.....[2]

(b) On the grid in Fig. 6.2, plot the **corrected** total against the thickness of the aluminium.
Draw the line of best fit on your graph.

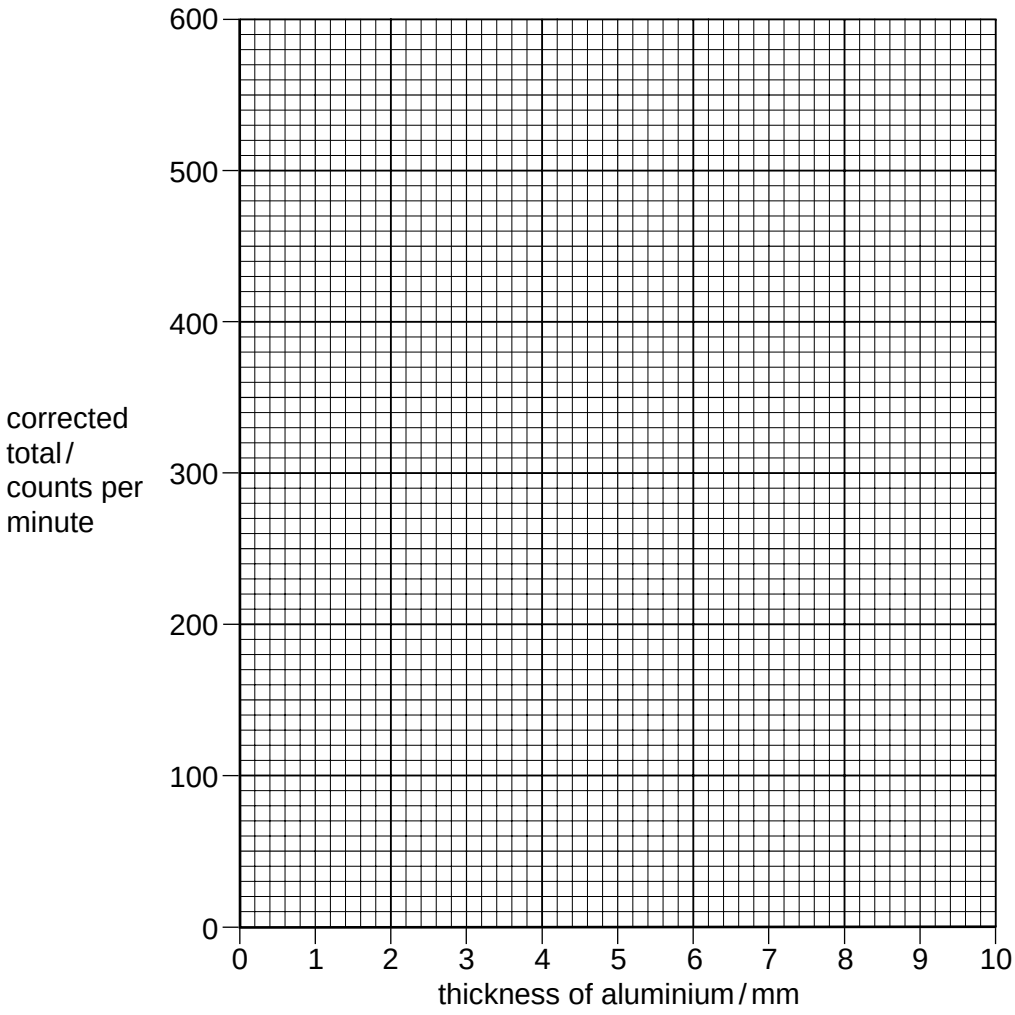

Fig. 6.2 [3]

(c) Use your graph to suggest the corrected total radiation which would pass through aluminium 4.0 mm thick in this investigation.

.....[1]

(d) Describe two safety precautions the teacher should take during this investigation.

1 .....

2 .....[2]

[Turn over

7 The enzyme lipase digests fat molecules. During this process, acids, which decrease the pH of the mixture, are formed.

The action of lipase in different conditions was investigated. At first, the pH value of all the mixtures was the same, 8.0. The results are shown in the table in Fig. 7.1.

	conditions	pH after 10 minutes
A	fat + distilled water, at 37 °C (without lipase)	8.0
B	lipase + fat + distilled water, at 20 ° C	7.5
C	lipase + fat + distilled water, at 37 °C	7.0
D	lipase + fat + distilled water, at 80 °C	8.0
E	lipase + fat + bile salts, at 37 °C	6.0

Fig. 7.1

(a) (i) Explain why the decrease in pH was greater in **C** than in **B**.

.....

.....[2]

(ii) Why did the pH **not** change in **D**?

.....

.....[2]

(iii) Suggest why the decrease in pH was greatest in **E**.

.....

.....

.....[2]

(b) Name the organ which produces bile salts.

.....[1]

8 Octane, a major component of petrol, burns in a car engine to form carbon dioxide and water.

(a) Explain how you could prove that the exhaust gases of a car contain carbon dioxide.

.....

.....

.....[2]

(b) Octane burns in a good supply of oxygen according to the following equation.

$$2C_8H_{18}(g) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(l)$$

What volume of carbon dioxide, measured at room temperature and pressure, would be produced by the complete combustion of 1.0 kg of octane?
[Use data from the Periodic Table on page 16 to help you answer this question.]

volume = ……. dm^3 [3]

(c) **(i)** In a car engine, not all of the fuel burns to form carbon dioxide and water.

Name another gas which is produced by this incomplete combustion of the fuel.

.....[1]

(ii) Explain why the release of this gas into the air is a problem.

.....

.....

.....[2]

(iii) Name **one** other pollutant released from car engines.

.....[1]

[Turn over

9 Fig. 9.1 shows a transformer used to step down the voltage of the electricity supplied to a lamp.

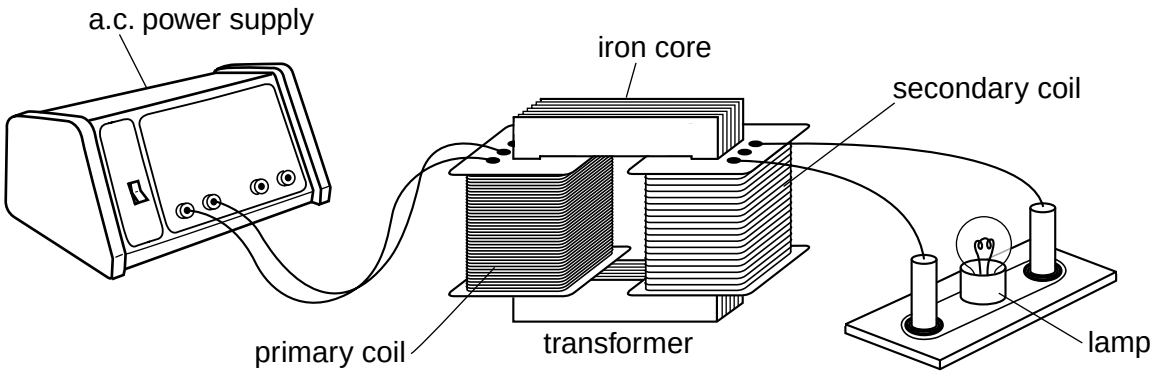

Fig. 9.1

(a) The power supply provides a voltage of 18 V.

The secondary coil of the transformer has 48 turns.

Calculate how many turns the primary coil needs to have to supply a voltage of 6.0 V to the lamp. Assume that the transformer has 100% efficiency.

number of turns = ... [3]

(b) In practice, the transformer does **not** have 100% efficiency. Some energy is lost.

Describe two ways by which this energy is lost.

1 .....

.....

2 .....

.....[2]

(c) Explain why the following are used in this transformer.

(i) an iron core

.....

.....[1]

(ii) an a.c. power supply

.....

.....[1]

[Turn over

Section B

Answer **one** part, either **(a)** or **(b)**, of each question in this section.

10 **Either** **(a)** **(i)** An athlete runs a long distance race.
After a few minutes, he is breathing more quickly than at the start.
Later in the race, he suffers cramp in his leg muscles.
Use your knowledge of respiration to suggest and explain the causes of these two observations. [7]

(ii) The athlete also sweats a great deal during the race.
Explain what causes this sweating and how it helps the athlete. [3]

Or **(b)** **(i)** Red blood cells in humans and root hair cells in plants are both examples of specialised cells.
For each of these **two** types of cell, describe how it is specialised and how this helps it to carry out its function. [6]

(ii) Human male and female gametes are also specialised cells.
How are their nuclei different from those of other cells?
How do the male and female gametes differ from each other? [4]

11 **Either** **(a)** **(i)** Define the term *redox*.
Use **one** example of a redox reaction to explain your definition. [5]

(ii) What is the difference between an endothermic and an exothermic reaction?
Give an example of an exothermic reaction and explain how bond-making and bond-breaking are involved in the total energy change. [5]

Or **(b)** Describe the formation, structure and uses of the polymers *Terylene* and poly(ethene).
Explain how the structures of *Terylene* and fats are similar. [10]

12 Either (a) Describe how you would investigate the relationship between load and extension for a spring.
Sketch a graph of the results you would expect.
Mark on your graph, and explain the meaning of, *the limit of proportionality*. [10]

Or (b) (i) Fig. 12.1 shows a coal-fired power station with an efficiency of about 30%.

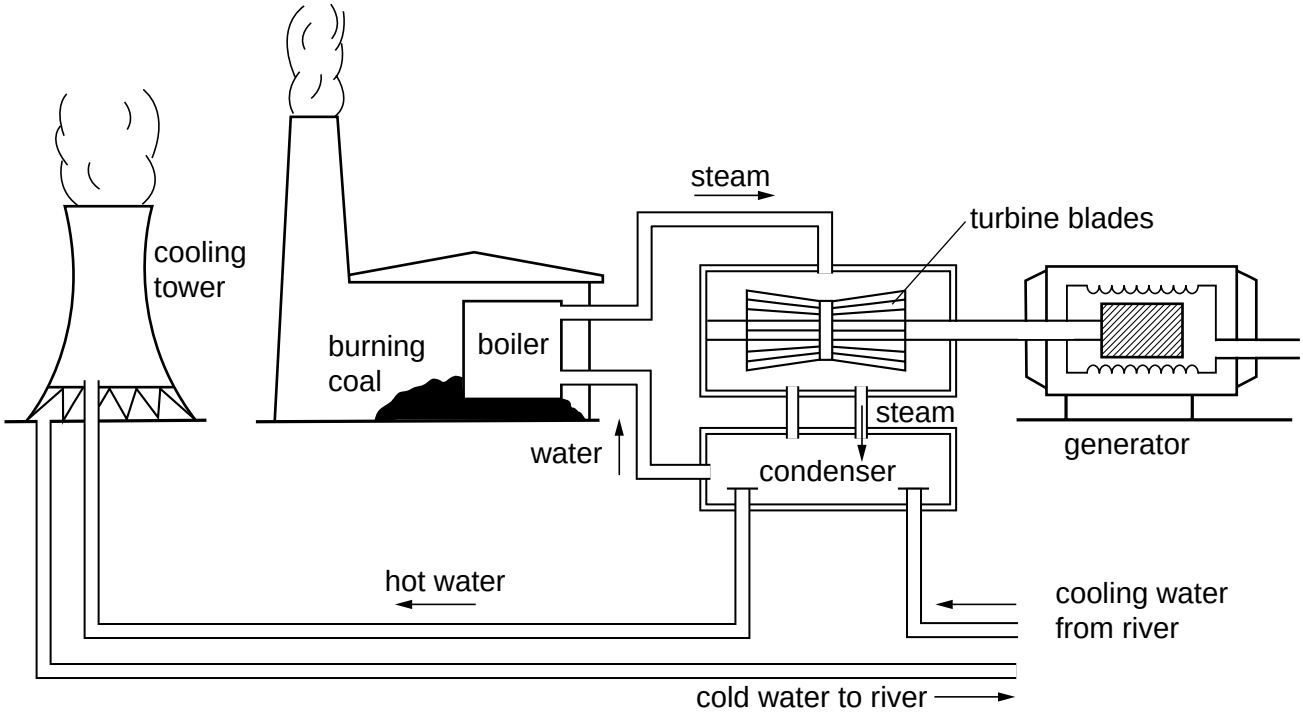

Fig. 12.1

Describe all the energy transfers which take place in this power station, stating where they occur.
Explain what is meant by the term *efficiency*. [7]

(ii) A possible future source of power is nuclear fusion.
In the fusion of a deuterium nucleus with a tritium nucleus, 0.0321×10^{-27} kg of mass is lost.
Calculate the energy released in this fusion.
[The speed of light, $c = 3.00 \times 10^8$ m / s.] [3]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 2
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 Sulphur 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.).