UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

**COMBINED SCIENCE** **5129/02**

Paper 2 **May/June 2012**

**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 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**

This document consists of **21** printed pages and **3** blank pages.

UNIVERSITY *of* CAMBRIDGE
International Examinations

**[Turn over**

1    Fig. 1.1 shows a photograph of some red blood cells that have been greatly magnified.
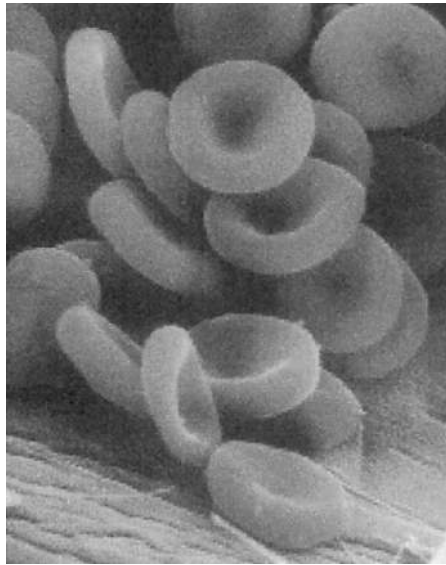
**Fig. 1.1**

(a) (i)  State the function of red blood cells.

.................................................................................................................................

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

(ii)  State **two** features of red blood cells that make them efficient in carrying out this function.

feature 1 ..................................................................................................................

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

(iii)  Explain the importance of each feature in **(a)(ii)**.

importance of feature 1 ........................................................................................

.................................................................................................................................

importance of feature 2 ........................................................................................

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

(b)  Name the liquid part of the blood that surrounds the red blood cells.

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

2    **(a)**  A string is used to pull a cube across a smooth horizontal surface.

This is shown in Fig. 2.1.

direction of motion

string                                                        cube
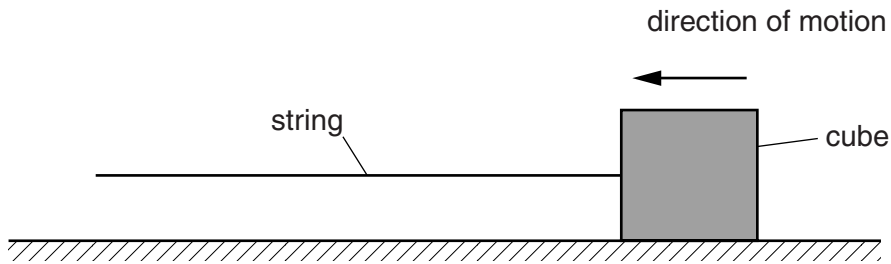
**Fig. 2.1**

The cube has a mass of 0.20 kg. The constant force accelerating the cube is 0.32 N.

Calculate the acceleration of the cube.

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

**(b)**  On Earth, the gravitational field strength $g$ = 10 N/kg.

Calculate the weight of the cube.

weight = ........................................... N  [1]

**3** **(a)** Sodium reacts with chlorine to produce sodium chloride.
The equation for the reaction is

$$2Na \ + \ Cl_2 \longrightarrow 2NaCl$$

The relative molecular mass, $M_r$, of sodium chloride is 58.5.
($A_r$: Na, 23; C$l$, 35.5)

Complete the following sentences.

46 g of sodium reacts with .................g of chlorine and produces

.................g of sodium chloride.

4.6 g of sodium reacts with .................g of chlorine and produces

.................g of sodium chloride.

1.15 g of sodium produces .................g of sodium chloride. [4]


**(b)** State the type of bonding present in sodium chloride.

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

**(c)** State why chlorine is used in the purification of water supplies.

.........................................................................................................................................

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

*For Examiner's Use*

4  **(a)**  State the units of the moment of a force.  ..................................... [1]

**(b)**  Fig. 4.1 shows a spanner being used to undo a bolt.

force

bolt

pivot

handle of spanner

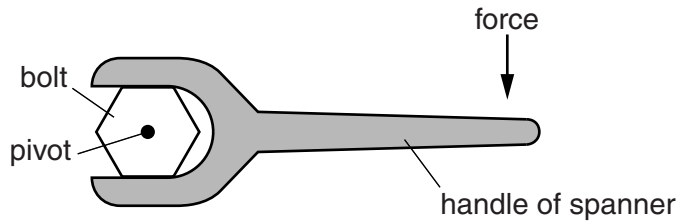**Fig. 4.1**

The force needed to undo the bolt is smaller when a spanner with a longer handle is used.

Explain why.

.................................................................................................................................

.................................................................................................................................

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

5  Atoms are made up of electrons, protons and neutrons.

**(a)**  Complete Fig. 5.1 to show the relative charge and the relative mass of each particle.

| particle | relative charge | relative mass |
|----------|-----------------|---------------|
| electron |                 | $\dfrac{1}{1840}$ |
| proton   | +1              |               |
| neutron  |                 | 1             |

[3]

**Fig. 5.1**

**(b)**  $^{12}C$ and $^{14}C$ are isotopes of the element carbon.

**(i)**  State how the two isotopes are different.

.........................................................................................................................

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

**(ii)**  Explain why the two isotopes have the same chemical properties.

.........................................................................................................................

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

   **[Turn over**

**6**



6    Fig. 6.1 shows the human digestive system.

A

B

C

D

E

F
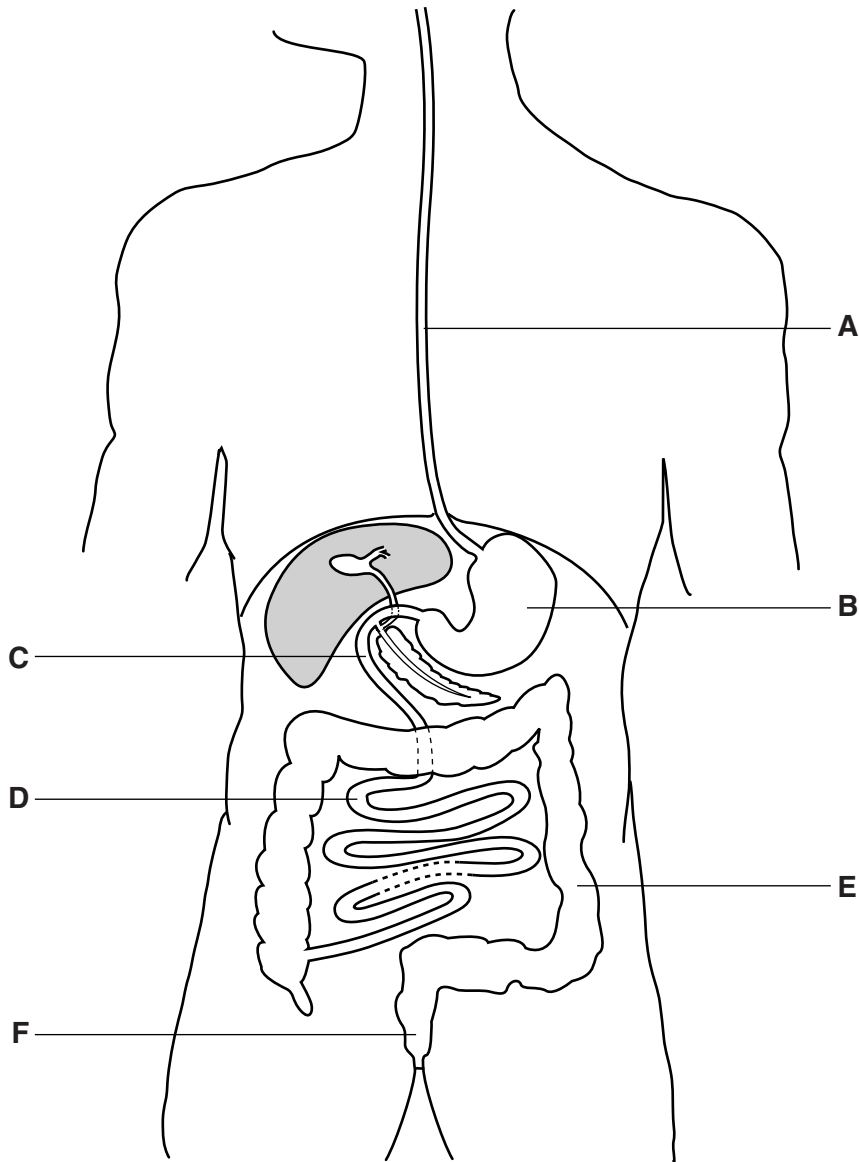
**Fig. 6.1**

**(a)** State a letter in Fig. 6.1 which shows where

  **(i)** glucose is absorbed, ........................... [1]

  **(ii)** most water is absorbed. ........................... [1]

**(b)** Some digestion takes place in the stomach.

Suggest and explain the importance of **another** function of the stomach.

function ...............................................................................................................

explanation of importance ...................................................................................

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

**(c)** There is a tube between the gall bladder and the duodenum.

State and explain how digestion is affected when this tube becomes blocked.

...................................................................................................................................................

...................................................................................................................................................

...................................................................................................................................................

...................................................................................................................................................

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

**7** **(a)** Respiration is defined as the release of energy from food substances in living cells.

State **two** differences between aerobic respiration and anaerobic respiration.

1 ..............................................................................................................................

.................................................................................................................................

2 ..............................................................................................................................

.................................................................................................................................

[2]

**(b)** The breathing of a student is observed while he is resting.

The student then exercises vigorously and his breathing is observed again.

State two **visible** differences in his breathing before and during exercise.

1 ..............................................................................................................................

.................................................................................................................................

2 ..............................................................................................................................

.................................................................................................................................

[2]

**(c)** Athletes compete in races of different distances.

Fig. 7.1 shows the percentage of energy released by aerobic respiration and anaerobic respiration during these races.



**key**

anaerobic respiration

aerobic respiration
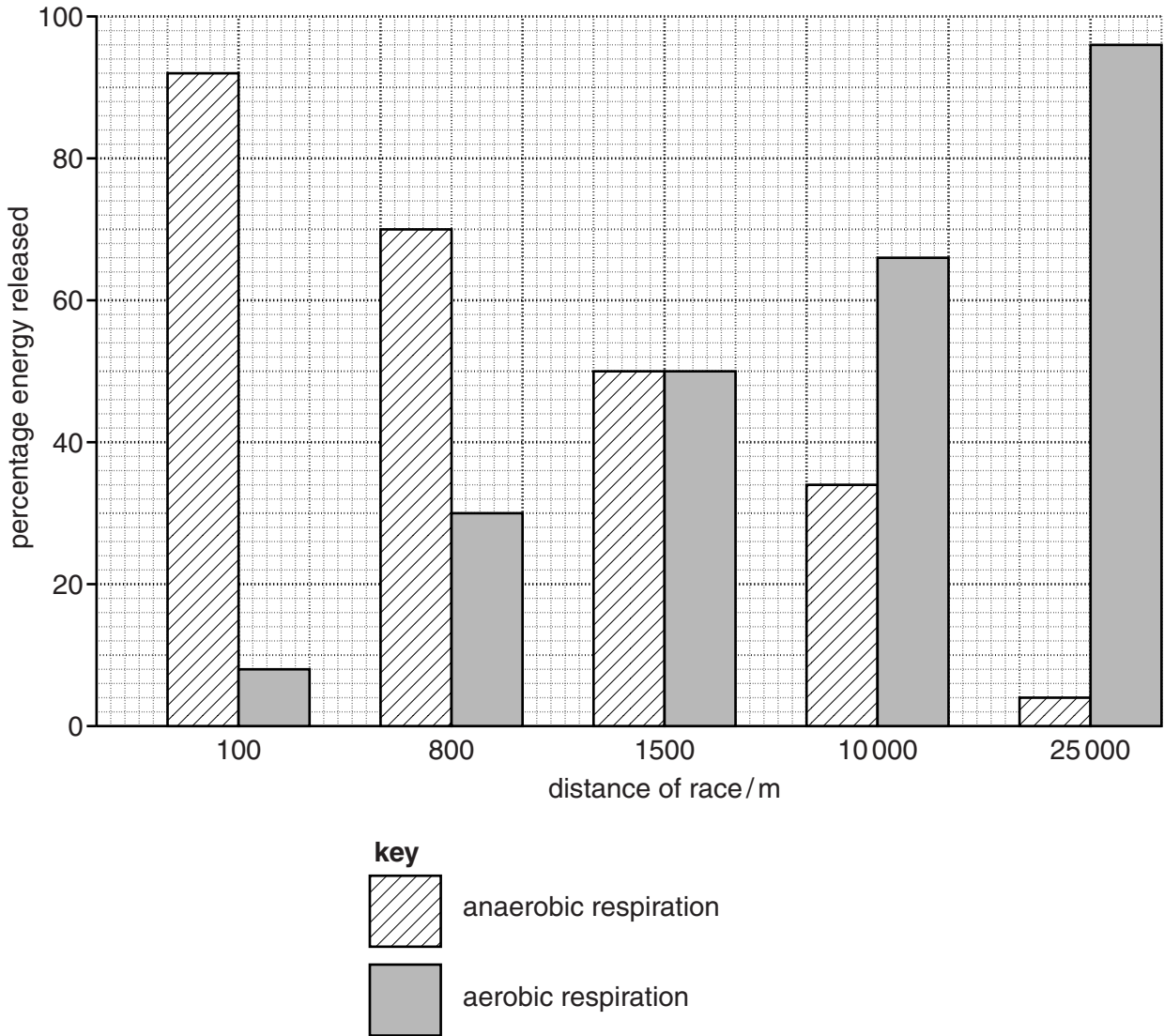
**Fig. 7.1**

**(i)** Use Fig. 7.1 to find the length of race for which the athlete gains 50% of his energy from aerobic respiration.

length of race = ........................................... m  [1]

**(ii)** What does Fig. 7.1 show about the type of respiration and the length of race?

.............................................................................................................................

.............................................................................................................................

.............................................................................................................................

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

8   A ripple tank is used to show wave motion on the surface of water.

The wave has a wavelength of 0.5 cm and an amplitude of 4.0 mm.

(a)   Complete Fig. 8.1 to show at least one wavelength of a wave with this wavelength and amplitude. [2]
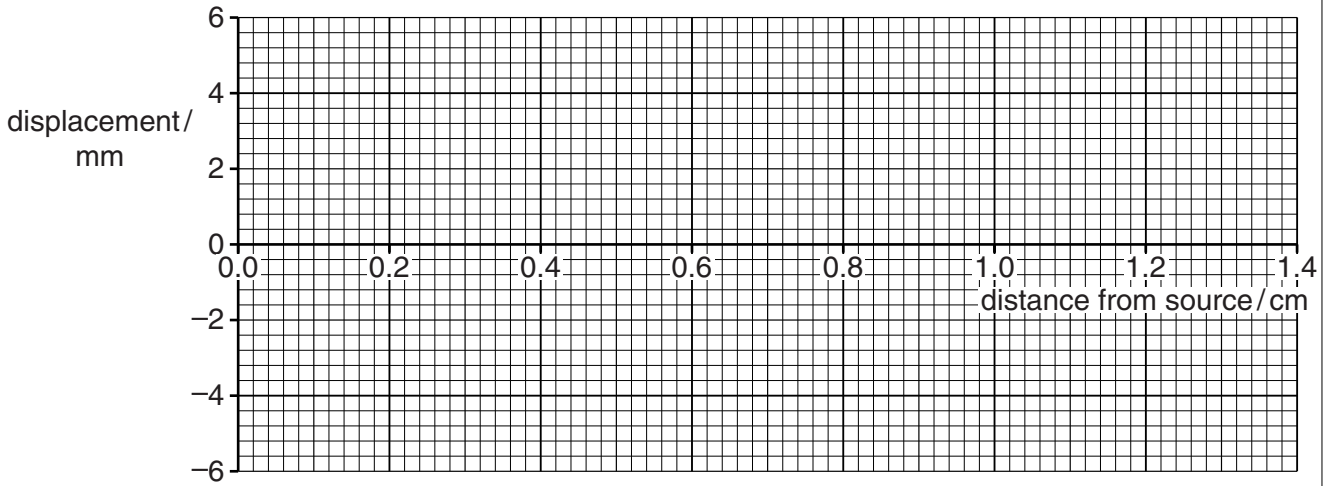


**Fig. 8.1**

(b)   The wave has a frequency of 6.0 Hz.

Calculate the speed of the wave.

speed = ...................................... cm / s  [2]

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**9** **(a)** In Fig. 9.1, the boxes on the left give the names of some elements.

The boxes on the right show the reaction of elements with water.

Draw a line to link each element to its reaction with water.

| element | | reaction with water |
|---|---|---|
| **element** | | **reaction with water** |

| copper |   | reacts vigorously with steam |

| magnesium |   | reacts vigorously with cold water |

| iron |   | no reaction |

| potassium |   | reacts slowly with cold water and steam |

[4]

**Fig. 9.1**

**(b)** When a metal reacts with water, hydrogen gas is released.

State the test for hydrogen gas.

test ................................................................................................................................

result ................................................................................................................................

[2]

             **[Turn over**

10 Use words from the list to complete the sentences below.

| mesophyll | osmosis | respiration |

| phloem | photosynthesis | xylem |

| root hair | transpiration |

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

Water enters a plant by moving into the .................................................. cells by

the process of .................................................. .

Water moves from cell to cell across the plant by the same

process until it reaches the .................................................. .

Water moves upwards to the leaves where it is lost through

the stomata. This process is called .................................................. .          [4]

**11** A ball on the end of a nylon string is given a charge.

A positively-charged rod is brought close to the ball.

The ball moves away from the positive charge, as shown in Fig. 11.1.
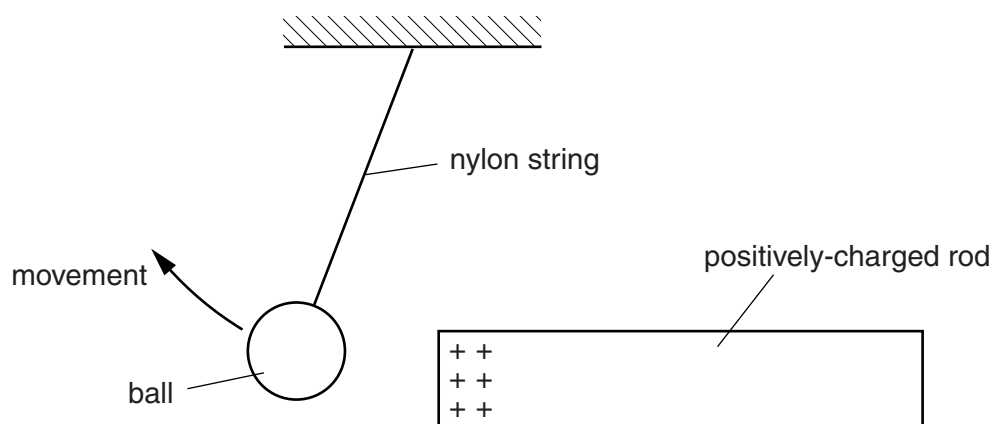


**Fig. 11.1**

**(a)** Explain why the ball moves away from the positively-charged object.

.........................................................................................................................................

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

**(b)** A spark is seen between two charged objects.

A spark is a flow of charge.

State the name given to the rate of flow of charge.

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

**12** A lamp is marked '240V, 60W'.

**(a)** The lamp is working normally.

Calculate

**(i)** the current in the lamp,

current = .............................................. A  [2]

**(ii)** the electrical energy converted in 10 minutes.

energy = ..............................................J  [2]

**(b)** Some lamps may produce waves in the infra-red, the visible or the ultraviolet regions of the electromagnetic spectrum.

State the name given to a component of the spectrum with wavelengths that are

**(i)** longer than those of infra-red radiation, ....................................................... [1]

**(ii)** shorter than those of ultraviolet radiation. ....................................................... [1]

13  Butane, natural gas and petrol are fossil fuels.

(a)  Name the main constituent of natural gas.  ............................................................... [1]

(b)  Petrol is a mixture of different hydrocarbons.

Explain the meaning of the term *hydrocarbon*.

.......................................................................................................................................

.......................................................................................................................................

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

(c)  Balance the equation for the combustion of butane.

$$2C_4H_{10} \ + \ ..........O_2 \ \longrightarrow \ .........CO_2 \ + \ .........H_2O$$ [1]
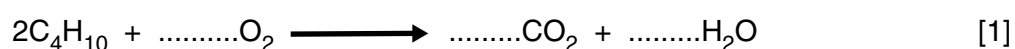
(d)  Some fossil fuels contain sulfur compounds.

(i)  State the name of a compound of sulfur that is formed when these fuels are burned.

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

(ii)  State and explain an environmental problem associated with this compound of sulfur.

...........................................................................................................................

...........................................................................................................................

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

**14** Fig. 14.1 shows part of a food web.
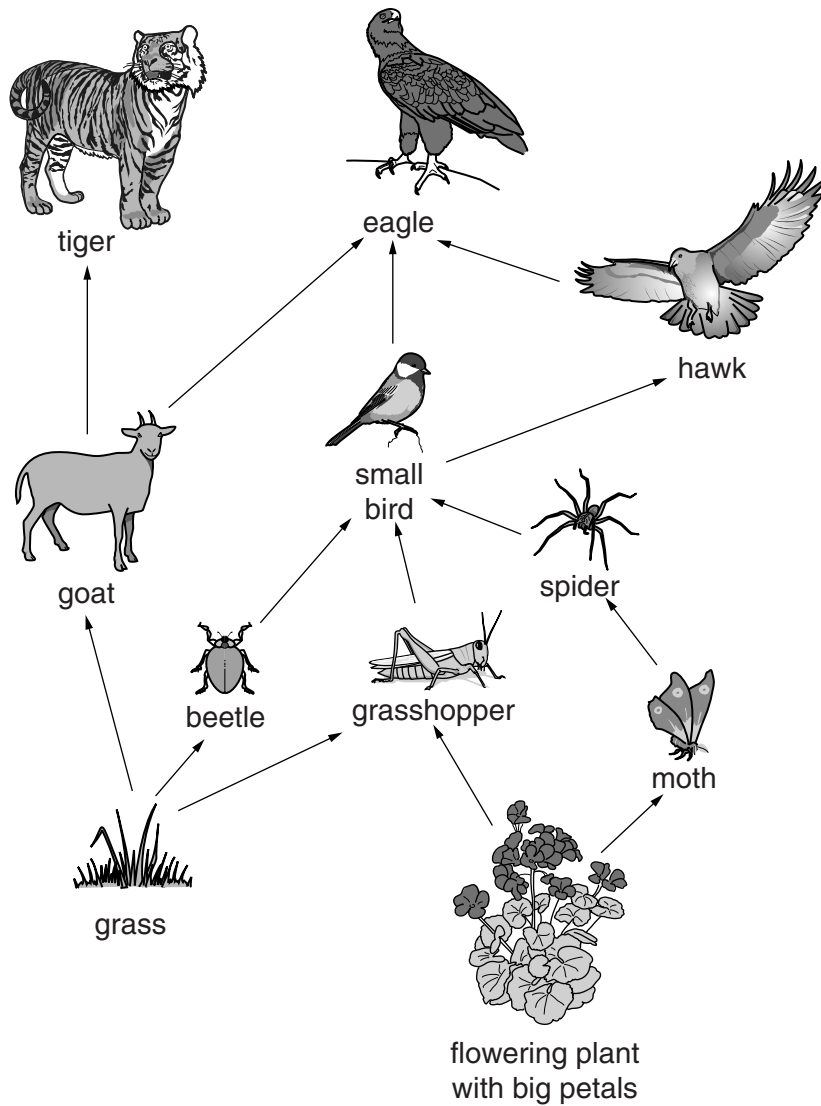
**Fig. 14.1**

**(a) (i)** State the source of energy for this food web.

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

**(ii)** State the form of this energy.

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

**(b) (i)** State how many species of herbivore and how many species of carnivore are shown in the food web.

Write your answers in Table 14.1.

**Table 14.1**

| type of organism | number of species |
|---|---|
| herbivore | |
| carnivore | |

[2]

**(ii)** State the number of species in the longest food chain shown in Fig. 14.1.

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

**(iii)** Explain why a short food chain is more efficient than a long food chain.

.................................................................................................................................

.................................................................................................................................

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

**(c)** Predict what would happen on the food web if 90% of the moths died. Explain why.

prediction ...........................................................................................................................

explanation .........................................................................................................................

.................................................................................................................................

[2]

**15** An athlete runs on a circular track.

He runs 400 m in 50 s.

**(a)** Calculate the average speed of the runner.

speed = ......................................... m / s  [2]

**(b)** The athlete maintains a constant speed on the circular track.

Explain why his velocity is not constant.

...................................................................................................................................

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

**16** Brass and stainless steel are both alloys.

**(a)** Name the two elements present in brass.

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

**(b) (i)** State one use of stainless steel.

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

**(ii)** Explain how and why alloys are made.

..............................................................................................................................

..............................................................................................................................

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

17 **(a)** Explain what is meant by the *principle of energy conservation*.

.......................................................................................................................................

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

**(b)** Coal is burned to generate electrical energy.

Complete the following sentences.

The energy in coal is .................................................... energy.

When coal is burned this energy is converted into ....................................................
energy.

Steam is produced and used to turn a turbine.

The turbine has .................................................... energy. [3]

18 The following is a list of substances.

**aluminium oxide**        **ammonium sulfate**        **calcium carbonate**

**potassium nitrate**        **sodium hydroxide**        **sodium oxide**

Use the list to complete the following sentences.

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

**(a)** ................................................................. is used to remove acidic impurities

during the extraction of iron in a blast furnace. [1]

**(b)** A substance that reacts with both acids and alkalis is

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

**(c)** A substance that contains two of the elements essential for

plant growth is ................................................................. . [1]

**(d)** A substance that reacts with dilute sulphuric acid to produce

a colourless gas is ................................................................. . [1]

**19** Fig. 19.1 shows a basic transformer.

..........................coil          ........................          ........................coil

240 V ∿          6 V lamp
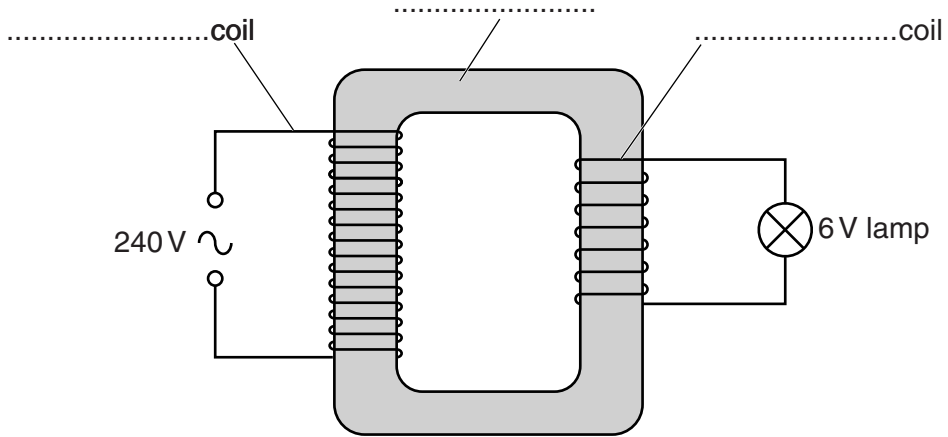
**Fig. 19.1**

(a) Complete the labels on Fig. 19.1. [2]

(b) The output of a transformer is connected to a lamp.

Explain why the lamp does not light when the input to the transformer is direct current.

...................................................................................................................................

...................................................................................................................................

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

**20** Explain what is meant by the *half-life* of a radioactive source.

...................................................................................................................................

...................................................................................................................................

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

**21**

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**23**

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# DATA SHEET
## The Periodic Table of the Elements

**Group**

| I | II | | | | | | | | | | III | IV | V | VI | VII | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1<br>**H**<br>Hydrogen<br>1 | | | | | | | | | | | 4<br>**He**<br>Helium<br>2 |
| 7<br>**Li**<br>Lithium<br>3 | 9<br>**Be**<br>Beryllium<br>4 | | | | | | | | | | 11<br>**B**<br>Boron<br>5 | 12<br>**C**<br>Carbon<br>6 | 14<br>**N**<br>Nitrogen<br>7 | 16<br>**O**<br>Oxygen<br>8 | 19<br>**F**<br>Fluorine<br>9 | 20<br>**Ne**<br>Neon<br>10 |
| 23<br>**Na**<br>Sodium<br>11 | 24<br>**Mg**<br>Magnesium<br>12 | | | | | | | | | | 27<br>**A*l***<br>Aluminium<br>13 | 28<br>**Si**<br>Silicon<br>14 | 31<br>**P**<br>Phosphorus<br>15 | 32<br>**S**<br>Sulfur<br>16 | 35.5<br>**C*l***<br>Chlorine<br>17 | 40<br>**Ar**<br>Argon<br>18 |
| 39<br>**K**<br>Potassium<br>19 | 40<br>**Ca**<br>Calcium<br>20 | 45<br>**Sc**<br>Scandium<br>21 | 48<br>**Ti**<br>Titanium<br>22 | 51<br>**V**<br>Vanadium<br>23 | 52<br>**Cr**<br>Chromium<br>24 | 55<br>**Mn**<br>Manganese<br>25 | 56<br>**Fe**<br>Iron<br>26 | 59<br>**Co**<br>Cobalt<br>27 | 59<br>**Ni**<br>Nickel<br>28 | 64<br>**Cu**<br>Copper<br>29 | 65<br>**Zn**<br>Zinc<br>30 | 70<br>**Ga**<br>Gallium<br>31 | 73<br>**Ge**<br>Germanium<br>32 | 75<br>**As**<br>Arsenic<br>33 | 79<br>**Se**<br>Selenium<br>34 | 80<br>**Br**<br>Bromine<br>35 | 84<br>**Kr**<br>Krypton<br>36 |
| 85<br>**Rb**<br>Rubidium<br>37 | 88<br>**Sr**<br>Strontium<br>38 | 89<br>**Y**<br>Yttrium<br>39 | 91<br>**Zr**<br>Zirconium<br>40 | 93<br>**Nb**<br>Niobium<br>41 | 96<br>**Mo**<br>Molybdenum<br>42 | **Tc**<br>Technetium<br>43 | 101<br>**Ru**<br>Ruthenium<br>44 | 103<br>**Rh**<br>Rhodium<br>45 | 106<br>**Pd**<br>Palladium<br>46 | 108<br>**Ag**<br>Silver<br>47 | 112<br>**Cd**<br>Cadmium<br>48 | 115<br>**In**<br>Indium<br>49 | 119<br>**Sn**<br>Tin<br>50 | 122<br>**Sb**<br>Antimony<br>51 | 128<br>**Te**<br>Tellurium<br>52 | 127<br>**I**<br>Iodine<br>53 | 131<br>**Xe**<br>Xenon<br>54 |
| 133<br>**Cs**<br>Caesium<br>55 | 137<br>**Ba**<br>Barium<br>56 | 139<br>**La**<br>Lanthanum<br>57 * | 178<br>**Hf**<br>Hafnium<br>72 | 181<br>**Ta**<br>Tantalum<br>73 | 184<br>**W**<br>Tungsten<br>74 | 186<br>**Re**<br>Rhenium<br>75 | 190<br>**Os**<br>Osmium<br>76 | 192<br>**Ir**<br>Iridium<br>77 | 195<br>**Pt**<br>Platinum<br>78 | 197<br>**Au**<br>Gold<br>79 | 201<br>**Hg**<br>Mercury<br>80 | 204<br>**T*l***<br>Thallium<br>81 | 207<br>**Pb**<br>Lead<br>82 | 209<br>**Bi**<br>Bismuth<br>83 | 209<br>**Po**<br>Polonium<br>84 | 210<br>**At**<br>Astatine<br>85 | 222<br>**Rn**<br>Radon<br>86 |
| 223<br>**Fr**<br>Francium<br>87 | 226<br>**Ra**<br>Radium<br>88 | 227<br>**Ac**<br>Actinium<br>89 † | | | | | | | | | | | | | | |

| 140<br>**Ce**<br>Cerium<br>58 | 141<br>**Pr**<br>Praseodymium<br>59 | 144<br>**Nd**<br>Neodymium<br>60 | 147<br>**Pm**<br>Promethium<br>61 | 150<br>**Sm**<br>Samarium<br>62 | 152<br>**Eu**<br>Europium<br>63 | 157<br>**Gd**<br>Gadolinium<br>64 | 159<br>**Tb**<br>Terbium<br>65 | 162<br>**Dy**<br>Dysprosium<br>66 | 165<br>**Ho**<br>Holmium<br>67 | 167<br>**Er**<br>Erbium<br>68 | 169<br>**Tm**<br>Thulium<br>69 | 173<br>**Yb**<br>Ytterbium<br>70 | 175<br>**Lu**<br>Lutetium<br>71 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 232<br>**Th**<br>Thorium<br>90 | 231<br>**Pa**<br>Protactinium<br>91 | 238<br>**U**<br>Uranium<br>92 | 237<br>**Np**<br>Neptunium<br>93 | 244<br>**Pu**<br>Plutonium<br>94 | 243<br>**Am**<br>Americium<br>95 | 247<br>**Cm**<br>Curium<br>96 | 247<br>**Bk**<br>Berkelium<br>97 | 251<br>**Cf**<br>Californium<br>98 | 252<br>**Es**<br>Einsteinium<br>99 | 257<br>**Fm**<br>Fermium<br>100 | 258<br>**Md**<br>Mendelevium<br>101 | 259<br>**No**<br>Nobelium<br>102 | 260<br>**Lr**<br>Lawrencium<br>103 |

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

**Key**

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

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