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.

[Turn over

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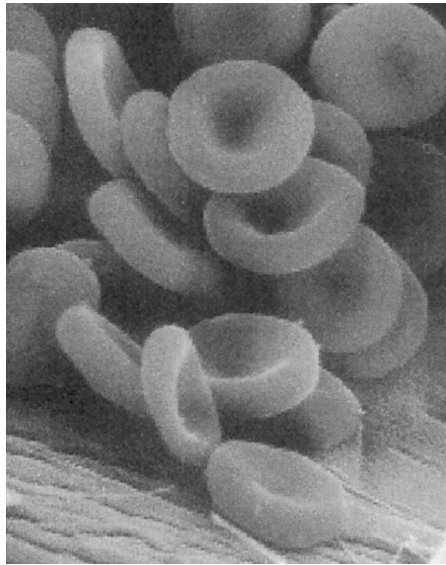
Fig. 1.1

(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
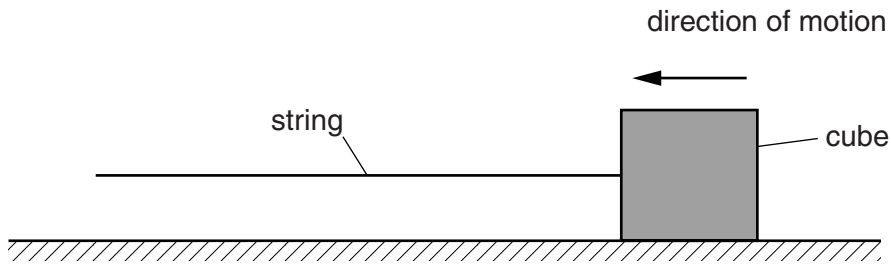
Fig. 2.1

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; Cl, 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]

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

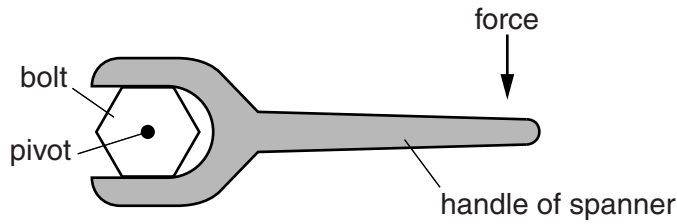**Fig. 4.1**

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]

6 Fig. 6.1 shows the human digestive system.

A

B

C

D

E

F
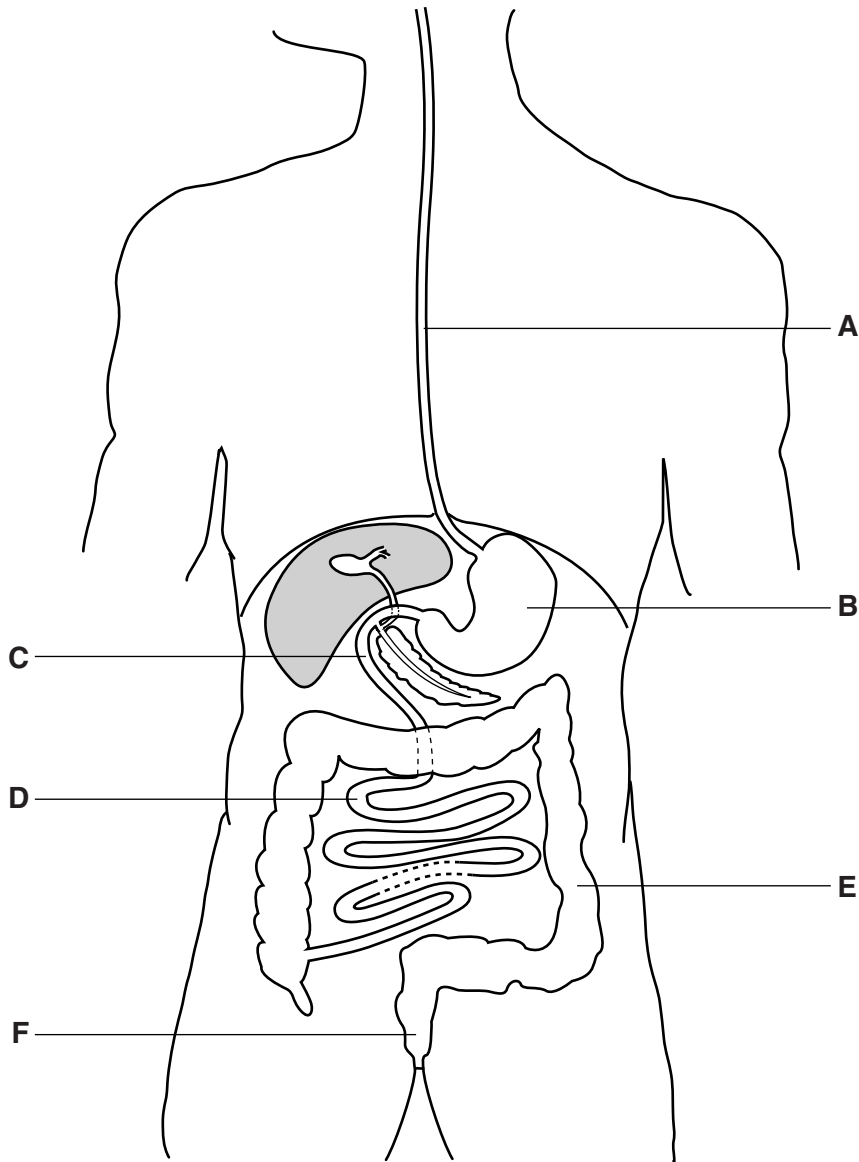
Fig. 6.1

(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]

 [Turn over

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.

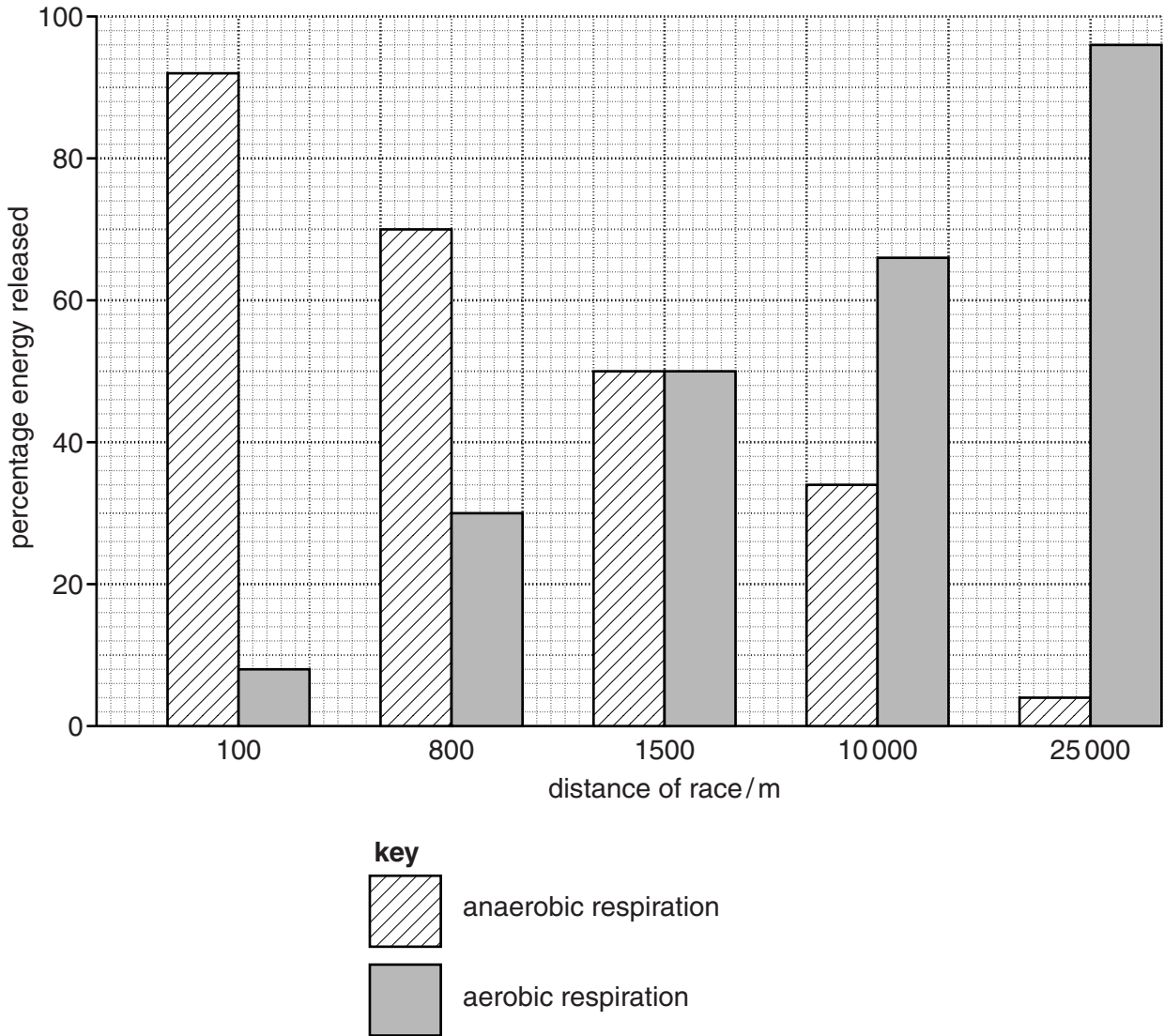1 ....

....

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.

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]

                                 [Turn over

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]
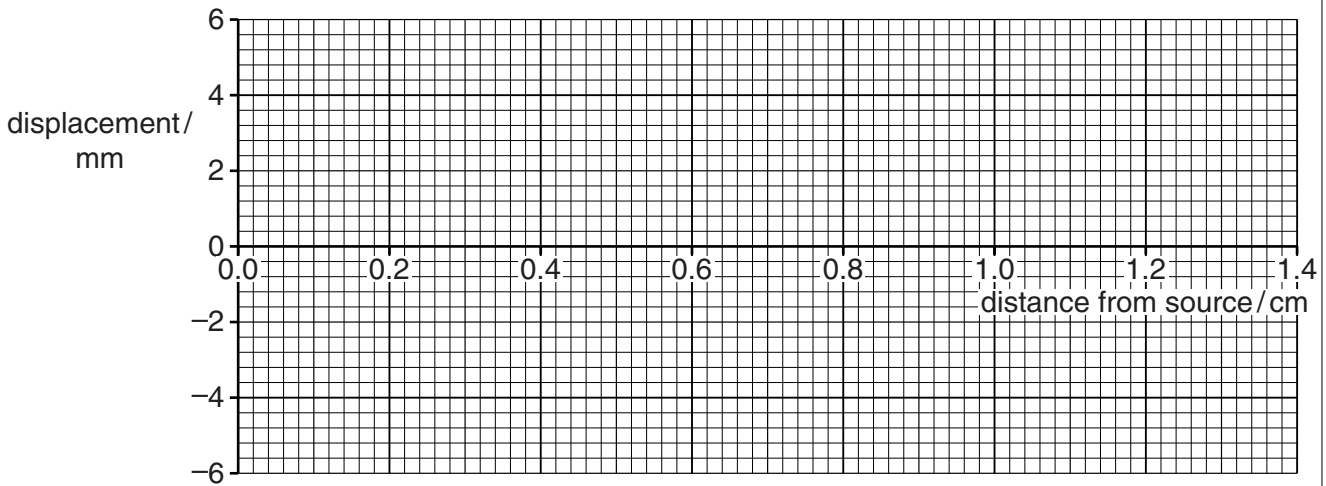

Fig. 8.1

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

   Calculate the speed of the wave.

speed = ... cm / s [2]

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.

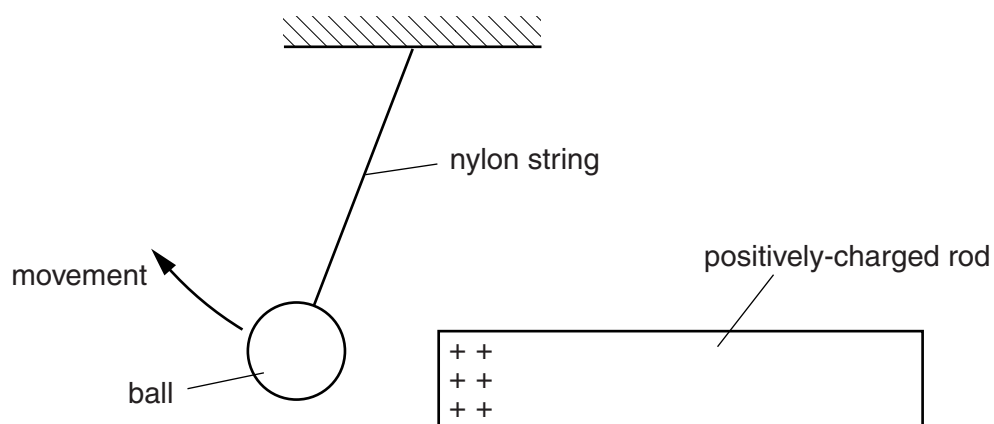The ball moves away from the positive charge, as shown in Fig. 11.1.

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]
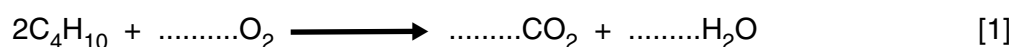
(d) Some fossil fuels contain sulfur compounds.

   (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.
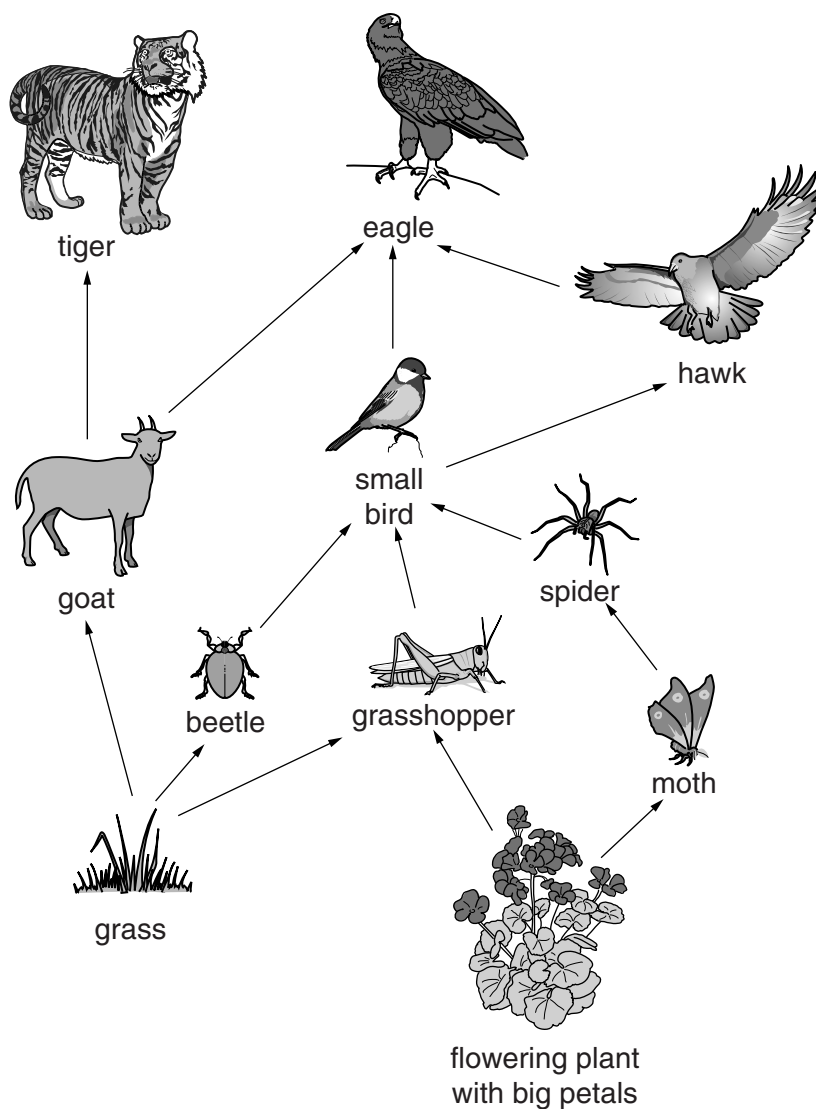
Fig. 14.1

(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

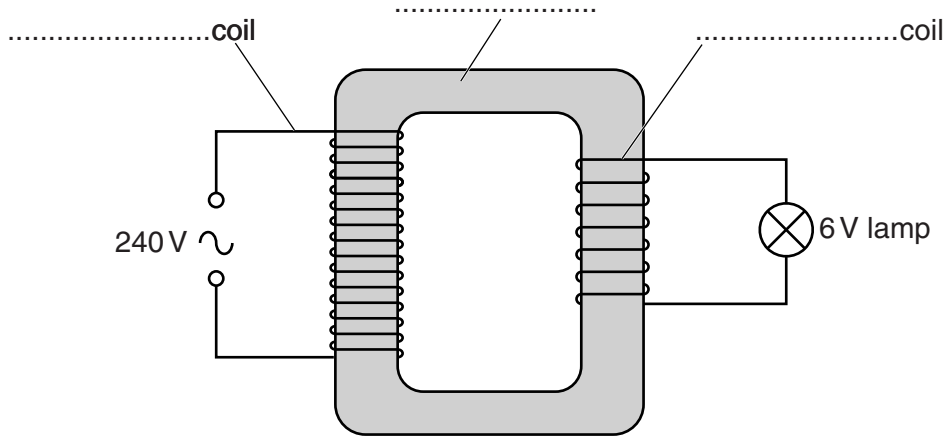240 V ∿   ⊗ 6 V lamp

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]

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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 **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 **A*l*** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **C*l*** 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 **T*l*** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	209 **Po** Polonium 84	210 **At** Astatine 85	222 **Rn** Radon 86
223 **Fr** Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †																

	140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	147 **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	231 **Pa** Protactinium 91	238 **U** Uranium 92	237 **Np** Neptunium 93	244 **Pu** Plutonium 94	243 **Am** Americium 95	247 **Cm** Curium 96	247 **Bk** Berkelium 97	251 **Cf** Californium 98	252 **Es** Einsteinium 99	257 **Fm** Fermium 100	258 **Md** Mendelevium 101	259 **No** Nobelium 102	260 **Lr** Lawrencium 103

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

Key

a
X
b

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

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