Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER				CANDIDATE NUMBER	
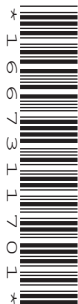
COMBINED SCIENCE **5129/21**

Paper 2 **May/June 2017**

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 an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
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.

This document consists of **23** printed pages and **1** blank page.

CAMBRIDGE
International Examinations

[Turn over

1 **(a)** Define *mass* and *weight*.

mass ....

....

weight ....

....
[2]

(b) A hammer has a mass of 0.75 kg.

Its weight on the Moon is 1.25 N.

(i) An astronaut on the Moon uses the hammer to break some pieces of rock.

Complete Fig. 1.1 to show how the astronaut now uses the hammer and the beam balance to measure a mass of 0.75 kg of rock. [1]
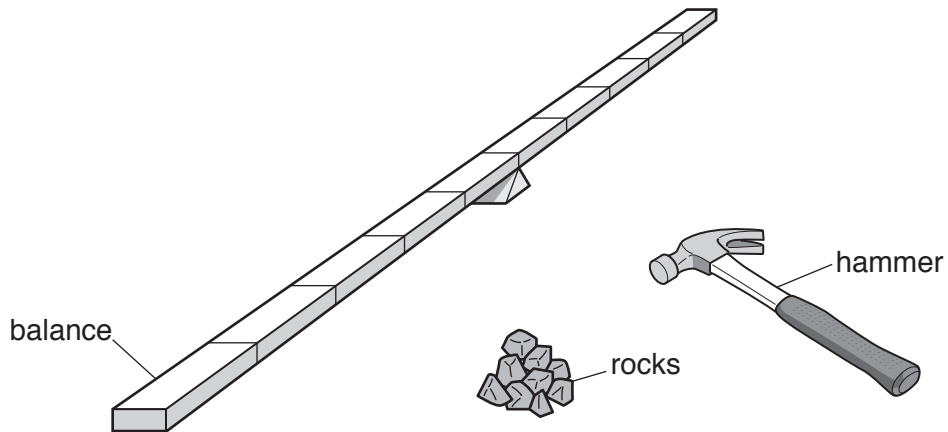
Fig. 1.1

(ii) The astronaut now drops the hammer.

Calculate the acceleration of the hammer as it falls to the surface of the Moon.

State the unit.

acceleration = ... unit .... [3]

2 Carbon dioxide reacts with carbon to produce carbon monoxide.

The equation for the reaction is

$$CO_2 + C \longrightarrow 2CO$$

(a) The relative molecular mass of carbon dioxide is 44.

[A_r: O, 16; C, 12]

(i) Calculate the relative molecular mass of carbon monoxide.

....[1]

(ii) Complete the following sentences.

44 g of carbon dioxide produces .... g of carbon monoxide.

1.1 g of carbon dioxide produces .... g of carbon monoxide. [2]

(b) Carbon monoxide is a common pollutant of the atmosphere.

Explain how the carbon monoxide in the atmosphere is produced other than by the reaction of carbon with carbon dioxide.

....

....[2]

(c) Carbon monoxide acts as a reducing agent in the extraction of iron from iron ore in the blast furnace.

Balance the equation for this reaction.

$$Fe_2O_3 + \text{.........}CO \qquad \text{.........}Fe + \text{.........}CO_2$$
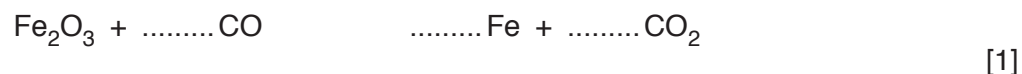
[1]

3 (a) (i) Complete Table 3.1 to compare the structure of arteries and veins.

Table 3.1

structure	arteries	veins
thickness of wall		
size of lumen		

[2]

(ii) Complete Table 3.2 to compare the blood pressure and direction of blood flow in arteries and veins.

Table 3.2

	arteries	veins
blood pressure		
direction of blood flow		

[2]

(b) Explain why the wall of a capillary is only one cell thick.

....

....

....[1]

(c) Veins have valves at intervals along their inner walls.

A section through one of these valves is shown in Fig. 3.1.

direction of
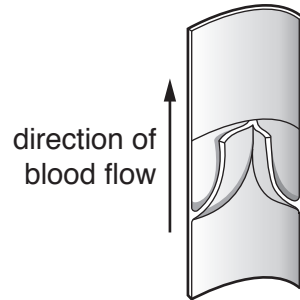blood flow

Fig. 3.1

   (i) State the function of the valve.

   ....

   ....[1]

   (ii) Explain why arteries do not have valves.

   ....

   ....

   ....

   ....[2]

4 A girl walks across a carpet and gains a positive electric charge.

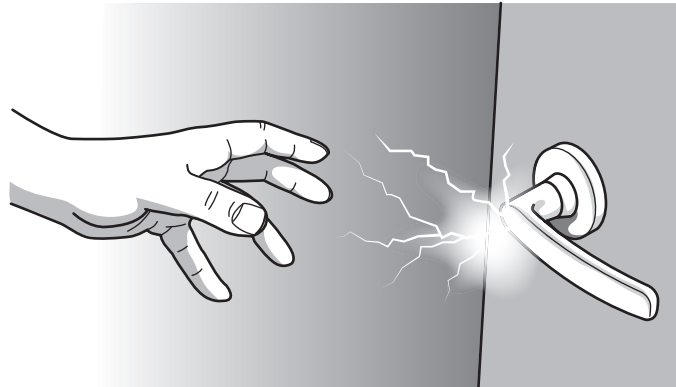As she touches a metal door handle, there is a small spark, as shown in Fig. 4.1.

Fig. 4.1

Explain why there is a small spark.

....

....

....

....[3]

5 Chlorine, bromine and iodine are diatomic elements in Group VII of the Periodic Table.

(a) (i) State the name given to the elements in Group VII.

....[1]

(ii) State how the melting points of the Group VII elements change down the group from chlorine to iodine.

....[1]

(b) State the meaning of the term *diatomic*.

....

....[1]

(c) Bromine displaces iodine from an aqueous solution of sodium iodide.

The equation for the reaction is

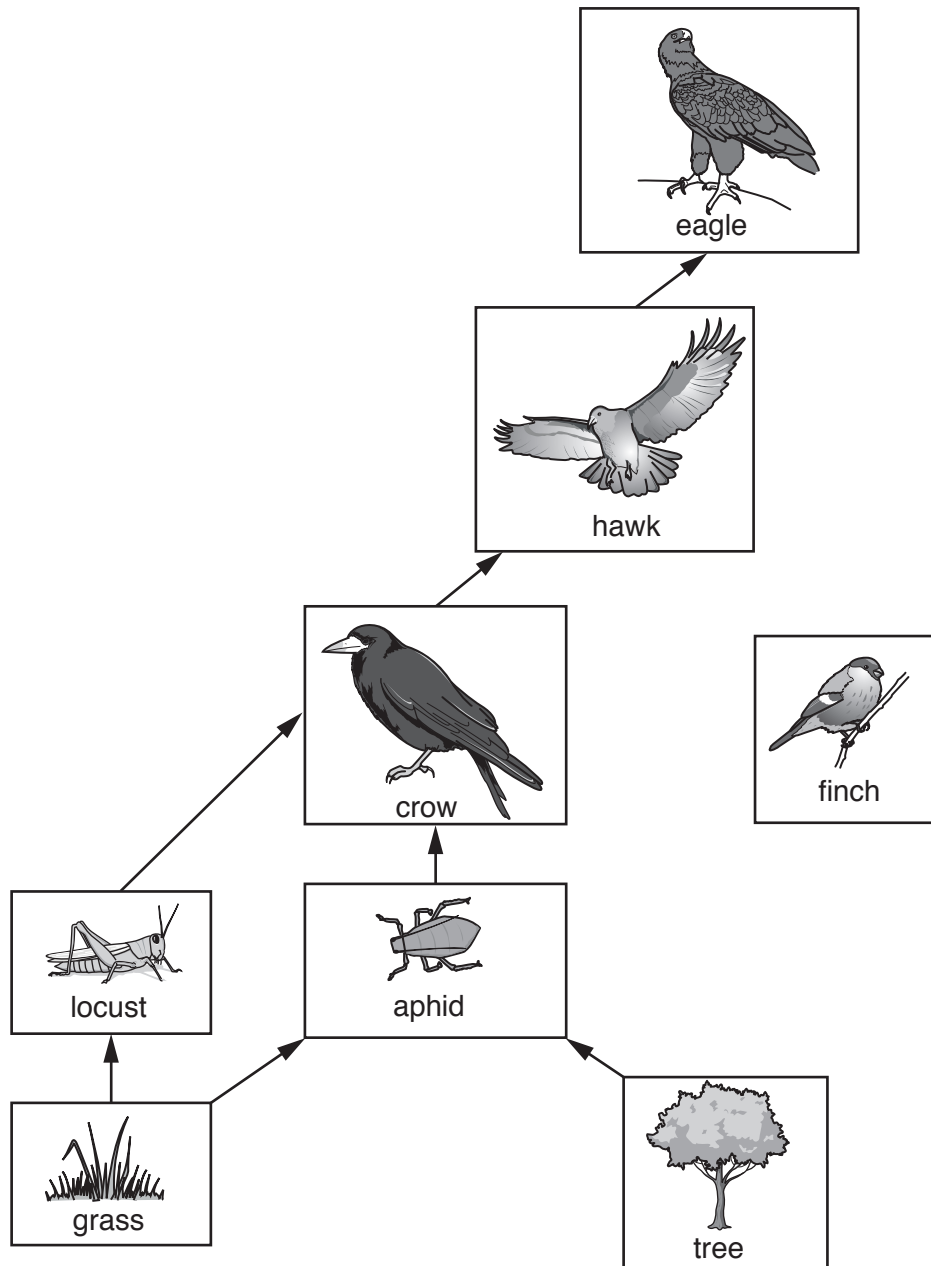$$Br_2 \ + \ 2NaI \ \longrightarrow \ 2NaBr \ + \ I_2$$

Explain why iodine is displaced by bromine.

....

....[1]

(d) Explain why chlorine is used in the purification of water supplies.

....

....[1]

6 Part of a food web is shown in Fig. 6.1.

not drawn to scale

Fig. 6.1

(a) Finches eat seeds from the tree.

Finches are eaten by hawks and eagles.

Complete Fig. 6.1 to show this information. [2]

(b) (i) State the source of energy for this food web.   ....[1]

(ii) Name **one** herbivore in this food web.   ....[1]

(c) The eagles in the food web die out.

Suggest what happens to the finch population and explain your answer.

....

....

....

....[2]

7 A beam rests on a pivot.

Masses **W**, **X** and **Y** are placed on the beam as shown in Fig. 7.1.
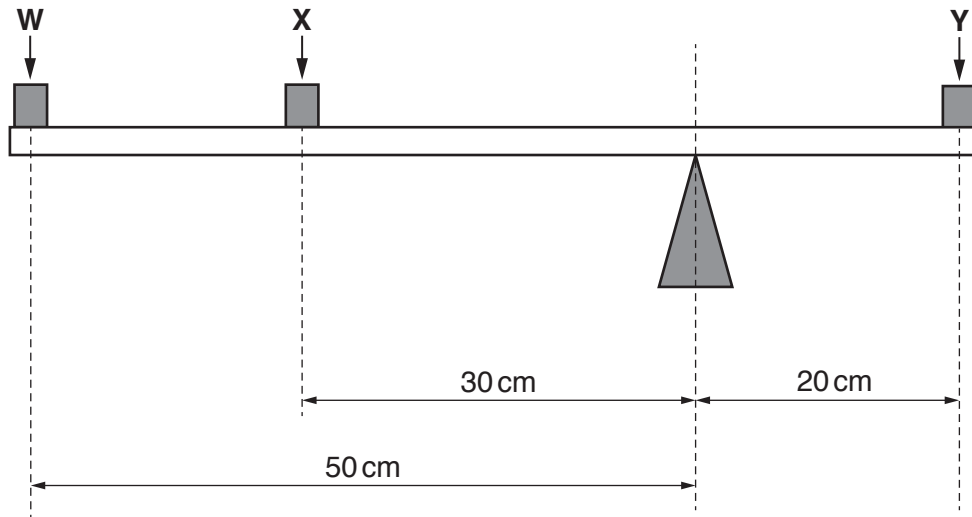
The beam has negligible mass.

Fig. 7.1

The weight of mass **Y** is 12 N and the weight of mass **W** is 4.0 N.

Calculate the weight of mass **X** that balances the beam.

weight = ... N [3]

8 An element Q exists as two isotopes, ^{113}Q and ^{115}Q.

Q is not the correct symbol for the element.

(a) Complete Table 8.1 for a neutral atom of each isotope.

Table 8.1

isotope	number of protons	number of neutrons	number of electrons
^{113}Q	49		
^{115}Q	49	66	

[2]

(b) Use the Periodic Table to identify element Q.

....[1]

(c) Explain why Q has similar chemical properties to aluminium.

....

....

....[2]

9 Use words from the list to complete the sentences about plant reproduction.

anther   carpel   cotyledon   cuticle

pericarp   radicle   root   sepal

shoot   stigma   testa

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

Pollen is produced by the .... of a flower.

When an insect visits a flower, the insect transfers pollen onto the ....

After fertilisation, seeds are produced. A seed contains a food store called the

....

The stored food is used by the plumule and the .... to grow during

germination.

The plumule develops into the .... of a young plant.   [5]

10 A power station uses a hydrocarbon fuel to produce electrical energy.

The energy **outputs** of the power station, shown as percentages of the total energy in the fuel, are given in Fig. 10.1.
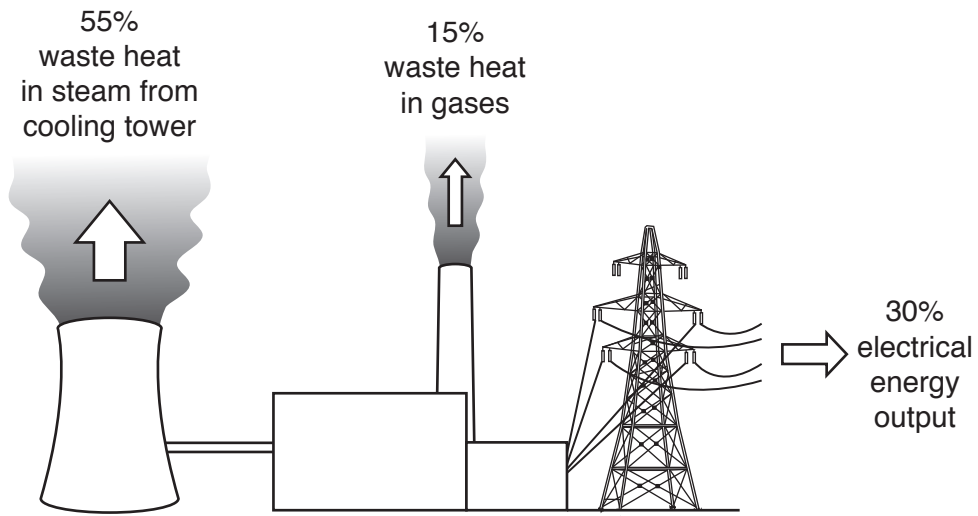
55%
waste heat
in steam from
cooling tower

15%
waste heat
in gases

30%
electrical
energy
output

Fig. 10.1

(a) Explain how Fig. 10.1 shows that energy is conserved in the power station.

....

....[2]

(b) Describe the energy transfers from the fuel to the generator.

....

....

....

....[3]

11 Sulfuric acid, H_2SO_4, and ethanoic acid, CH_3CO_2H, are both acids.

(a) (i) State the name of the ion that causes acidity. ....[1]

(ii) Complete Table 11.1 for sulfuric acid and ethanoic acid.

Table 11.1

acid	colour with Universal Indicator	pH value of the acid
sulfuric acid	red	
ethanoic acid		5

[2]

(b) Zinc sulfate is prepared by reacting zinc metal with sulfuric acid.

(i) Name **two** other substances that produce zinc sulfate when they react with sulfuric acid.

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

(ii) Suggest a reason why copper(II) sulfate is **not** made by adding copper to sulfuric acid.

....

....[1]

12 Fig. 12.1 shows the names of different parts of the alimentary canal and some functions.

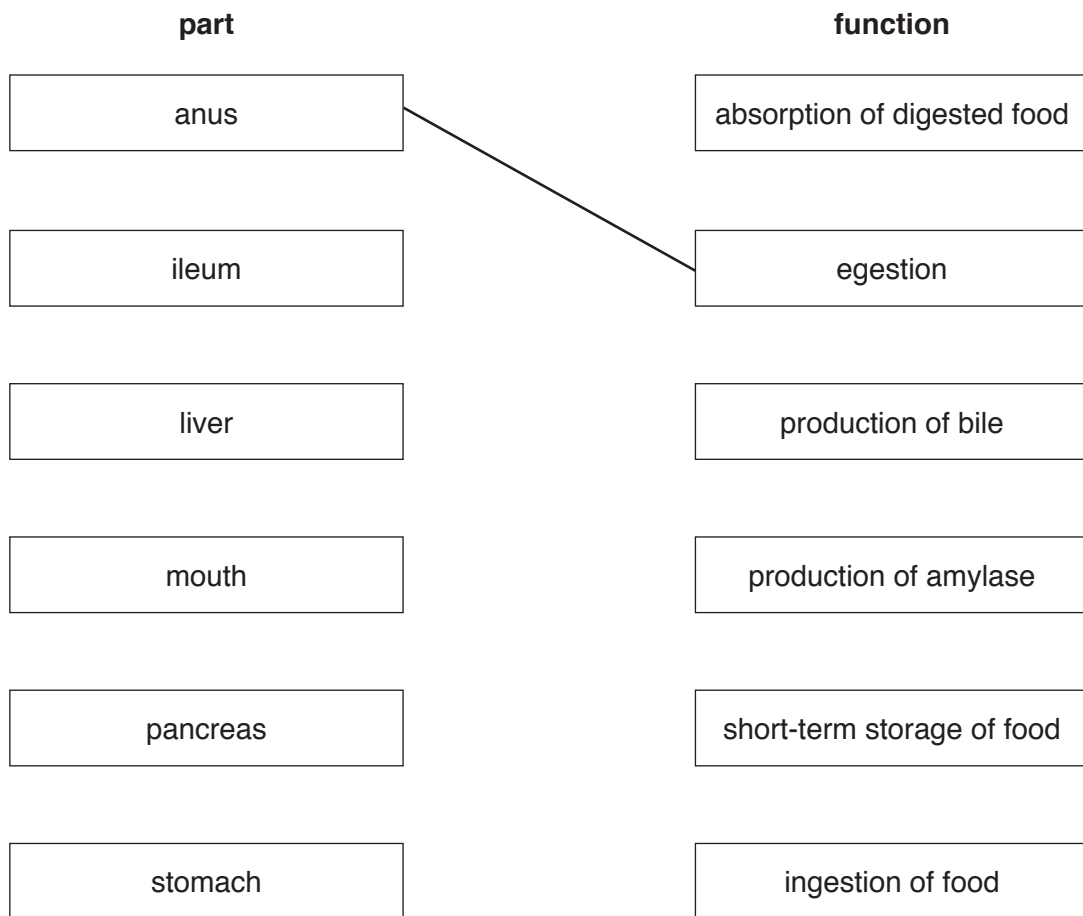| **part**	**function**
anus	absorption of digested food
ileum	egestion
liver	production of bile
mouth	production of amylase
pancreas	short-term storage of food
stomach	ingestion of food

Fig. 12.1

(a) Complete Fig. 12.1 by drawing **one** line from each part to its function.

One has been done for you. [5]

(b) The number of villi in the ileum of four students is compared.

Table 12.1 shows the average number of villi present in 1 cm^2 of ileum for each student.

Table 12.1

student	average number of villi/cm^2
P	4200
Q	4500
R	3500
S	4050

(i) Student **Q** absorbs digested food more rapidly than the other three students.

Use the information in Table 12.1 to suggest a reason for this.

Explain your reasoning.

....

....

....[2]

(ii) The absorption of the products of digestion involves diffusion.

Suggest why this diffusion occurs continuously.

....

....[1]

13 A circuit containing a battery, a motor, a resistor and a buzzer is shown in Fig. 13.1.
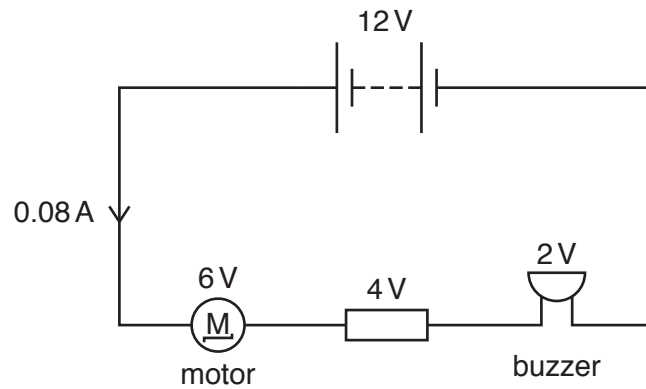

Fig. 13.1

The potential differences across the motor, resistor and buzzer are also shown in Fig. 13.1.

(a) (i) The current in the circuit is 0.08 A.

Calculate the total resistance in the circuit.

resistance = ...Ω [3]

(ii) Calculate the energy transferred by the motor in 30 s.

energy = ... J [2]

(b) The circuit is re-arranged as shown in Fig. 13.2.

The battery is the same battery, producing the same e.m.f., as in Fig. 13.1.

The currents in the motor, the resistor and the buzzer in the new arrangement are also shown in Fig. 13.2.
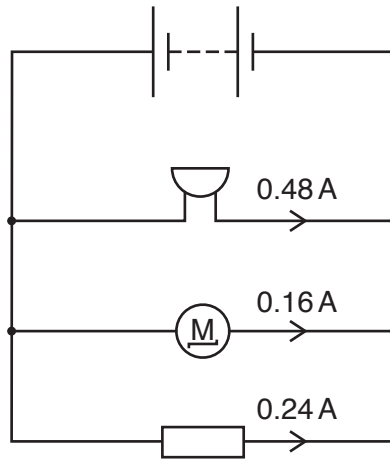
Fig. 13.2

(i) Calculate the current in the battery.

current = ... A [1]

(ii) Explain why the current calculated in **(b)(i)** is different to the current given in **(a)(i)**.

....

....[1]

14 Fig. 14.1 shows some reactions of ethene.

```
                                                              ┌──────────┐
                                                              │ ethanol  │
                                                              └──────────┘
                                                            ↗
                                           reagent A
  ┌──────────┐   hydrogen   ┌──────────┐
  │  ethane  │ ◀─────────── │  ethene  │
  └──────────┘              └──────────┘
                                           process B
                                                            ↘
                                                              ┌──────────────┐
                                                              │ poly(ethene) │
                                                              └──────────────┘
```
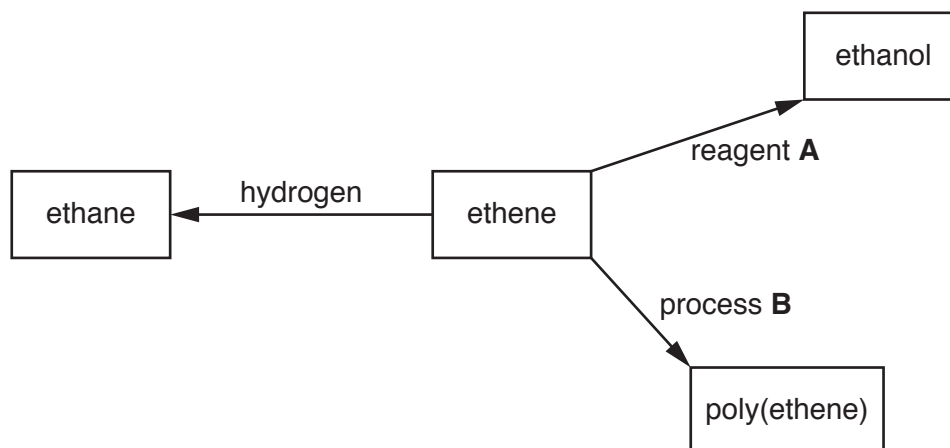
Fig. 14.1

(a) Name reagent **A** and process **B**.

reagent **A**   ....

process **B**   ....   [2]

(b) Explain why the conversion of ethene to ethane is called reduction.

....

....[1]

(c) Name the reagent that is used to distinguish between ethene and ethane.

....[1]

(d) **(i)** Draw the structure of ethanol.

[1]

(ii) Ethanol is a constituent of wine, beer and other alcoholic drinks.

State one **other** use of ethanol.

....[1]

15 Fig. 15.1 shows the male reproductive system

A ....

B ....

C ....
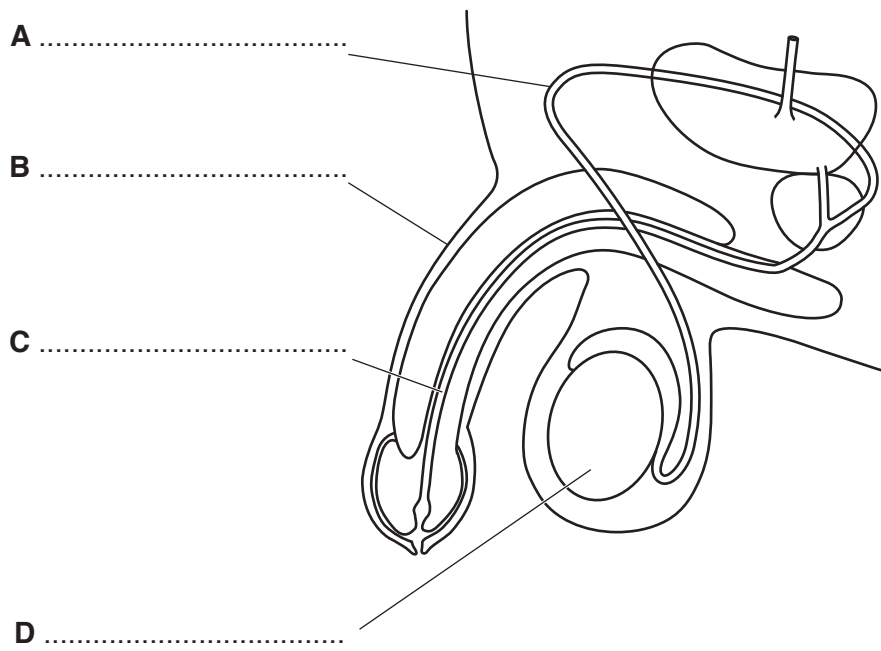
D ....

Fig. 15.1

(a) Complete Fig. 15.1 by labelling the parts **A**, **B**, **C** and **D**. [4]

(b) State a function of the prostate gland and of the scrotum.

prostate gland ....

....

scrotum ....

....
[2]

(c) One method of birth control is surgical, when a surgeon makes a cut in part of the male reproductive system.

On Fig. 15.1, draw a cross (**X**) to show where the cut is made. [1]

16 (a) A wave is shown in Fig. 16.1

On Fig. 16.1, label a one-quarter wavelength of the wave. [1]
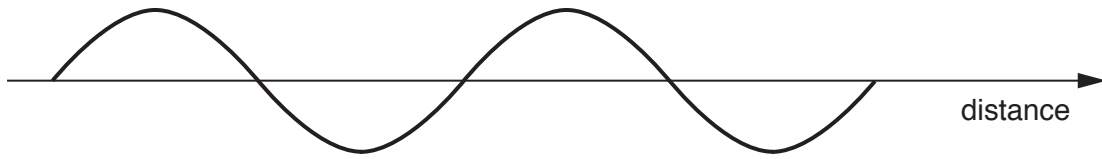
Fig. 16.1

(b) A tuning fork can be used to produce a sound wave in a column of air, as shown in Fig. 16.2.
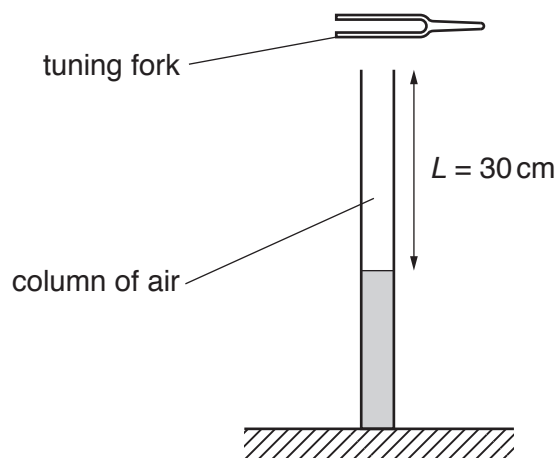
Fig. 16.2

The fork vibrates with a constant frequency. The sound produced has the same frequency as the tuning fork.

The length *L* of the column of air is one quarter of the wavelength of the sound produced.

(i) Calculate the wavelength of the sound wave that is produced.

wavelength = ... m [1]

(ii) The speed of the sound wave in air is 330 m/s.

Calculate the frequency of the sound wave.

frequency = ... Hz [2]

17 The following is a list of substances.

ammonium nitrate   **calcium carbonate**   **carbon monoxide**

nitrogen   **nitrogen dioxide**   **oxygen**   **potassium nitrate**

Use the list to complete the following sentences.

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

(a) The substance that contains **two** essential elements for plant growth

is ....   [1]

(b) The substance that is used to remove impurities in the extraction

of iron in the blast furnace is ....   [1]

(c) The substance that makes up about 21% of the air

is ....   [1]

(d) The substance that dissolves in water to produce an acidic solution

is ....   [1]

(e) The substance used in the manufacture of ammonia in the Haber process

is ....   [1]

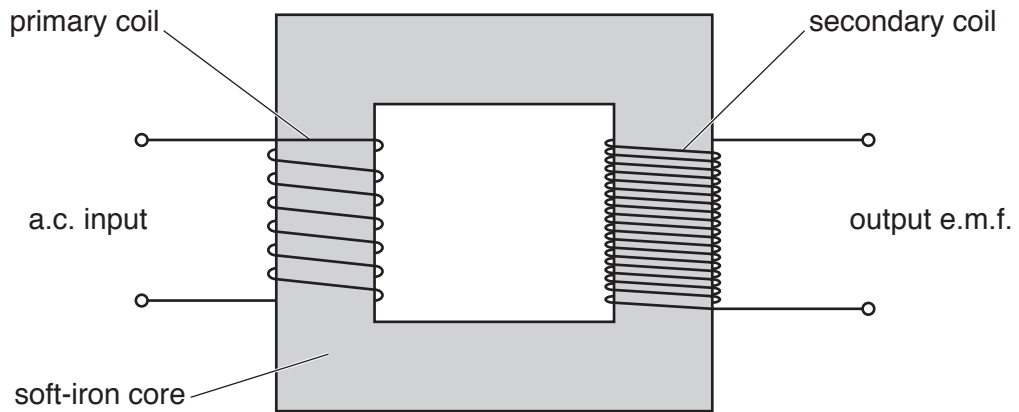**18** A transformer is shown in Fig. 18.1.

Fig. 18.1

(a) An e.m.f. is induced in the secondary coil.

Describe what happens in the primary coil, the soft-iron core and the secondary coil to produce the e.m.f. in the secondary coil.

....

....

....

....[3]

(b) The current in a cable from the transformer is 100 A.

The resistance of 1 km length of the cable is 1 Ω.

Calculate the potential difference across 1 m of the cable.

potential difference = ... V [2]

23

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The Periodic Table of Elements

Group

Key

atomic number
atomic symbol
name
relative atomic mass

I	II	III	IV	V	VI	VII	VIII
							2 He helium 4
3 Li lithium 7	4 Be beryllium 9	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40

H — 1 — hydrogen — 1

I	II												III	IV	V	VI	VII	VIII
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65		31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112		49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201		81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –			116 Lv livermorium –		

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

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