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6888/02

October/November 2018

1 hour 15 minutes

No Additional Materials are required.

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 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.

You may use an electronic calculator.

A copy of the Periodic Table is printed on page 17.
You may lose marks if you do not show your working or if you do not use appropriate units.
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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5	
6	
7	
8	
9	
10	
11	
Total	

[Turn over

- 1 Table 1.1 shows the electronic configuration of some elements in the Periodic Table.

Table 1.1

symbols of elements	Li	Be	B	C	N	O	F	Ne
electronic configuration	2,1	2,2	2,3	2,4	2,5	2,6	2,7	2,8

- (a) Explain why the elements in Table 1.1 belong to the same period in the Periodic Table.

..... [1]

- (b) Identify the element, in Table 1.1, that is

(i) in Group VI, [1]

(ii) a metal [1]

- (c) Describe how an ionic bond is formed between magnesium and fluorine.

.....

 [2]

- (d) Graphene is an allotrope of carbon.

Explain why graphene has a high melting point.

.....
 [2]

- 2 A 0.1 kg steel ball-bearing is released from a stationary helicopter 1000 m above the ground.

Fig. 2.1 shows a velocity-time graph for the steel ball-bearing.

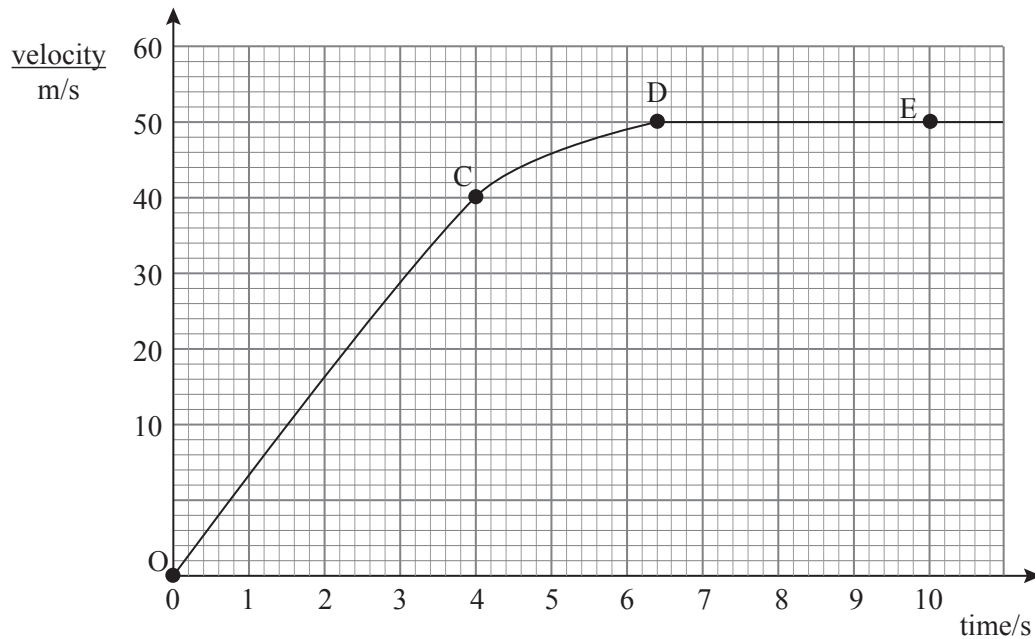


Fig. 2.1

- (a) Define the term *velocity*.

.....
 [2]

- (b) State the times between which the acceleration of the steel ball-bearing is non-uniform.

..... [1]

- (c) Describe the motion of the steel ball-bearing and comment on the forces acting upon it, in the intervals **OC** and **DE**.

OC

 [2]

DE

 [2]

(d) Calculate the kinetic energy of the ball between points **D** and **E**.

..... [3]

- 3** A student prepares an insoluble salt, lead(II) iodide, by mixing solutions of lead(II) nitrate and potassium iodide.

The equation for this reaction is



The student uses 500 cm³ of 1 mol/dm³ lead(II) nitrate solution.

- (a)** Calculate the relative formula mass, M_r , of lead(II) nitrate.

[A_r : Pb, 207; N, 14; O, 16]

..... [2]

- (b) (i)** Calculate the number of moles of lead(II) nitrate in 500 cm³ of 1 mol/dm³ lead(II) nitrate.

..... [2]

- (ii)** Calculate, using Avogadro's constant, the number of particles in 500 cm³ of 1 mol/dm³ lead(II) nitrate.

[The Avogadro's constant is 6.02×10^{23} /mol]

..... [2]

- (c)** Calculate the mass of lead(II) iodide produced.

[The formula mass of lead(II) iodide is 461]

..... [2]

4 (a) Solids, liquids and gases expand when heated and contract when cooled.

- (i) State and explain, in terms of intermolecular forces, the relative order of expansion of solids, liquids and gases.

expand most.....

.....

expand least..... [1]

explanation

.....

..... [2]

- (ii) State **one** example of thermal expansion.

.....

..... [1]

- (b) Fig. 4.1 shows a bimetallic strip, made of brass and iron.

The bimetallic strip is placed in a heater circuit to control the temperature of an incubator.

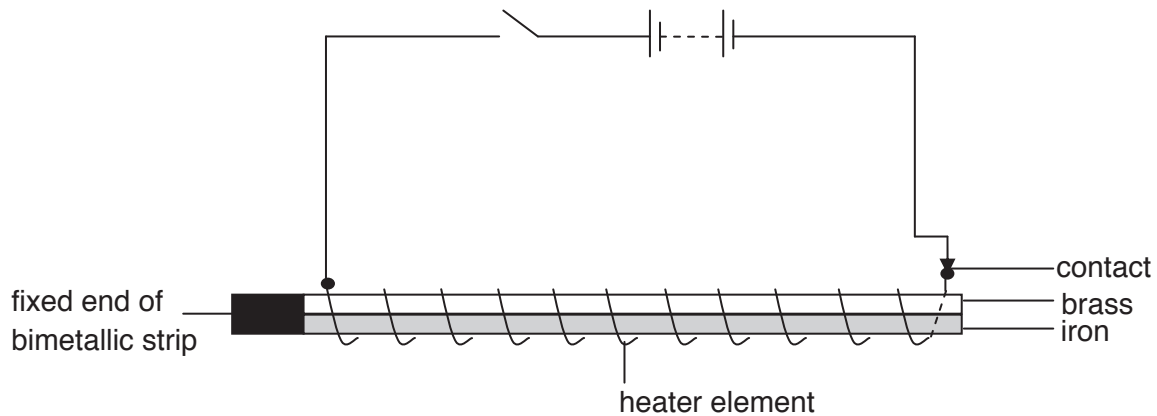


Fig. 4.1

- (i) When the heater has been switched on for a period of time, it is then automatically switched off by the bimetallic strip. (Brass expands more than iron).

Describe how the heater is switched off by the bimetallic strip.

.....
 [2]

- (ii) A thermocouple thermometer is used to measure the temperature in the incubator.

State the physical property that varies with temperature in a thermocouple thermometer.

..... [1]

- (iii) A thermocouple thermometer is preferred over a liquid-in-glass thermometer to measure the temperature in the incubator, because of its sensitivity.

Explain what is meant by *sensitivity* of a thermometer.

.....
 [2]

- 5 Fig. 5.1 shows a strip of photographic paper which uses an endothermic reaction.

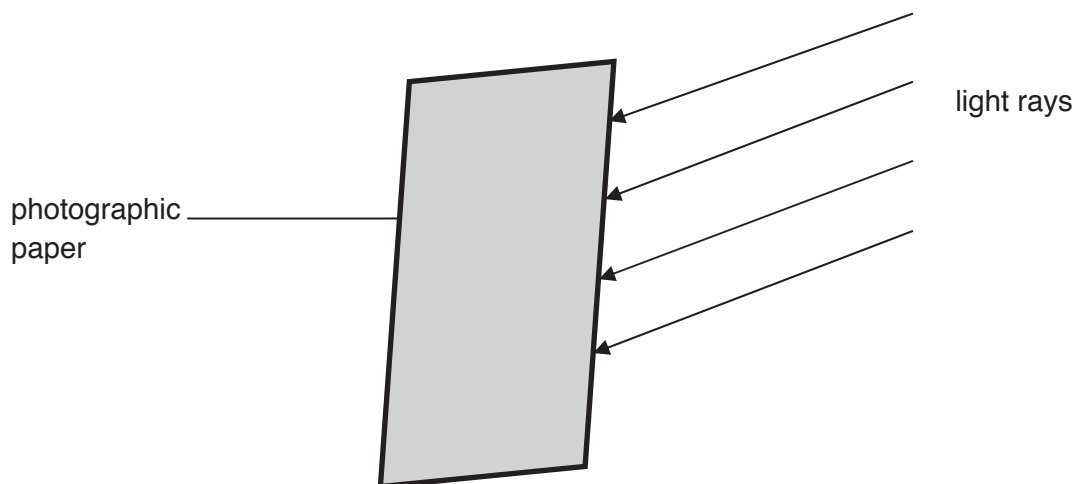


Fig. 5.1

- (a) Name a silver halide that is found in the photographic paper in Fig. 5.1.

..... [1]

- (b) (i) Describe the colour change that will be observed on the photographic paper if it is left exposed to the rays of light for more than 10 minutes.

..... [1]

- (ii) Name the type of reaction responsible for this change in colour in (b) (i).

..... [1]

- (c) The silver halide decomposes in the presence of light.

What is the role of light in this reaction?

..... [1]

- (d) Photosynthesis is an example of an endothermic reaction.

Explain, with reference to bond formation and bond breaking, why photosynthesis is an endothermic reaction.

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

- 6 (a) Fig. 6.1 shows wavefronts produced when a stone is dropped into a pond at position **X**.

Two sides of the pond are indicated by letters **Y** and **Z**.

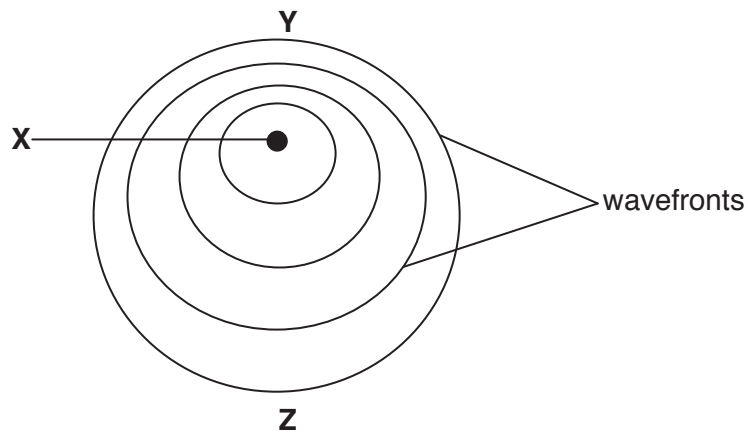


Fig. 6.1

- (i) State, giving a reason, which side of the pond is deeper, **Y** or **Z**.

.....
 [1]

- (ii) State what happens to the frequency of the waves as they approach **Y**.

..... [1]

- (b) Fig. 6.2 shows wavefronts approaching a narrow gap.

As the wavefronts pass through the gap they are diffracted.

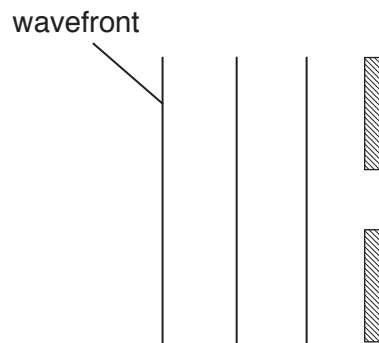


Fig. 6.2

- (i) Draw, on Fig. 6.2, three diffracted wavefronts after passing through the narrow gap. [2]
- (ii) The speed of the wavefronts before the narrow gap is 5 cm/s and two complete waves pass in one second.

Calculate the wavelength of the waves before passing through the narrow gap.

..... [2]

(c) Fig. 6.3 shows refraction of waves.

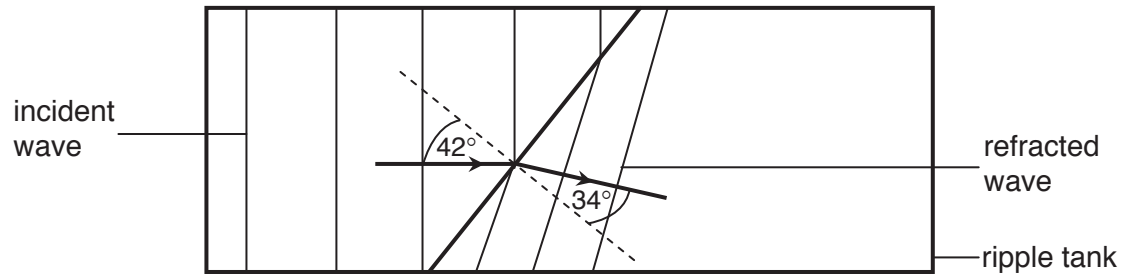


Fig. 6.3

The wave striking the shallow side of the tank at an angle of 42° , is refracted at an angle of 34° .

Calculate the refractive index of the shallow water with respect to the deep water.

..... [2]

7 Copper and gold are metals that are found native in the ground.

(a) Name the main ore from which copper is extracted.

..... [1]

(b) Suggest a method that can be used to extract gold from the earth

..... [1]

(c) Copper may also exist in the soil as malachite, CuCO_3 .

When the malachite is heated, it decomposes into black copper(II) oxide and a gas which turns lime water milky evolves.

(i) Explain why the decomposition of malachite is a chemical change.

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

(ii) State the type of oxide to which copper(II) oxide belongs.

..... [1]

(d) State and explain **one** use of copper metal.

use

.....

explanation

..... [2]

- 8** The motor of a crane uses five batteries connected in series to lift a 40 kg iron block.
Each battery has a potential difference of 9 V.

[use $g = 10 \text{ N/kg}$]

- (a)** Calculate the total voltage of the five batteries.

..... [1]

- (b)** Calculate the weight of the iron block.

..... [2]

- (c)** The crane lifts the block through a height of 4 metres in 5 seconds.

Calculate

- (i)** the gravitational potential energy of the iron block,

..... [2]

- (ii)** the power of the crane.

..... [2]

- 9 Table 9.1 shows the composition of normal air from the atmosphere and polluted air from Factory X in an industrial area in the Manzini region.

Table 9.1

gas	percentage (%) in normal air from the atmosphere	percentage (%) in polluted air from chimney
nitrogen	78	74
oxygen	21	17
carbon dioxide	0.04	5
other gases	0.96	4

- (a) One of the gases in the polluted air in Table 9.1 is sulfur dioxide.

- (i) Describe how the sulfur dioxide is produced.

.....
 [1]

- (ii) Describe how sulfur dioxide affects buildings.

.....

 [2]

- (b) Describe how the polluted air shown in Table 9.1 contributes to global warming.

.....

 [2]

- (c) The carbon dioxide in Table 9.1 is also produced during the process of respiration.

Describe how carbon dioxide is produced from respiration.

.....
 [1]

- 10 Fig. 10.1 shows a cross-section of a moving-coil microphone.

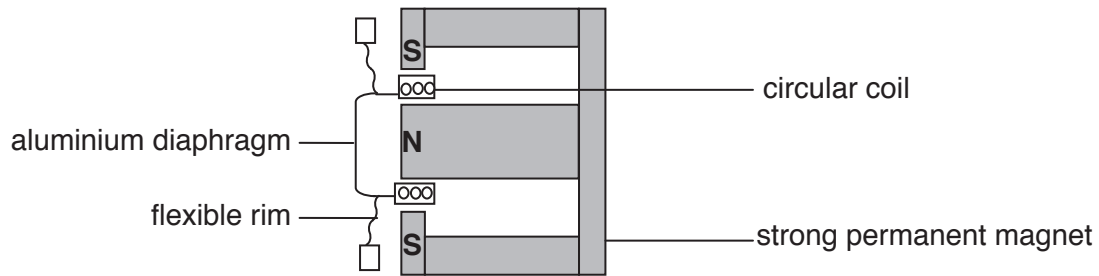


Fig. 10.1

- (a) The aluminium diaphragm vibrates when hit by sound waves.

These vibrations cause the circular coil attached to the diaphragm to also vibrate in-between the poles of the magnet.

State and explain the effect of the vibrations on the circular coil.

.....

 [2]

- (b) Another moving-coil microphone with a smaller number of turns is hit by the same sound waves as in (a).

State the effect of using less turns in the coil.

..... [1]

- (c) State the main energy changes in the microphone.

..... [1]

- (d) Name another device that uses a principle similar to the one used in the moving-coil microphone.

..... [1]

11 Decaying organic matter releases methane as one of the products.

(a) Draw the structural formula of methane.

[1]

(b) Methane belongs to the homologous series of alkanes.

State **one** characteristic of the homologous series of alkanes.

.....

..... [1]

(c) Longer-chained alkanes are cracked to form a mixture of shorter-chained alkanes and alkenes.

State **two** conditions for the catalytic cracking of alkanes in industry.

1

2 [2]

(d) Alkenes are hydrolysed to form alcohols.

(i) Name the alkene that is hydrolysed to form ethanol.

..... [1]

(ii) Explain why beer, which contains ethanol, becomes sour if left uncovered overnight.

.....

..... [2]

DATA SHEET

The Periodic Table of the Elements

[illegible]

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

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

Key

140	141	144	147	150	152	157	159	163	165	167	169	173	175
Ce Cerium	Pr Praseodymium	Nd Neodymium	Pm Promethium	Sm Samarium	Eu Europium	Gd Gadolinium	Tb Terbium	Dy Dysprosium	Ho Holmium	Er Erbium	Tm Thulium	Yb Ytterbium	Lu Lutetium
58	59	60	61	62	63	64	65	66	67	68	69	70	71
Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium	Lr Lawrencium
90	91	92	93	94	95	96	97	98	99	100	101	102	103

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

