UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Subsidiary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0317708477

PHYSICAL SCIENCE **8780/02**

Paper 2 Short Response **October/November 2013**

40 minutes

Candidates answer on the Question Paper.

Additional Materials: Data Booklet

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 pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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 Data Booklet is provided.

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 **8** printed pages.

Answer **all** the questions in the spaces provided.

Relevant Data, Formulae and the Periodic Table are provided in the Data Booklet.

1 Parallax can cause systematic errors or random errors.

Explain how these errors may occur when reading a burette.

systematic errors .....

.....

random errors .....

.....

[1]

2 Fig. 2.1 shows the distribution of energies of molecules in a sample of a monatomic gas.

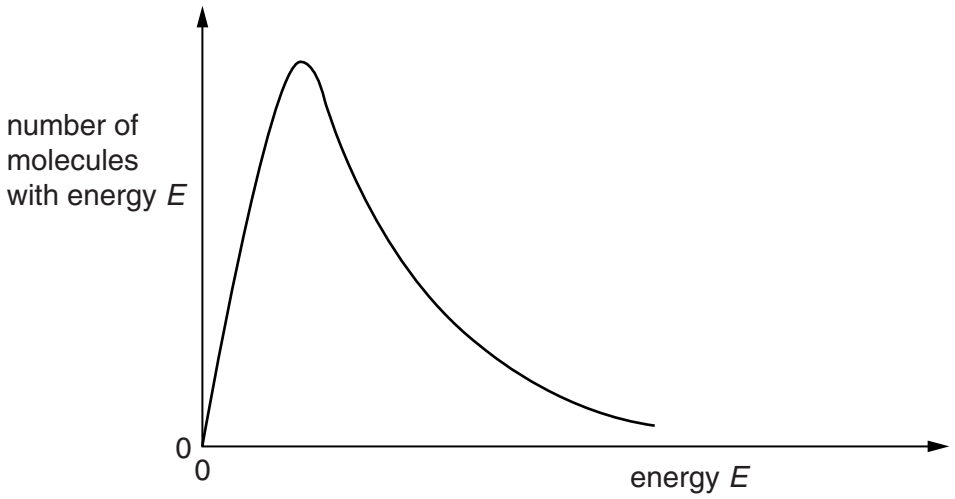


Fig. 2.1

The temperature of the gas is increased.

On Fig. 2.1, sketch a curve to show the distribution of energies at a higher temperature. [2]

3 A solid catalyst is used in the Contact process.

(a) Name this solid catalyst.

.....[1]

(b) The use of a catalyst greatly increases the rate of a reaction.

Explain, in terms of the Boltzmann distribution, why this occurs.

.....

.....

.....

.....[2]

4 **(a)** Complete Fig. 4.1 to show **all** of the atomic orbital energy levels from 1s to 4p.

Label each level and write the number of electrons that level can hold.

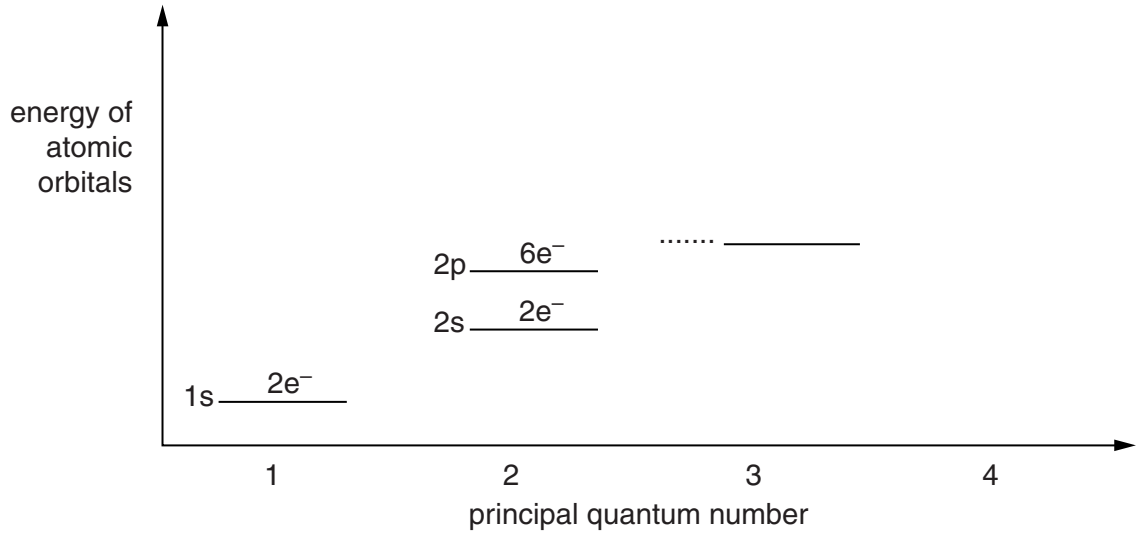


Fig. 4.1

[2]

(b) Complete the electron configuration for a vanadium(III) ion, V^{3+}.

$1s^2 2s^2 2p^6$ .....[1]

5 A polystyrene ball is dropped from rest at a height of 10 m.

Fig. 5.1 represents its position after equal successive time intervals.

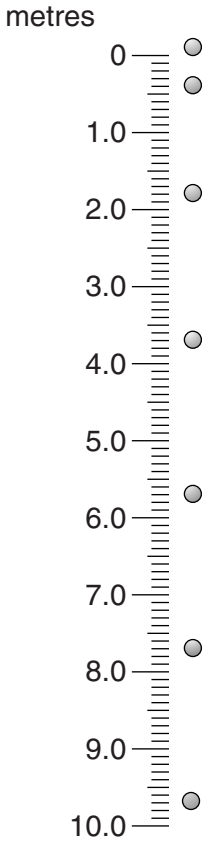


Fig. 5.1

(a) Describe how the motion of the ball changes as it falls.

.....

.....[1]

(b) Explain why the motion changes in this way.

.....

.....

.....[2]

6 **(a)** Dilute nitric acid, followed by aqueous silver nitrate, is added to a sample of an aqueous solution of a salt, **X**.

A cream-coloured precipitate is formed which slowly dissolves in an excess of concentrated ammonia.

Identify this cream-coloured precipitate.

.....[1]

(b) Chlorine water is added to a second sample of the solution of **X**.

Describe what would be observed when the chlorine water is added. Write an ionic equation for the reaction that occurs.

observation .....

.....

equation .....

[2]

7 A mixture of ethane and bromine is exposed to ultraviolet light. The mixture reacts by a free radical mechanism and a range of different organic products is formed.

The overall equation for the formation of one of these products is shown below.

$$C_2H_6 + Br_2 \longrightarrow C_2H_5Br + HBr$$

Write equations for the initiation and propagation stages of the mechanism for the reaction shown.

.....

.....

.....[3]

8 Red light of wavelength 720 nm travels from the Sun to the Earth.

(a) Calculate the frequency *f* of this red light.

f = ...Hz [2]

(b) State what is meant by the *frequency* of a wave.

.....

.....[1]

(c) Light travels more slowly in air than in a vacuum.

Explain what happens to the wavelength of the red light as it passes into the Earth's atmosphere.

.....

.....

.....[1]

9 By making estimates of suitable quantities, estimate the number of molecules in a cup of tea. Show your working.

quantities estimated:

calculation:

number of molecules = ...[3]

10 A radioactive gas has a long half-life. The count rate of a sample of the gas is me every ten seconds. Table 10.1 shows the results.

Table 10.1

time/s	count rate/s^{-1}
0	238
10	234
20	223
30	246
40	216
50	234
60	225

The pressure of the gas is increased. The measurements are repeated and the results are shown in Table 10.2.

Table 10.2

time/s	count rate/s^{-1}
0	231
10	230
20	245
30	223
40	229
50	239
60	219

Explain how these results provide evidence that radioactive decay is both *random* and *spontaneous*.

random .....

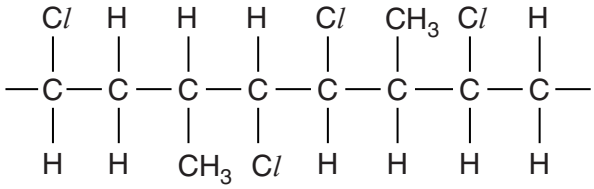
.....

spontaneous .....

.....

[2]

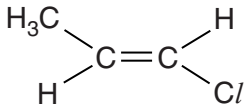
11 A fragment of a polymeric chain is shown below. This chain can be formed by polymerisation of a mixture of **two** monochloroalkenes, compounds **A** and **B**.



(a) The structure of compound **A** is shown below.

Name compound **A** and draw the structure of compound **B**.

compound **A**



compound **B**

name ..... [2]

(b) Explain why compound **A** is able to show cis-trans isomerism.

.....

.....

.....[1]