UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the November 2005 question paper

0652 PHYSICAL SCIENCE

0652/03   **Paper 3 (Extended)**   **maximum raw mark 80**

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

The minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

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1 **(a)** one electron in outer shell ;

eight electrons in each of second and third shells ;

(b) **(i)** $2Li + 2H_2O \rightarrow 2LiOH + H_2$;;

one mark for formulae, one mark for balance **[2]**

(ii) apply a lighted splint ;

gas burns with a pop / squeak ; **[2]**

(c) hydrogen catches fire / flame ;

reaction quicker / moves more quickly around surface ; } any two

metal melts ; **[2]**

Total **[8]**

2 **(a)** use of $\sin i / \sin r = n$; **[1]**

correct rearrangement or 0.63 seen ; **[1]**

$39.0(5)^o$; **[1]**

(b) block with incident, refracted and emergent rays ; **[1]**

incident and emergent rays parallel by eye ; **[1]**

incident and refracted angles consistent with part (**a**) ; **[1]**

Total **[6]**

3 **(a)** **(i)** $1.0 \times 20/1000 = 0.02$; **[1]**

(ii) 0.02 (allow error carried forward from (i)) ; **[1]**

(iii) $64 + 32 + (4 \times 16)$;

= 160 ; **[2]**

(iv) 160×0.02 ; (allow error carried forward from (ii) and (iii))

= 3.2 ; **[2]**

(b) filter off the excess copper(II) oxide ;

evaporate off some of the water ;

leave solution to cool / collect crystals and dry ; **[3]**

Total **[9]**

4 **(a)** all timings accurate ;

constant positive gradient from origin to (0.1,20) ; **[1]**

horizontal line from end of acceleration to (0.9,20) ; **[1]**

variable gradient line from end of constant speed to (1.2,0) ; **[1]**

(b) use of $\frac{1}{2}mv^2$ *or* $\frac{1}{2} \times 0.15 \times 20^2$ **[1]**

30 **[1]**

J **[1]**

(c) acceleration equation or use of gradient **[1]**

200 **[1]**

m/s^2 **[1]**

Total [10]

5 **(a)** $2H_2 + O_2 \rightarrow 2H_2O$

one mark for formulae ; one mark for balance ; **[2]**

(b) **(i)** catalytic converter / using a catalyst ; **[1]**

(ii) carbon monoxide is poisonous / uses blood's O_2 ; owtte **[1]**

(c) advantage: no pollution / limitless supply / renewable ;

disadvantage: needs to be pressurised / cooled ; **[2]**

Total [6]

6 **(a)** idea of balanced forces ;

moments balanced ; [1]

(b) **(i)** centre of mass at its centre ; [1]

(ii) attempted use of moments ; [1]

use of 10 cm and 22 cm ; [1]

50 x 10 = m x 22 ; [1]

mass = 22.7(3) ; accept 23 [1]

Total [7]

7 **(a)** **(i)** **A** ; [1]

(ii) reaction rate increases with concentration ;

A has the steepest curve / has reaction completed in shortest time ; [2]

(iii) same mass of calcium carbonate and excess acid used each time / same mass of acid and all calcium carbonate reacts each time ; [1]

(b) sketch on graph with steeper slope than **A** ;

starts at origin and reaches 100 cm^3 before 20 s ; [2]

(c) **(i)** 100/24000 = 0.0042 (accept 0.00417) ; [1]

(ii) 0.0042 ; (allow error carried forward from (i)) [1]

(iii) 100 x 0.0042 ; (allow error carried forward from (ii))

= 0.42 ; [2]

Total [10]

8 **(a)** **(i)** (nuclear) fusion ;

(ii) light nuclei fuse / join together ; [1]

forming heavier nuclei ; [1]

idea of increased mass defect and kinetic energy of fusion products / highly exothermic ; [1]

(b) $E = mc^2$ seen ; [1]

c squared (9×10^{16} seen or implied) ; [1]

1.08 ; [1]

$\times 10^{20}$ J ; [1]

Total [8]

9 **(a)** **(i)** **C** and **E** (both required) [1]

(ii) **B** [1]

(b) **(i)** bubble through / shake with / add bromine (water) ;

only **D** changes (red/orange of bromine) to colourless ; [2]

(ii) (catalytic) cracking ; [1]

(c)
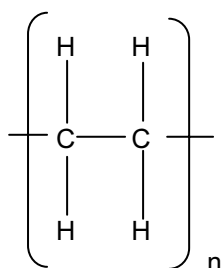
one mark for two carbon atoms and four hydrogen atoms with seven bonds shown, including a 'spare' bond on each side ;

second mark for brackets and n or any number above 2 ;

(marks can be scored for a diagram that shows three monomers joined ; with a 'spare' bond at each end ;) [2]

Total [7]

10 **(a)** so that it draws negligible current ;

almost no voltage is dropped across internal resistance ; **[1]**

(b) **(i)** R = 1000 (Ω) ; **[1]**

$V = IR$; **[1]**

I = 1.5 mA ; in any form **[1]**

(ii) 1.5 mA x 995 (Ω) ; **[1]**

1.49(25) V ; **[1]**

(iii) its resistance is much higher than the internal resistance of the cell ; **[1]**

little voltage dropped across internal resistance ; **[1]**

Total [9]