



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**COMBINED SCIENCE**

**0653/61**

Paper 6 Alternative to Practical

**May/June 2016**

**MARK SCHEME**

Maximum Mark: 60

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**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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| Page 2 | Mark Scheme                     | Syllabus | Paper |
|--------|---------------------------------|----------|-------|
|        | Cambridge IGCSE – May/June 2016 | 0653     | 61    |

- 1 (a) time/minutes ;  
volume/cm<sup>3</sup> ; [2]
- (b) 6.8 ; 0.5 ; [2]
- (c) both axes labelled at least one with units ;  
linear scale covering >1/2 paper ;  
at least 4 plots correct  $\pm$  half square ;  
best fit line ; [4]
- (d) increases amount of juice produced / more juice per unit time ; [1]
- (e) keeps volume in each beaker constant / show that the water of enzyme solution  
does not have an effect / no effect without enzyme ; [1]

[Total: 10]

- 2 (a) (i) 124 ; [1]
- (ii) C is 2.00 mol dm<sup>-3</sup>  
D is 0.50 mol dm<sup>-3</sup>  
E is 1.00 mol dm<sup>-3</sup>;; [2]

one correct = 1 mark, three correct = 2 marks

- (b) add marble chip / add UI / add Mg ;
- (marble chips or magnesium) count bubbles / collect gas / measure volume of gas ;  
in a certain time ;  
**OR**  
(for marble chips) time ;  
for limewater to go milky ;  
**OR**  
add NaOH from measuring cylinder / burette ;  
until UI just green ;
- the more bubbles or gas the more concentrated / the shorter the time (for  
limewater) the more concentrated / the more NaOH the more concentrated ;
- equal volumes of the acids (in test-tubes) ; [5]
- (c) (acidified) silver nitrate / AgNO<sub>3</sub> AND white ppt. ; [1]
- (d) too long for magnesium to disappear / reaction too slow ; [1]

[Total: 10]

| Page 3 | Mark Scheme                     | Syllabus | Paper |
|--------|---------------------------------|----------|-------|
|        | Cambridge IGCSE – May/June 2016 | 0653     | 61    |

3 (a)  $p = 29.5 \text{ cm}$  ; [1]

(b)  $x$  values correct (e.c.f.  $p$ )  
24.5 ecf, (21.8), **19.1, 16.4, 13.6** ;

$y$  values correct  
20.5 ecf, (18.2), **15.9, 13.6, 11.4** ; [2]

(c) (i) suitable choice of scales  $\geq \frac{1}{2}$  the grid (can plot the 5 points) used AND linear ;  
minimum 4 plots correct to  $\frac{1}{2}$  small square on easy to read scale ;  
good best fit straight line judgement ; [3]

(ii) indication on graph of how the data were obtained AND more than half the line ;  
calculation correct ; [2]

(d)  $m$  correct to 2/3 significant figures ; [1]

(e) **Any one from:**

difficulty in obtaining balance ;  
centre of mass of rule not at the 50.0 cm mark ;  
load not uniform ;  
difficulty in placing the centre of load over the mark on the rule ; [1]

**[Total: 10]**

4 (a) placed in the dark ;  
at least 24 hours ; [2]

(b) (i) potassium hydroxide/sodium hydroxide/soda lime ; [1]

(ii) any in the same state as (i) that does not absorb  $\text{CO}_2$  ; [1]

(c) (i) iodine solution ;  
boiling/hot water ;  
hot alcohol/ethanol ;  
rinse with water ;  
(safety) water bath/not naked flame ; [max 4]

(ii) G is blue-black AND F is brown/orange ;  
(because) G can photosynthesise and F cannot (photosynthesise) ;

**OR**

F is brown no photosynthesis ;  
G is blue-black can photosynthesise ; [2]

**[Total: 10]**

| Page 4 | Mark Scheme                     | Syllabus | Paper |
|--------|---------------------------------|----------|-------|
|        | Cambridge IGCSE – May/June 2016 | 0653     | 61    |

- 5 (a) (i) limewater ;  
white ppt. ; [2]
- (ii) diagram showing filter funnel and paper ;  
two relevant labels ; [2]
- (iii) blue ppt. AND blue ppt. ;  
(deep) blue solution ; blue ppt. ; [3]
- (b) copper carbonate /  $\text{CuCO}_3$  ; [1]
- (c) use of (acidified aqueous) barium chloride / barium nitrate ;  
white ppt. etc. ; [2]
- [Total: 10]**
- 6 (a) (i) 112 ; [1]
- (ii) correct symbol for ammeter and voltmeter ;  
ammeter in series and voltmeter in parallel ;  
correct symbols for lamp and switch in series ;  
workable circuit (no short circuits, no gaps) ; [4]
- (iii) 54 and 21 ;  
33 (ecf) ; [2]
- (iv)  $112 \text{ (ecf)} \times 33 \text{ (ecf)} \times 4.2 / 1000 = 15.5 / 16$  ; [1]
- (b) air / surroundings ;  
wires / leads / (heater) casing / circuit ;  
AVP e.g. heat transferred to: beaker / used in evaporation ; [max 2]
- [Total: 10]**



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|        | Cambridge IGCSE – May/June 2016 | 0653     | 62    |

- 1 (a) reducing sugar    protein    starch ;; [2]

3 correct = 2 marks, 1 correct = 1 mark

- (b) to release nutrients from the cells/break open the cells/let reagent/solution in ; [1]

(c)

|                       |        |                |
|-----------------------|--------|----------------|
| blue ;                | blue ; | (blue–)black ; |
| yellow/green/orange ; | blue ; | (blue–)black ; |

all 6 correct = 3 marks, 4/5 correct = 2 marks, 2/3 correct = 1 mark

[3]

- (d) peel or crush peas/sweetcorn ;  
(dissolve in) ethanol ;  
water added ;  
cloudy/emulsion ;  
no naked flames (ignore other safety precautions) ;

[max 4]

**[Total: 10]**

- 2 (a) test:  
dissolve **D** in (distilled) water ;  
add ammonia (solution) ;

*observations:*

(different) colour of ppt. (identifies metal cation) ;

[3]

- (b) (i) **D** and limewater correctly labelled ;  
glassware correct ;  
(in two separate containers connected somehow)  
(delivery tube must be under level of limewater)

[2]

(ii) carbonate /  $\text{CO}_3^{2-}$  ;

[1]

- (c) sulfate /  $\text{SO}_4^{2-}$  ;  
chloride /  $\text{Cl}^-$  ;

[2]

- (d) sodium hydroxide (solution) / NaOH / LiOH / KOH ;  
blue ppt. ;

[2]

**[Total: 10]**

| Page 3 | Mark Scheme                     | Syllabus | Paper |
|--------|---------------------------------|----------|-------|
|        | Cambridge IGCSE – May/June 2016 | 0653     | 62    |

- 3 (a) 77.0 ; [1]
- (b) both units correct, s and °C (in table) ; [1]
- (c) (i) 8.5 (°C) ; [1]
- (ii) 0.047 ; [1]
- (d) (i) 6.5 (°C) ; [1]
- (ii) 0.036 ; [1]
- (e) using a lid / beaker Q AND because  $R_Q$  is less than  $R_P$  / lower fall in temperature in same time ; [1]  
(accept reverse argument for the reason)
- (f) thicker insulation ;  
insulate the bottom of the beaker ; [2]
- (g) (same) size (thickness) of beakers / (same) volume of water / (same) initial temperature of hot water / (same) room temperature / (same) material / position of thermometer / surface area of liquid ; [max 1]
- [Total: 10]**

- 4 (a) geotropism ; [1]
- (b) (i) horizontal / same direction / continues straight ; [1]
- (ii) effect of gravity on the seedling has been removed ; [1]
- (c) young root points down ;  
approximately same length as Fig. 4.2 ; [2]
- (d) bean seedlings different / only 1 / 2 seedling used / different growth rates ; [max 1]
- (e) upwards ; [1]
- (f) water ;  
warmth / correct / suitable temperature ;  
suitable substrate e.g. cotton wool ; [3]
- [Total: 10]**

| Page 4 | Mark Scheme                     | Syllabus | Paper |
|--------|---------------------------------|----------|-------|
|        | Cambridge IGCSE – May/June 2016 | 0653     | 62    |

- 5 (a) (i) measuring cylinder / burette / pipette / syringe ; [1]
- (ii) evens the temperature / ensures mixing / ensures max T ; [1]
- (iii) reaction / reactant has finished / no more heat evolved ; [1]
- (b) (i) 6 AND 10 ; [1]
- (ii) 4 points plotted (within half square) ;  
curve ; [2]
- (iii) full line from their maximum and value  $V_2$  ; [1]
- (iv) value  $C_2$  ( $2 \times 50 / (b)(iii)$ ) ; [1]
- (c) more readings around max (20–35) / insulate beaker / use burette not ms  
(dependent on answer to (a)(i)) / add an indicator / stir with thermometer ;; [max 2]

**[Total: 10]**

- 6 (a) (i) 36 ;  
43 ; [2]
- (ii) correct scale on vertical axis (starts at 20 ends at 50) ; [1]
- (iii) correct plotting of min 5 points silver can ;  
correct plotting of min 5 points white can ;  
three reasonable curves ;  
each line labelled ; [4]
- (b) containers same size ;  
volume same in each container ;  
containers same distance from heater ; [3]

**[Total: 10]**



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- 1 (a) incisor (front) ;  
molar (back) ; [2]
- (b) (i) dissolve sample of plaque in distilled water ;  
use of full range indicator / pH meter ; [2]
- (ii) below 7 ; [1]
- (iii) acid produced by bacteria / sugar forms acid ; [1]
- (c) 2 groups – brushing twice and brushing three times ;  
over several days / weeks ;  
compare / measure amount of staining ;  
less staining means less plaque ;  
swap groups over as a control ; [max 4]

[Total: 10]

- 2 (a) (i) salt **C** label pointing to residue in filter paper  
**AND**  
salt **B** label pointing to filtrate in beaker ; [1]
- (ii) correct residue label  
**AND**  
correct filtrate label ; [1]

(b) (i)

|                  | conclusion                               |
|------------------|------------------------------------------|
| (add HCl)        | not carbonate / not $\text{CO}_3^{2-}$ ; |
| (add HCl + BaCl) | sulfate / $\text{SO}_4^{2-}$ ;           |
| (add NaOH)       | copper(II) / $\text{Cu}^{2+}$ ;          |

[3]

- (ii) copper(II) sulfate ; [1]

- (c) (i) limewater goes milky / white ppt. ; [1]
- (ii) white ppt. ;  
ppt. dissolves ; [2]
- (iii)  $\text{ZnCO}_3$  ; [1]

[Total: 10]

| Page 3 | Mark Scheme                     | Syllabus | Paper |
|--------|---------------------------------|----------|-------|
|        | Cambridge IGCSE – May/June 2016 | 0653     | 63    |

- 3 (a) 0.19 (V) ; [1]
- (b) *R* values correct (should be: 0.79, 2.42, 4.00) ;  
consistent significant figures ; [2]
- (c) axes labelled with units ;  
suitable choice of scales ( $\geq \frac{1}{2}$  the grid used) ;  
plots correct to  $\frac{1}{2}$  small square ;  
good best-fit line judgement ; [4]
- (d) directly proportional ;  
straight line through the origin ; [2]
- (e) switch off between readings / fan the wire / resistor in series with the wire ; [max 1]
- [Total: 10]**
- 4 (a) good size drawing with clear lines ;  
correct shape ; [2]
- (b) (i) correct measurement (34 mm) ; [1]
- (ii) correct measurement (from their drawing) ; [1]
- (iii) correct calculation ; [1]
- (c) (i) 3 correct labels ;;; [3]
- (ii) (agree)  
cell wall and nucleus = 1 mark ;  
*any one from:* starch grain / vacuole / chloroplast ; [max 2]
- [Total: 10]**
- 5 (a) (i) 71.8 ;  
79.6 ; [2]
- (ii) 20.3 ;  
28.1 ; [2]
- (iii) 48 ; [1]
- (iv) not all iron reacted / not hot enough ; etc. [1]
- (b) chlorine / gas is toxic ; [1]

|               |                                        |                 |              |
|---------------|----------------------------------------|-----------------|--------------|
| <b>Page 4</b> | <b>Mark Scheme</b>                     | <b>Syllabus</b> | <b>Paper</b> |
|               | <b>Cambridge IGCSE – May/June 2016</b> | <b>0653</b>     | <b>63</b>    |

- (c) use of sodium hydroxide ;  
 mention of dissolving, water, solution or aqueous ;  
 iron(II) green ppt. **AND** iron(III) brown ppt.; [3]

**[Total: 10]**

- 6 (a) (i) 118 ; [1]

- (ii) 83 (only) ; [1]

- (iii) max use of paper e.g. vertical axis starts at 30 ;  
 correct plotting ;  
 smooth curves ;  
 (at least) one curve labelled ; [4]

- (iv) (*similar*) both start at same temp/both go down, etc. ;  
 (*different*) go down at different rates/end at different temps, etc. ; [2]

- (b) result at 8 mins is wrong/anomalous ; [1]

- (c) e.g. pour same volume of water into each container ;  
**or** record initial temperatures in the beakers ; [max 1]

**[Total: 10]**