

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0653 COMBINED SCIENCE

0653/61

Paper 6 (Alternative to Practical), maximum raw mark 60

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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- 1 (a) water (is produced / present) ; [1]
- (b) carbon dioxide (produced / present) ; [1]
- (c) control / to show that water and carbon dioxide are not present ; [1]
- (d) respiration ; [1]
- (e) heat / it gets hot ;
light ; [2]
- (f) goggles / tie hair back / Bunsen position or safety flame ; [max 1]
- (g) (i) mass / amount of water ;
distance to test-tube ;
volume of water ;
start temperature of water ;
mass / amount of food ; [max 2]
- (ii) heat loss to air / not all energy goes to water ;
incomplete burning ; [max 1]
- [Total: 10]**
- 2 (a) starch ; [1]
- (b) (i) burette / pipette / syringe ; [1]
- (ii) (dropping) pipette / syringe / burette / dropper ; [1]
(must be different to the answer to (b)(i))
- (c) 57 ;
8 ;
4 ; [3]
- (d) Fe^{2+} (no mark if no explanation) because it caused a faster reaction / shorter time / faster ; [1]

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(e) (i) copper ; [1]

(ii) copper hydroxide ; [1]

(f) add 1 cm³ water ; [1]

[Total: 10]

3 (a) (i) $h = 8.2$ (cm) ; [1]

(ii) $B = 4.6$ (cm) ; [1]

(iii) $T = 6.7$ (cm) ; [1]

(iv) $d = 4.6 + 6.7 = 11.3$, $\frac{11.3}{2} = 5.7$ (cm) ; (allow: 5.65 or ecf) [1]

(v) $V_1 = \pi d^2 \frac{h}{4} = 3.14 \times 5.7^2 \times \frac{8.2}{4} = 209$ or 209.2 (cm³) ; [1]

(b) (i) 55 (cm³) ; [1]

(ii) $V_2 = 250 - 55 = 195$ (cm³) ; [1]

(c) the student cannot tell when the cup is 'full' of water/owtte ;
measuring cylinder / scale is not accurate / to 1 cm³ ;
air bubbles in the water ;
warmer / colder affecting density ; [max 2]

(d) subtract the masses **AND** gives volume ; [1]
(allow: subtract masses and divide by the density)

[Total: 10]

4 (a) water ;
oxygen ;
suitable temperature / warmth ; [max 2]

(b) (*all must extend the line*)
dish **A**: seedling is straight / towards light ;
dish **B**: seedling is curved to the left ;
dish **C**: seedling is straight ; [3]

(c) phototropism ; [1]

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(d) Benedict's (and heat) ;
red / orange / yellow / green (from blue) ; [2]

(e) demonstrates repeatability / reliability ;
not all germinate / AW ; [2]

[Total: 10]

5 (a) tube dips into water, in suitable vessel ; [1]

(b) (i) (first signs of the) whiteness or milkiness ; [1]

(ii) 6.4 (cm³) ;
7.7 (cm³) ;
7.0 (cm³) ; [3]

(iii) 7(.0) or 7.03 (cm³) ; [1]

(c) $7.03 \times \frac{0.015}{25}$ or $7 \times \frac{0.015}{25}$ or 0.004218 ;
0.004(2) (mol / dm³) ; [2]

(d) litmus ;
red **to** blue ;
OR
universal indicator ;
orange / yellow **to** green / blue / purple ;
(allow other suitable indicator and result ;;) [max 2]

[Total: 10]

6 (a) one student times the 1-metre run and the other times the 2-metre run ;
OR
one student releases and the other times at 1 m and 2 m ; [max 1]

(b) 2.6(s) **AND** 3.5(s) recorded in correct place ; [1]

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- (c) (i) $\frac{1}{3.5} = 0.29 \text{ (m/s)} ;$
 $\frac{2}{4.9} = 0.41 \text{ (m/s)}$ or $\frac{1}{1.4} = 0.71 \text{ (m/s)}$ (so must have accelerated) ;
OR
same distance (1 m) ;
in less time quoting 1.4 s ;
OR
correct calculation of acceleration ;; [max 2]
- (ii) height = 2 cm, average speed = 0.41 (m/s) ;
height = 4 cm, average speed = 0.57 (m/s) ;
height = 5 cm, average speed = 0.65 (m/s) ; [max 2]
- (d) since acceleration due to gravity is independent of mass ;
the results will be the same ;
OR
more friction ;
slower ; [max2]
- (e) (speeds too great) difficult to measure time / reaction time now significant ; [1]
- (f) (gravitational) potential energy **to** kinetic energy ; [1]

[Total: 10]

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- 1 (a) *Benedict's*: (reducing) sugar ;
biuret: protein ;
iodine: starch ; [3]

(b)

<i>Benedict's</i>	<i>biuret</i>	<i>iodine</i>
green / yellow / orange / red ;	purple / lilac	(orange)
(blue)	purple / lilac (both) ;	blue-black / black ;

[3]

- (c) (i) dissolve in / mix with ethanol ; [2]
add water ;

- (ii) cloudy / milky / white emulsion ; [1]

- (iii) milk is white / milky / cannot see the result / AW ; [1]

[Total: 10]

- 2 (a) apply a lighted splint / flame **AND** gas ignites / a flame is seen ; [1]

- (b) (i) suitable diagram of CO₂ passing into limewater ;
white ppt. / white / milky ; [2]

- (ii) carbon dioxide ; [1]

- (c) calcium carbonate / calcium hydrogencarbonate ; [1]

- (d) (i) litmus paper / pH paper / universal indicator (in the vapour) ;
blue to red (*blue can be line above*) ;
OR
full range indicator / universal indicator / pH indicator ;
red / orange / yellow ; [max 2]

- (ii) to avoid ejection of hot acid / to avoid vapour of nitric acid / to avoid acid touching
the paper ; [1]

- (e) connect a gas syringe to the tube / collect in measuring cylinder over
water / counting bubbles (in water) ;
find the volume of gas evolved in a fixed time / time taken to give out a certain
volume of gas / number of bubbles in a fixed time / time taken for a certain number
of bubbles ; [2]

[Total: 10]

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- 3 (a) $d = 25 \text{ cm}$: 0.69 (amps) ;
 $d = 40 \text{ cm}$: 0.48 (amps) ;
1.1 and 1.2 both required (volts, for $d = 25$ and 40 cm respectively) ; [3]
- (b) (i) points correctly plotted $\pm \frac{1}{2}$ small square (allow one error) ;
straight line drawn ; [2]
- (ii) indication on graph of how data obtained **AND** at least half of line used ;
correct calculation for triangle method using data from graph ; [2]
- (iii) 0.67 or 0.7 ; [1]
- (c) (i) the ammeter reading will be off the scale / current greater than 1A / the
ammeter may be damaged ; [max 1]
- (ii) the wire will heat up / (so that) the resistance (of the wire) will be changed ; [1]
- [Total: 10]**
- 4 (a) (i) $39 \pm 2 \text{ (mm)}$; [2]
(OR (for max 1): $39 \pm 4 \text{ (mm)}$ or $3.9 \pm 0.2 \text{ (cm)}$)
- (ii) shows measurement of the scale bar in working $20 \text{ mm} \pm 1 \text{ mm}$;
answer = 0.4 (mm) ; [2]
- (b) 32
72
45
10 (all four numbers to be correct) ; [1]
- (c) (i) axes labelled with units;
suitable linear scale;
at least 4 plots correct $\pm$ half small square;
best-fit line peaking at or above 0.5 mol/dm^3 ; [4]
- (ii) read from peak of graph $\pm$ half small square ; [1]
- [Total: 10]**
- 5 (a) (i) rusty ; [1]
- (ii) the nail has not rusted / no change ; [1]
- (iii) the paint excludes air / oxygen / water / cannot react with air / oxygen / water
/ prevents oxidation ; [1]

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- (b) (i) lighted splint **AND** pops ; [1]
- (ii) (add aqueous) ammonia/sodium hydroxide **AND** green precipitate ; [1]
- (iii) yellow/orange/brown/red-brown ; [1]
- (iv) (add aqueous ammonia/sodium hydroxide and) orange/red-brown/brown precipitate ; [1]
- (c) hang mass from iron wire **AND** steel wire ;
measure deflection/bend/distance with the ruler;
use wires of same thickness/same length ; [3]

[Total: 10]

- 6 (a) (teat) pipette/dropper ; [1]
- (b) (i) A: 16.5 ;
B: 8.0 ;
C: 11.5 ; [3]
- (ii) A
C
B ; [1]
- (c) (anhydrous) copper sulfate/cobalt chloride ;
boiling/freezing point/melting point ; [2]
- (d) (i) measuring cylinder (*to measure*) volume ;
balance/scale(s) (*to measure*) mass ; [2]
- (ii) the mass is divided by the volume/ $\frac{\text{mass}}{\text{volume}}$; [1]

[Total: 10]

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- 1 (a) minutes ; [1]
- (b) axes labelled with units; temperature/°C **and** time/ mins ;
correct plots for set **A** $\pm$ half square ;
correct plots for set **B** $\pm$ half square (*allow 1 incorrect per set*) ;
two best-fit curves ; [4]
- (c) large test-tubes cooled more slowly/retained heat ;
prevents penguins getting too cold/helps body temperature to be maintained ; [2]
- (d) (i) water cooler at start in last tube poured / can't read both thermometers at the
same time / only measures temperature in one tube in **A** ; [max 1]
- (ii) do each set separately / have two people reading the thermometers / read all
three tubes and average ; [max 1]
- (e) repeat the experiment ; [1]
- [Total 10]**
- 2 (a) (i) 43 ;
32.5 ;
29.5 ; [3]
- (ii) 23, 12.5, 8.0 (*all required for mark*) ; [1]
- (b) (i) the temperature changes get less as volume of **X** increases ; [1]
- (ii) **X** reacts with copper sulfate / some copper sulfate is removed from the solution ;
less copper sulfate to react with zinc / less heat produced ; [2]
- (c) sodium hydroxide / potassium hydroxide / sodium carbonate / potassium carbonate ; [1]
- (d) plastic absorbs less heat (than glass) / more accurate temperature change / reduces
heat losses / better insulation ; [max 1]
- (e) to keep the volume constant for a fair comparison of the temperature rise / owtte ;
solution **X** is the only variable ;
fair test ; [max 1]
- [Total: 10]**

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- 3 (a) (i) 1.5 cm (± 0.1 cm) ; [1]
- (ii) light rays cannot bend (so part of the screen is not lit)/the object blocks the light ; [1]
- (b) ($d = 15$ cm): 6.1 ± 0.1 ; (*must have 1dp*)
($d = 25$ cm): 3.8 ± 0.1 ; (*must have 1dp*) [2]
- (c) (i) points correctly plotted $\pm \frac{1}{2}$ small square (*allow 1 error*) (ecf) ;
smooth curve drawn ; [2]
- (ii) H_{30} **or** suitable line marked on the graph ;
equation used correctly ; [2]
- (d) (i) h correctly read from candidate's extrapolation at $d = 10$ cm ; [1]
- (ii) shadow will not fit on screen / will become blurred ; [1]
- [Total: 10]**
- 4 (a) control ; [1]
- (b) (i)&(ii) 4.3 (cm) for **A** ;
2.9 (cm) for **B** ;
0.1 (cm) for **A and B** and 3.1 (cm) for **B** ; [3]
- (c) (i) may have cooled / warmed slightly ; [1]
- (ii) (use a) water-bath ; [1]
- (d) organisms use up oxygen (in flask) ;
in respiration ;
carbon dioxide produced absorbed (by soda lime) ; [3]
- (e) oil drop travels further (to left) / faster / AW ; [1]
- [Total 10]**

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- 5 (a) (i) 80 (cm³) ;
125 (cm³) ; [2]
- (ii) both points plotted correctly $\pm \frac{1}{2}$ square ;
smooth curve drawn ;
beginning at the origin $\pm \frac{1}{2}$ or 1 square ; [3]
- (b) hydrogen does not dissolve in water / does not react with water ; [1]
- (c) the reaction slows ;
as reactant used up / gets less concentrated ;
less (frequent) collisions ;
and stops (when level) / no more H₂ produced ; [max 3]
- (d) zinc is less reactive / zinc pieces have lower surface area / pieces of zinc are larger / ORA ; [max 1]
- [Total: 10]**
- 6 (a) 74, 78 (cm³)
36, 54 (°C) ;;
all 4 correct 2 marks, 3 or 2 correct 1 mark [max 2]
- (b) (i) so that the syringe / gas are at the same temperature as the water / owtte ; [1]
- (ii) add ice to water / put in freezer ; [1]
- (c) molecules move faster / have more energy / gas has more (kinetic) energy ;
molecules get further apart ;
molecules hit syringe with more force / harder ; [max 2]
- (d) gas **G** turns to a liquid / condenses ; [1]
- (e) water level too low / all of gas not in water ;
temperature of water not gas ;
vertical syringe gravity acting on barrel compresses gas ;
no stirring / thermometer too high ;
gap between seal and syringe ; [max 2]
- (f) **C** marked on barrel – above the level of the beaker ; [1]
- [Total: 10]**