

**CAMBRIDGE**  
INTERNATIONAL EXAMINATIONS

**NOVEMBER 2003**

**INTERNATIONAL GCSE**

**MARKING SCHEME**

**MAXIMUM MARK:**

**SYLLABUS/COMPONENT: 0654/01**

**CO-ORDINATED SCIENCES  
Paper 1 (Multiple Choice)**



|               |   |                 |              |
|---------------|---|-----------------|--------------|
| <b>Page 1</b> | <b>Mark Scheme</b>                        | <b>Syllabus</b> | <b>Paper</b> |
|               | <b>IGCSE EXAMINATIONS – NOVEMBER 2003</b> | <b>0654</b>     | <b>1</b>     |

| <i>Question Number</i> | <i>Key</i> | <i>Question Number</i> | <i>Key</i> |
|------------------------|------------|------------------------|------------|
| 1                      | <b>B</b>   | 21                     | <b>B</b>   |
| 2                      | <b>D</b>   | 22                     | <b>A</b>   |
| 3                      | <b>B</b>   | 23                     | <b>C</b>   |
| 4                      | <b>C</b>   | 24                     | <b>C</b>   |
| 5                      | <b>D</b>   | 25                     | <b>A</b>   |
| 6                      | <b>B</b>   | 26                     | <b>D</b>   |
| 7                      | <b>B</b>   | 27                     | <b>C</b>   |
| 8                      | <b>C</b>   | 28                     | <b>A</b>   |
| 9                      | <b>C</b>   | 29                     | <b>C</b>   |
| 10                     | <b>C</b>   | 30                     | <b>D</b>   |
| 11                     | <b>C</b>   | 31                     | <b>B</b>   |
| 12                     | <b>A</b>   | 32                     | <b>A</b>   |
| 13                     | <b>C</b>   | 33                     | <b>A</b>   |
| 14                     | <b>B</b>   | 34                     | <b>C</b>   |
| 15                     | <b>A</b>   | 35                     | <b>A</b>   |
| 16                     | <b>B</b>   | 36                     | <b>B</b>   |
| 17                     | <b>B</b>   | 37                     | <b>B</b>   |
| 18                     | <b>A</b>   | 38                     | <b>C</b>   |
| 19                     | <b>A</b>   | 39                     | <b>B</b>   |
| 20                     | <b>C</b>   | 40                     | <b>B</b>   |

**CAMBRIDGE**  
INTERNATIONAL EXAMINATIONS

**NOVEMBER 2003**

**INTERNATIONAL GCSE**

**MARK SCHEME**

**MAXIMUM MARK:**

**SYLLABUS/COMPONENT: 0654/02**  
**CO-ORDINATED SCIENCES (DOUBLE AWARD)**  
**Paper 2 (Core)**



| Page 1 | Mark Scheme                        | Syllabus | Paper |
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|        | IGCSE EXAMINATIONS – NOVEMBER 2003 | 0654     | 2     |

|   |        |   |       |   |
|---|--------|---|-------|---|
| 1 | (a)(i) | cell/plasma, membrane;<br>cytoplasm;  |       | 2 |
|   | (ii)   | no cell wall;<br>no vacuole ;   |       | 2 |
|   | (b)    | makes mucus;<br>which traps, dirt/bacteria;<br>keeps lungs clean;   | 2 max | 2 |
|   | (c)    | cilia (normally) sweep mucus upwards;<br>mucus now collects in lungs;<br>bacteria live in it/bacteria collect in lungs;<br>coughing/poor gas exchange/shortness of breath;                              | 3 max | 3 |
| 2 | (a)    | all symbols correct;;<br>lose one mark for one mistake<br>accurate diagram;   |       | 3 |
|   | (b)    | more cells/reduce resistance/remove lamp/remove resistor/increase<br>voltage;   |       | 1 |
|   | (c)(i) | decreases - resistance of circuit higher;   |       |   |
|   | (ii)   | decreases - resistance of circuit higher;   |       |   |
|   | (iii)  | gets dimmer - less current flowing/less voltage across lamp;  |       | 3 |
| 3 | (a)(i) | reference to ignition;<br>(squeaky) pop;  |       | 2 |
|   | (ii)   | measure time for a certain volume to be collected;<br>the more gas collected per unit time the higher the rate;<br>some reference to 'fair test' e.g. same temp/surface area/<br>concentration of acid; |       | 3 |
|   | (b)    | rusting prevented if attached metal is more reactive than iron;<br>iron rusts if attached metal is less reactive than iron;<br>rusting is worse than control if less reactive metal is attached;        | 2 max |   |
| 4 | (a)(i) | distance = speed x time;<br>distance = 330 x 0.2 = 66m;<br>moth is 33m away;  |       | 3 |
|   | (ii)   | series of compressions and rarefactions;<br><b>or</b> air particles vibrate;<br>this vibration is passed on from one particle to the next;  |       | 2 |
|   | (iii)  | more waves;<br>same amplitude;  |       | 2 |

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|   |        |   |       |   |
|---|--------|---|-------|---|
|   | (b)    | kinetic energy = $\frac{1}{2} mv^2$ ;<br>= $0.5 \times 2.5/1000 \times 3 \times 3$ ; (or for converting g to kg);<br>= $11.25 \times 10^{-3} \text{ J}$ ;                                   |       | 3 |
| 5 | (a)(i) | 7.5;  |       | 1 |
|   | (ii)   | bacteria act on food;<br>produce acids;   |       | 2 |
|   | (iii)  | line higher than original ;<br><i>accept either going up, or going down less</i>  |       | 1 |
|   | (iv)   | increases pH/reduces acidity;<br>by neutralisation;<br>by removing, food/bacteria ;<br>less acid to damage teeth;<br>by, acting on/reacting with/dissolving, enamel;                        | 3 max | 3 |
|   | (b)(i) | one of the front two teeth labelled ;   |       | 1 |
|   | (ii)   | chewing/crushing/grinding;<br>breaks food down into smaller pieces;<br>increase surface area of food;<br>so enzymes can act on it more, rapidly/easily;                                     | 2 max | 2 |
|   | (iii)  | food gets stuck, in depressions on tooth surface/between teeth;<br>food in contact with teeth for longer ;  |       | 2 |
| 6 | (a)(i) | phosphorus/sulphur/chlorine/argon;  |       | 1 |
|   | (ii)   | tin/lead;   |       | 1 |
|   | (iii)  | four;<br>Si in group IV outer electrons same as group number;   |       | 2 |
|   | (b)(i) | mixture <b>B</b> will be coloured and <b>A</b> will be colourless;<br><b>B</b> contains a transition metal compound/an iron compound;   |       | 2 |
|   | (ii)   | giant structure;<br>disorderly arrangement of atoms;  |       | 2 |
|   | (c)    | conserves raw materials;<br>avoids damage to landscape;<br>removes waste glass/reference to reducing (dangerous) waste;<br>uses less energy (per kg of glass)/less fossil fuel used per kg; | 2 max | 2 |
| 7 | (a)    | A a mirror;<br>light is reflected;  |       |   |
|   |        | B a glass or perspex block/lens etc;<br>light is refracted;   |       | 4 |

| Page 3 | Mark Scheme                    | Syllabus | Paper |
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|   |        |  |       |   |
|---|--------|--|-------|---|
|   | (b)    | ray is a series of straight lines;<br>reflected off surface;<br>at correct angles;   |       | 3 |
| 8 | (a)(i) | water;<br>air;<br>fire;  |       | 3 |
|   | (ii)   | any element;<br>substance which;<br>cannot be made simpler/be broken down and further/<br>contains only one type of atom;  |       | 2 |
|   | (b)(i) | protons;<br>neutrons;  |       | 2 |
|   | (ii)   | electrons;   |       | 1 |
|   | (iii)  | gains (one) electron/achieves eight electrons in outer shell;  |       | 1 |
| 9 | (a)    | water;<br>oxygen;<br>carbohydrate/sugar/glucose/starch;<br><i>all three for two marks, two for one mark</i>  |       | 2 |
|   | (b)    | absorb sunlight; <i>not 'attract'</i><br>provides energy for reaction;<br>allows plants to use energy;<br>able to use sunlight;  | max 2 | 2 |
|   | (c)(i) | phloem;  |       | 1 |
|   | (ii)   | for respiration;<br>to provide energy;<br><b>or</b><br>for nectar;<br>to attract insects to flower;<br><b>or</b><br>for stigma;<br>to stimulate pollen to germinate ;  |       | 2 |
|   | (d)(i) | fewer plants means less carbon dioxide absorbed;<br>so carbon dioxide in atmosphere may increase;<br>if trees burnt then carbon dioxide released;<br>carbon dioxide is a greenhouse gas/words to that effect;<br>more heat trapped in atmosphere ; | 3 max | 3 |
|   | (ii)   | loss of, habitat/food;<br>animals become extinct;<br>may lead to drier atmosphere;<br>plants/animals, short of water;  | 2 max |   |

| Page 4 | Mark Scheme                    | Syllabus | Paper |
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|    |        |   |       |   |
|----|--------|---|-------|---|
| 10 | (a)(i) | work = force x distance;<br>= 650 x 50;<br>= 32500J;  |       | 3 |
|    | (ii)   | gravitational potential energy etc;   |       | 1 |
|    | (b)(i) | need large pressure to get stick into ice/snow;<br>gets this with a small area;<br>use less force;  | max 2 | 2 |
|    | (ii)   | stick only needs to go in a few centimetres then stop;<br>disc reduces pressure - larger area;  |       | 2 |
|    | (c)    | reduce friction;  |       | 1 |
| 11 | (a)    | water/rain enters tiny cracks and may freeze;<br>expansion (of ice) deepens cracks;<br><b>or</b><br>heat/sun causes rock to expand;<br>this causes rock to crack/weaken;<br><b>or</b><br>sand/dust carried by wind;<br>hits rock weakening it/damaging surface; | 2 max | 2 |
|    | (b)(i) | reacts with soap/forms scum with soap/<br>reduces ability of soap to clean things;<br>causes limescale in hot water systems/reduces efficiency of<br>water heating/blocks pipes/scales kettles;   |       | 2 |
|    | (ii)   | boil it/distill it/use ion exchange/use washing soda;   |       | 2 |
|    | (c)(i) | (thermal) decomposition;  |       | 1 |
|    | (ii)   | add acid to solid;<br>if gas/CO <sub>2</sub> evolved then solid is a carbonate;   |       | 2 |

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INTERNATIONAL EXAMINATIONS

**NOVEMBER 2003**

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**MARK SCHEME**

**MAXIMUM MARK: 110**

**SYLLABUS/COMPONENT: 0654/03**  
**CO-ORDINATED SCIENCES (DOUBLE AWARD)**  
**Paper 3 (Extended)**





| Page 1 | Mark Scheme                        | Syllabus | Paper |
|--------|------------------------------------|----------|-------|
|        | IGCSE EXAMINATIONS – NOVEMBER 2003 | 0654     | 3     |

- 1 (a) sawdust has greater surface area;  
so higher rate of reaction; [2]
- (b) in (primary) cell reactants are used up/reaction cannot be reversed;  
car battery is rechargeable (by the engine); [2]
- (c) glowing splint tests for (free) oxygen;  
in water oxygen is combined;  
heating does not decompose water; 2 max
- (d) MgO has giant structure/many strong bonds;  
much energy needed to break bonds;  
CO<sub>2</sub> is simple molecular/weak forces between molecules;  
less energy needed to break bonds; 3 max
- 2 (a) ray bent in the correct direction and dispersed at first surface;  
ray bent in the correct direction and dispersed at second surface;  
red at top and blue at bottom; [3]
- (b) have a different, frequency/wavelength; [1]
- (c) equation  $v = f\lambda$  stated in any form; *ignore formula triangles*  
correct substitution, e.g.  $f = 3 \times 10^8 \div 6 \times 10^{-7}$ ;  
 $5 \times 10^{14}$  Hz/ $5 \times 10^{11}$  kHz; [3]

|               |   |                 |              |
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- 3 (a)(i) reflex (action); [1]
- (ii) sensory, relay/intermediate, motor;;  
*all correct for 2 marks*  
*2 in correct sequence relative to each other for 1 mark* [2]
- (b)(i) mass converted to newtons/20 used in calculation;  
 $F = 20 \times 30 \div 5$ /any correct working;  
 $= 120 \text{ N}$ ; [3]
- (ii) 1 food/glucose/carbohydrate;  
2 respiration/combined with oxygen/oxidised;  
3 in the (muscle), tissue/cells/mitochondria;  
4 idea that the energy originated in the Sun;  
5 Sun's/light, energy converted to chemical energy by photosynthesis; max 3
- (iii) when one contracts the other relaxes;  
(contraction of) one causes bending while the other causes straightening; [2]

| Page 3 | Mark Scheme                        | Syllabus | Paper |
|--------|------------------------------------|----------|-------|
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- 4 (a)(i) cracking; [1]
- (ii) one mark for each entirely correct;; [2]
- (b)(i) (molecular mass of ethane = ) 30;  
 $300 \div 30 = 10$  ; [2]
- (ii) 9; [1]
- (iii) (molecular mass of ethene = ) 28;  
 $9 \times 28 = 252$  g; [2]
- (c)(i) reaction with steam;  
in presence of catalyst;  
ref. to addition reaction; 2 max
- (ii) must be unsaturated/unsaturated/alkene;  
undergoes addition reaction with bromine; [2]
- (d) melts/becomes softer;  
as molecules separate and move;  
only relatively weak attractive forces between molecules; 2 max

|               |   |                 |              |
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| <b>Page 4</b> | <b>Mark Scheme</b>                        | <b>Syllabus</b> | <b>Paper</b> |
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- 5 (a)(i) friction;  
as clothes rub against, one another/plastic door;  
electron transfer; [2]
- (ii) electrons; [1]
- (b)(i) 2000; [1]
- (ii) 2000 W/Js<sup>-1</sup>; [1]
- (iii) substitution, e.g. 2000 = 250 x current;  
current = 8 A; [2]
- (iv)  $I = V \div R$ ;  
 $250/125 = 2 \text{ A}$ ; [2]

| Page 5 | Mark Scheme                        | Syllabus | Paper |
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- 6 (a)(i) curve rises then, flattens/falls;  
S shaped; [2]
- (ii) point at which the curve begins to flatten/fall; [1]
- (b)(i) a change in, genetic material/DNA/genes/chromosomes;  
sudden/random/unpredictable; [2]
- (ii) 1 allele **a**/allele (for long hair), is recessive;  
2 no goat in the next generation could be aa;  
3 all goats in the next generation will be Aa or AA; 2 max
- (iii) 1 two heterozygous goats/Aa and Aa, could breed together;  
2 some gametes from each will contain allele a;  
3 so some offspring will be aa;  
*take from written explanation and/or genetic diagram* [3]
- (c)(i) 1 long hair, provides insulation/traps warm air;  
2 less heat lost from body of long-haired goat;  
3 food required to generate heat;  
4 by respiration;  
5 if less heat lost then less heat needs to be produced  
(to keep temperature constant); 3 max
- (ii) 1 long-haired goats more likely to survive/vice versa;  
2 when food is in short supply/when weather is cold/during winter;  
3 so they breed;  
4 passing on their alleles/genes, to their offspring;  
5 this happens over several generations;  
6 this is natural selection; 3 max

| Page 6 | Mark Scheme                        | Syllabus | Paper |
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|        | IGCSE EXAMINATIONS – NOVEMBER 2003 | 0654     | 3     |

- 7 (a)(i) 3 O<sub>2</sub> and 2 SO<sub>2</sub>; [1]
- (ii) too unreactive/strong bonds in N<sub>2</sub>; [1]
- (b)(i) zinc oxide + sulphuric acid → zinc sulphate + water;; [2]
- (ii) neutralisation; [1]
- (c) 1 zinc ion moves to cathode/negative electrode;  
 2 because opposite charges attract;  
 3 gains electrons (from cathode);  
 4 each ion gains two electrons;  
 5 becomes neutral/electrons cancel ionic charge; 4 max
- (d) (gelatinous) white, precipitate/solid;  
 (re-)dissolves in excess; [2]
- (e) 1 brass is less malleable than pure metal/more difficult to bend/less chance of damage when connection is made;  
 2 diagram of pure metal showing atoms all the same size;  
*note - must be regularly arranged and touching*  
 3 reference to slippage of atoms (under pressure);  
 4 diagram of allow with atoms of different sizes;  
 5 reference to greater difficulty of slippage; 3 max

|        |                                    |          |       |
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| Page 7 | Mark Scheme                        | Syllabus | Paper |
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- 8 (a) cosmic radiation/the Sun; *not sunlight* [1]
- (b)(i) 2600 cps  $\pm$  100; [1]
- (ii) 52 s  $\pm$  1;  
working (on graph or with answer); [2]
- (iii) (atoms containing) same number of protons;  
different number of neutrons; [2]
- (c)(i) ionising;  
damages, DNA/genes/chromosomes;  
causes mutations;  
causes cancer;  
harms/kills, cells; 2 max
- (ii) alpha particle contains 2 protons and 2 neutrons;  
radon 220 contains 86 protons and 134 neutrons;  
so atom now contains 84 protons and 132 neutrons;  
*allow ecf if radon 220 p and n incorrect* [3]

|               |   |                 |              |
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- 9 (a)
- 1 cell wall is outside cell membrane;
  - 2 cell wall is made of cellulose;
  - 3 cell wall is (fully) permeable;
  - 4 cell membrane is made of, protein/lipids;
  - 5 cell membrane is thinner than cell wall;
  - 6 cell membrane is partially permeable;
  - 7 cell membrane is more flexible than cell wall;
  - 8 cell wall stops cell bursting (when full of water); 3 max
- (b)(i)
- 1 osmosis;
  - 2 through partially permeable (cell) membrane;
  - 3 down, diffusion/concentration, gradient;
  - 4 concentration of solution is higher inside the cell than outside; 3 max
- (ii)
- in xylem vessels;  
 by mass flow;  
 pulled by transpiration stream; 2 max
- (c) cells lose water;  
 cells, become flaccid/lose turgor; [2]



|               |   |                 |              |
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- 10 (a) pointer moves one way;  
then in the opposite direction; [2]
- (b) magnetic (field) strength;  
number of turns (of coil);  
speed of turning; 2 max
- (c) 1 correct diagram of transformer with iron core and two sets of coils;  
2 more turns on secondary coil than on primary;  
3 primary coil voltage changes;  
4 which causes change in magnetic field;  
5 which induces current in secondary coil;  
6 producing secondary coil voltage;  
7 ref. to a.c.; 5 max

**CAMBRIDGE**  
INTERNATIONAL EXAMINATIONS

**NOVEMBER 2003**

**INTERNATIONAL GCSE**

**MARK SCHEME**

**MAXIMUM MARK: 45**

**SYLLABUS/COMPONENT: 0654/05**  
**CO-ORDINATED SCIENCES (DOUBLE AWARD)**  
**Practical**



| Page 1 | Mark Scheme                        | Syllabus | Paper |
|--------|------------------------------------|----------|-------|
|        | IGCSE EXAMINATIONS – November 2003 | 0654     | 5     |

- 1 (a)(i) zero reading included  
readings for 10 mins  
temperatures show decrease and B is finally less than A [3]
- (b)(i) suitable scale for temperature  
correct plotting of points  
smooth curves drawn [3]
- (iii) tube A [1]
- (c) yes  
test-tube A stayed warm for longer;  
insulation provided by surrounding test-tubes;  
rate of heat loss by conduction/convection/radiation is less;  
smaller difference in temperature between tube A and surroundings  
compared with tube B (and its surroundings). 3 max
- (d) suitable temperature between A and B (1)  
some insulation/prevention of heat loss provided by tube A and tubes on  
either side/less insulation/prevention of heat loss than tube A because of  
side exposed to air. (1) [2]
- (e) lines continued as smooth curves. [1]
- (f) any suitable suggestion, e.g. ensure same starting temperatures, ensure  
identical volumes

**Total 15**

- 2 (a) blue colour (not green) [1]
- (b)(i) no effervescence or no reaction  
no carbonate [2]
- (ii) white ppt.  
chloride present [2]
- (iii) litmus turns blue  
ammonia [2]
- (c) each test for copper correctly described scores three [6]
- (d) ammonium chloride and copper [2]

**Total 15**

|               |   |                 |              |
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3 (c)(d) Table

Correctly calculating mass of nitrate/100g [1]  
 At least three temperatures recorded [1]

Temperatures 70-78  
 62-70  
 55-63  
 50-58 [4]

(e) correct plotting  
 smooth curve drawn  
 continues curve beyond plotted points [3]

(f) correctly read from graph [1]  
 solubility correctly read [1]

(g) heating is irregular etc [1]

(h) one for each correct answer [3]

**Total 15**

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**MARK SCHEME**

**MAXIMUM MARK: 60**

**SYLLABUS/COMPONENT: 0654/06**

**CO-ORDINATED SCIENCE**  
**Alternative to Practical**



1. (a) Average values correct as in table. (-1 for each error, 2 errors = 0 marks)

| alcohol concn. /% | average heart rate per minute |
|-------------------|-------------------------------|
| 0                 | 210                           |
| 1                 | 192                           |
| 2                 | 174                           |
| 3                 | 146                           |
| 4                 | 92                            |
| 5                 | 46                            |
| 6                 | 34                            |
| 7                 | 24                            |
| 8                 | 18                            |

[2]

- (b) suitable scales (1) points plotted correctly (1) smooth curve drawn (1) [3]

- (c)(i) (gradual) fall in heart rate (1)  
(ii) steeper fall than in (i) (1) [2]

- (d) slower reaction/reaction time increased [1]

- (e)(i) counting error/variation in individual daphnia/warming effect of light  
different temperatures/ any other appropriate reason [1]

- (ii) longer count time/repeat several times at each alcohol strength/  
check temperatures/any other appropriate (any one) [1]

**Total 10 marks**

2. (a) 25, 3, 44, cm<sup>3</sup> [3]

- (b)(i) copper or zinc, (no reaction with water) [1]

- (ii) iron (1)  
iron rusts (and reacts with oxygen) (1) [2]

- (iii) magnesium or calcium (1)  
reacts with water (1) [2]

- (c) hydrogen [1]

**Total 9 marks**

|        |                                    |          |       |
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3. (a) 70, 62, 55°C [3]  
 (b) 140 g [1]  
 (c) points plotted (2) (-1 for each error)  
 smooth curve (not straight line) (1) [3]  
 (d) 40g of potassium nitrate in 100g water at 60°C [1]  
 (e) heat to evaporate (1)  
 allow to cool (1) [2]

**Total 10 marks**

4. (a)(i) 57  
 (ii) 43 [2]  
 (b) Table with 3 columns correctly headed and 2 rows (or vice versa), (1)  
 data correctly entered (1) (-1 overall if 0 time omitted) [2]  
 (c) tube A [1]  
 (d) (yes) (no mark for this)  
 A stayed warm for longer/surrounding tubes acted as insulation/  
 any reference to mechanism of heat loss/smaller difference in  
 temperature across the wall of tube A compared with tube B [3]  
 (e) repeat and average/put all tubes in a water bath at first/measure  
 volumes accurately/any sensible suggestion (any 2) [2]

**Total 10 marks**

5. (a) test 1 carbon or copper oxide  
 test 3 not a carbonate  
 test 4 chloride (ions)  
 test 5 ammonia [4]  
 (b) fumes with HCl [2]  
 (c)(i) light (1) blue precipitate (1)  
 (ii) deep (1) blue solution(1) (any 3 points) [3]  
 (d) ammonium chloride  
 copper oxide [2]

**Total 11 marks**

|               |   |                 |              |
|---------------|---|-----------------|--------------|
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6. (a)(i) radio (wave) [2]  
(ii) sound (wave)
- (b) The further away the source, the weaker is the sound OWTTE [1]
- (c)(i) 3.0 s  
(ii) 3.8 +/- 0.1s [2]
- (d)(i)  $1000/3 = 333 \text{ m/s}$  [1]  
(ii)  $1000/3.8 = 263 \text{ m/s}$  [1]
- (e) The first (1), because the other one may be affected by the responses of the observer (1) OWTTE [2]
- (f) repeat the experiment and average the results [1]

**Total 10 marks**