

**MARK SCHEME for the May/June 2012 question paper  
for the guidance of teachers**

**0654 CO-ORDINATED SCIENCES**

**0654/21**

Paper 2 (Core Theory), maximum raw mark 120

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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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- 1 (a) (speed) = distance/time ;  
= 25/2 = 12.5 (km/h) ;
- (b) (i) chemical ; [1]  
(ii) heating engine/heating surroundings/light/sound ; [1]
- (c) metal track expands in summer/hot weather ;  
metal can expand into gap ;  
prevents track from buckling/bending/being damaged/becomes unsafe for  
trains to move ; [max 2]
- (d) (i) ethanol is renewable source/no sulfur dioxide produced/does not deplete  
fossil fuel supplies ; [1]  
(ii) carbon, hydrogen, oxygen ; [1]
- (e) (i) 5 (km/h) ; (accept 4/reference to greater than 3, but equal to or less than 5) [1]  
(ii) 1200 (W) ; [1]  
(iii) dependent on wind/wind speed unreliable or variable/owtte ; [1]  
(iv) kinetic ;  
electrical ; [2]
- [Total: 13]**
- 2 (a) (i) nitrogen 78% oxygen 21% others 1% ;; [2]  
(all three correct 2 marks, two correct 1 mark)  
(ii) carbon dioxide/water (vapour) ; [1]
- (b) (i) contain only one type of atom/all atoms have same proton number ; [1]  
(ii) covalent ;  
bonded elements are both non-metals/compounds are gases ;  
(iii) pure water is neutral ;  
rain water (generally) is more acidic (than pure water) ;  
rainwater during thunderstorm is the most acidic ;  
likely to be caused by nitrogen oxides ;  
which have reacted with the rain to form an acid ; [max 3]
- [Total: 9]**

- 3 (a) label to root hair cell ;
- (b) water ;  
minerals / ions / named mineral ion ; [2]
- (c) (i) xylem ; [1]
- (ii) A in central area of root ; [1]

(iii)

structure	plant cells	animal cells
cell membrane	✓	✓
cell wall	✓	x
nucleus	✓	✓
vacuole containing sap	✓	x

one mark for any row correct ;;; [4]

[Total: 9]

- 4 (a) (i) between 10 and 20 Hz to between 20 000 and 25 000 Hz ; [1]
- (ii) *frequency* –  
number of waves produced / passing a point per second ;  
*wavelength* –  
distance between two consecutive peaks / troughs on two consecutive waves ; [2]
- (b) (i) *sound* – longitudinal ;  
*light* – transverse ; [2]
- (ii) no medium / material for waves to travel through ; [1]
- (iii) quieter ; [1]
- (iv) microwaves ; [1]

[Total: 8]

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- 5 (a) (an animal that) eats plants ;  
only plants / not meat ;  
reference to getting energy from, its food / plants ; [m
- (b) (i) eat a lot ;  
eat / take in, more energy than they use ;  
excess, carbohydrate / protein, converted to fat ; [max 2]
- (ii) the greater the body mass, the greater the chance of survival ;  
idea that effect is greater at lower body masses / levels off at higher body masses ;  
use of figures ; [max 2]
- (iii) insulator / poor conductor / reduces conduction ; [1]
- (c) carbon dioxide ;  
methane ; [2]
- (d) (i) mean body mass is increasing ; [1]
- (ii) marmots have more time to feed (from spring onwards) ;  
marmots lose less weight during hibernation (as winters are shorter) ;  
reference to more food available ; [max 1]
- [Total: 11]**
- 6 (a) add magnesium to acid ;  
insert bung ;  
measure time for known volume of gas to collect ;  
measure volume of gas at fixed intervals ; [max 3]
- (b) time for (same volume) of gas to collect is shorter ;  
because rate of reaction is greater / greater collision frequency / faster reaction /  
more vigorous ; [2]
- (c) (i) (atom) loses electrons / achieves complete outer shell ; [1]
- (ii)  $MgCl_2$  ; [1]
- (d) (i) to increase reaction / burning rate ;  
(powder has) large surface area ;  
high rate needed to get all light at once / so brighter ; [max 2]
- (ii) light / low density ;  
reduces weight of aircraft / less energy or fuel needed for flight ;  
  
strong ;  
reference to maintenance of the integrity of airframe / safety ; [4]
- [Total: 13]**

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- 7 (a) use – cancer treatment / tracers / kill bacteria / sterilising surgical equipment ;  
correct description ;
- (b) gamma  
alpha  
gamma  
alpha  
(2 marks for four correct, 1 mark for two or three correct) ;; [2]
- (c) destroys / damages cells ;  
caused cancer ;  
mutations / damages DNA ; [max 2]
- [Total: 6]
- 8 (a) (i) nucleus ; [1]
- (ii) 18 ; [1]
- (iii) (no) – no mark  
reference to isotopes ;  
which are atoms of same element with different number of neutrons ; [2]
- (iv) hydrogen ; [1]
- (b) (i) any typical metal property for **X** and corresponding non-metal for **Y** ; [1]  
e.g. **X** conductor **Y** insulator  
**X** malleable **Y** not malleable  
**X** forms positive ions **Y** forms negative ions  
**X** high fixed points **Y** low fixed points
- (ii) **Y** is more reactive / **Z** is less reactive / unreactive / specific example ; [1]
- (c) (i) combustion of carbon ;  
(thermal) decomposition / breakdown of calcium carbonate ; [2]
- (ii) soil is acidic ;  
lime reacts with acid / reduces acidity / neutralises ;  
to increase fertility ; [max 2]
- [Total: 11]

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- 9 (a) nutrition  
 excretion  
 respiration  
 reproduction  
 growth  
 movement  
 (1 mark for any two correct) ;; [2]
- (b) chemical ;  
 produced by a gland ;  
 carried by the blood ;  
 affects (specific) target organs ;  
 destroyed by the liver ; [max 3]
- (c) more respiration ;  
 more energy (for muscles) ;  
 muscles can work, harder/faster ; [max 2]
- (d) (positive) phototropism ;  
grows towards the light ; [2]
- [Total: 9]**
- 10 (a) (i) ammeter in series ;  
 voltmeter in parallel ;  
 all else correct ; [3]
- (ii) to change voltage across, current through lamp ; [1]
- (iii)  $R = V/I$  ;  
 $= 3/0.3 = 10 (\Omega)$  ; [2]
- (b) (i) **D** it's longer (resistance proportional to length) ; [1]
- (ii) **A** smaller cross-sectional area ; [1]
- (c) (i) positive and negative ; [1]
- (ii) electron ; [1]
- [Total: 10]**

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- 11 (a) **A** larynx ;  
**B** trachea ;  
**C** bronchus/bronchiole ;
- (b) more carbon dioxide ;  
less oxygen ;  
more water vapour ; [max 2]
- (c) (i) diffusion ; [1]  
(ii) pulmonary vein ; [1]
- (d) (i) 1 in 4 / one quarter / 0.25 ; [1]  
(ii) (parents' genotypes) both **Ff** ;  
gametes **F** and **f** from both parents ;  
offspring genotypes **FF**, **Ff**, **Ff** and **ff** ;  
**ff** identified as having cystic fibrosis ; [4]
- [Total: 12]
- 12 (a) petroleum/crude oil ; [1]
- (b) (i) goes cloudy/milky/opaque/white ;  
carbon dioxide ; [2]  
(ii) water ; [1]  
(iii) (no) – no mark  
ethanol's combustion products are the same as methane's ; [1]
- (c) water/steam ; [1]
- (d) (i) polymerisation/addition/self addition ; [1]  
(ii) link together ;  
into long chains/into chain molecules ; [2]
- [Total: 9]