

MARK SCHEME for the October/November 2013 series

0653 COMBINED SCIENCE

0653/32

Paper 3 (Extended Theory), maximum raw mark 80

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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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- 1 (a) P decane covalent molecules only / no ions present ;
 Q solid copper chloride ions are not mobile ;
 R aqueous copper chloride ions are mobile ;
 (may refer to ions as charge carriers)
 (max 2 if suggested that immobile ions exist in decane) [3]
- (b) (i) chlorine ; [1]
- (ii) copper is / copper atoms are forming / copper ions are being attracted ;
 copper ions are gaining electrons ;
 copper ions are being discharged / (gaining) two (electrons) each ; [3]
- (c) sodium and chloride ions have opposite (electrical) charge ;
 reference to force of attraction (between opposite charges) ; [max 2]
- [Total: 9]**
- 2 (a) (i) reflection ;
 total internal ;
 when angle (of incidence) is greater than critical angle ; [3]
- (ii) time = distance/speed ;
 0.03 s ; [2]
- (iii) distance is less (for optical fibre) ; [1]
- (b) sound waves need a medium ;
 as the air is sucked out there is less of a medium to convey the sound wave ;
 no air means sound waves cannot pass through ; [max 2]
- [Total: 8]**

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- 3 (a) (i) increased / numerical example ; [1]
- (ii) colour change (blue) to red ;
effervescence / (gas) bubbles produced ; [2]
- (b) (i) colour change of cobalt chloride paper shows water and limewater reaction shows carbon dioxide ;
(test results are not required) [1]
- (ii) $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O}$; ; [2]
(LHS RHS; and balanced;)
- (iii) sodium hydrogencarbonate provides barrier between paper and and air/oxygen ;(if paper does burn) sodium hydrogencarbonate decomposes / releases carbon dioxide / water ;
carbon dioxide / water inhibits burning / owtte ; [max 2]
- (iv) (endothermic)
heat energy supplied (to keep the reaction going) ;
heat is transferred to chemical energy ;
heat is used to decompose (the reactant) /to break bonds in the reactant ; [max 2]

[Total: 10]

- 4 (a) (i) more root hairs ;
shorter root hairs ; [2]
- (ii) increase in number in both types is, the same / 0.44 more root hairs per unit area /
percentage increase is different ;
decrease in length is much greater in type B plants ; [2]
- (iii) reduced surface area ;
less able to take up water ;
so less water available for photosynthesis ;
less able to take up, mineral ions / named ion ;
less able to take up nitrates to form proteins ;
plant may wilt ;
because water loss greater than water uptake ; [max 3]
- (b) ref. to eutrophication ;
nitrate leached into waterways ;
causes algal growth to increase ;
reduces photosynthesis / light available for submerged plants ;
submerged plants / algae die ;
bacteria feed on dead plants / algae ;
bacteria use oxygen (for respiration) ;
which causes animals to die because of lack of oxygen ; [max 4]

[Total: 11]

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- 5 (a) parallel ; [1]
- (b) (i) $1/R_1 + 1/R_2 = 1/R$;
correct substitution ;
 $R = 10/3 = 3.3 \Omega$; [3]
- (ii) $I = V/R$;
 $9/10 = 0.9 A$; [2]
- (c) density = mass/volume ;
 $= 9000/3000 = 3.0 \text{ g/cm}^3$; [2]
- [Total: 8]**
- 6 (a) **A** to placenta ;
B to amniotic fluid ;
C to cervix ; [3]
- (b) oxygen comes from mother('s blood) ;
ref. red blood cells ;
ref. haemoglobin ;
diffusion across placenta ;
blood (vessels) in umbilical cord carry oxygen to foetus ; [max 3]
- [Total: 6]**
- 7 (a) gaseous / a gas ;
reference to smaller / lighter molecules ;
reference to low attraction between molecules ; [max 2]
- (b) (i) covalent ;
non-metallic elements joined / it is a molecule ; [2]
- (ii) 7 ; [1]
- (iii) 8 ;
each halogen atom shares an electron (pair) with carbon ;
reference to the completion of the outer shell of the halogen ; [max 2]
- [Total: 7]**

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- 8 (a) (i) driving force forwards and friction forces backwards ; [1]
- (ii) equal and opposite ; [1]
- (iii) constant speed ; [1]
- (iv) driving force is greater than friction force ; [1]
- (b) (i) work done = $F \times D$;
 $= 10000 \times 1000 = 10000000 \text{ J}$; [2]
- (ii) power = work/time ;
 $10000000/100 = 100000$; [2]
- (c) (i) infra-red ; [1]
- (ii) copper is a good conductor of heat ;
(convection off) large surface area ;
thin pipes means shorter distance for conduction ; [2]

[Total: 11]

- 9 (a) (i) 1 carbon dioxide ;
2 oxygen ; [2]
- (ii) movement of molecules ;
from region of high concentration to low concentration / down a concentration gradient ;
reference to random movement (of molecules) ; [2]
(max 1 if implication that a membrane is required)
- (iii) thin / only one cell thick ;
reduces diffusion distance ; [2]
- (b) (i) carbon monoxide
tar
particulates / smoke particles
nicotine ; ; [2]
(any two for one mark)
- (ii) mucus not swept upwards / away from lungs / details of the normal functioning of cilia
and the fact that this is impaired ;
mucus accumulates in, lungs / alveoli ;
bacteria breed / accumulate in mucus ; [max 2]

[Total: 10]