

**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**International General Certificate of Secondary Education**

**MARK SCHEME for the October/November 2011 question paper  
for the guidance of teachers**

**0654 CO-ORDINATED SCIENCES**

**0654/23**

Paper 2 (Core Theory), maximum raw mark 100

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) (i) line from cell **A** to leaf ;  
line from cell **B** to root ; [2]
- (ii) structure **X** is a chloroplast ;  
for photosynthesis ;  
cell **B** does not have them because it, is underground/gets no light ; [3]
- (iii) has a large surface area ;  
for uptake of, water/mineral salts ; [2]

(b) (i)

genotype	phenotype
RR	<b>red</b>
Rr	<b>red</b>
rr	<b>white</b>

[1]

(ii) circle around **Rr** ; [1]

(iii) 3 red : 1 white ; [1]

- (c) tissue culture is sexual/producing seeds is sexual ;  
tissue culture produces identical plants ;  
tissue culture produces) genetically identical plants ;  
plants grown from seed show (genetic) variation ;  
seeds may not germinate/mature plants produced more quickly using tissue culture ; [max 2]

**[Total: 12]**

- 2 (a) (i) driving force is greater than frictional force ; [1]
- (ii) driving force and frictional forces are the same ; [1]
- (iii) (kinetic energy =)  $\frac{1}{2} mv^2$  ;  
 $= \frac{1}{2} \times 1500 \times 20 \times 20 = 300\,000$  (J) ; [2]
- (iv) (distance =) speed  $\times$  time  
 $= 20 \times 120 = 2400$  (m) ; [2]
- (b) (i) **X** at 2 seconds ; [1]
- (ii) deceleration = change in speed/time (or gradient) ;  
 $= 5$  (m/s<sup>2</sup>) ; [2]

**[Total: 9]**

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- 3 (a) (i) **R** ;  
it is a halogen / non-metal / in Group 7 ; [2]
- (ii) **S** ;  
reactivity increases down Group 1 / **S** is further down Group 1 ; [2]
- (iii) 4 ;  
neutrons from nucleon number – proton number ; [2]
- (iv) **P/Q/S/T** with **R** ;  
metals react with non-metals (to form ionic compounds) ; [2]
- (b) (i) sodium chloride solution ;  
an electrolyte must contain ions / conduct a current / gasoline and water are not ionic / do not conduct ; [2]
- (ii) the voltmeter reading would fall to zero ;  
cell produces voltage when different metals used as electrodes ; [2]
- [Total: 12]**
- 4 (a) (i) (work =) force  $\times$  distance ;  
 $= 1000 \times 5 = 5000$  (J) ; [2]
- (ii) 5000 (J) ; [1]
- (b) frequency = pitch ;  
loudness = amplitude ; [2]
- (c) (i) green ; [1]
- (ii) yellow / cyan / magenta ; [1]
- (d) (i) 50 000 (m<sup>3</sup>) ; [1]
- (ii) mass = density  $\times$  volume ;  
 $= 1.3 \times 50\,000 = 65\,000$  (kg) ; [2]
- [Total: 10]**

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- 5 (a) (i) monomers are small molecules ;  
monomers link together ;  
to form polymers ;  
which are long chain molecules ; [max 3]
- (b) (i) two carbons and four fluorines ;  
atoms/in a molecule/bonded together ; [2]
- (ii) no hydrogen/hydrocarbons contain carbon and hydrogen (only) ; [1]
- (iii) amino acid ; [1]
- (c) melts/softens ;  
returns to original state/hardens ; [2]
- (d) (i)  $(\text{Ca}(\text{HCO}_3)_2$  – no mark)  
hardness caused by calcium ; [1]
- (ii) easier to wash things/soap does not form scum/use of soap is more  
efficient ;  
no build-up of limescale in pipes etc./on clothes ; [max 1]

**[Total: 11]**

- 6 (a) (i) alveolus/air sac; [1]
- (ii) capillary ; [1]
- (iii) arrow leading out of the alveolus ; [1]
- (iv) respiration (in body cells) produces  $\text{CO}_2$  ;  
 $\text{CO}_2$  diffuses from the cells into the blood **OR**  $\text{CO}_2$  carried to the lungs in the  
blood/pulmonary artery ; [2]
- (v) from right ventricle ;  
heart/right ventricle/cardiac muscle, contracts ;  
(heart) produces pressure ;  
blood travels along pulmonary artery ; [max 3]
- (b) (i) ref to goblet cells ;  
smoke/component of smoke, causes more mucus to be produced ;  
cilia do not work normally ;  
mucus not swept upwards ; [max 2]
- (ii) idea that gases have to pass through a bigger distance ;  
layer of mucus plus alveolar wall and capillary wall ;  
takes more time ; [max 2]

**[Total: 12]**

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- 7 (a) (i) changes the way the body works/owtte ; [1]  
(ii) pain relief ; [1]
- (b) (i) limestone is calcium carbonate/ not calcium oxide ; [1]  
(ii) it is exothermic/ gives off heat ; [1]  
(iii) (not balanced)  
to be balanced must have same number of each type of atom on both sides/  
no loss or gain of atoms going left to right ;  
detail of why this is not balanced ; [2]
- (c) (i) carbon dioxide ;  
goes cloudy ; [2]  
(ii) any sensible acid e.g. hydrochloric ;  
correctly matched calcium salt/ water ; [2]
- [Total: 10]**
- 8 (a) heats kettle/surroundings ; [1]
- (b) (i) 1500(W) ; [1]  
(ii) 5(minutes) ; [1]
- (c) liquid – most particles touching in random arrangement ;  
gas – particles well spaced out in random arrangement ; [2]
- (d) (i) (current =)  $1000/250 = 4$  (A) ; [1]  
(ii) (charge =) current  $\times$  time ;  
=  $4 \times 120 = 480$  (C) ; [2]  
(iii) (resistance =) voltage/current ;  
=  $250/10 = 25$  ( $\Omega$ ) ; [2]
- (e) hot water rises/cold water sinks ;  
heated water expands and is less dense ; [max 2]
- (f) can touch live wire and be electrocuted/short circuit ;  
socket overheats/danger of fire ;  
water is a good electrical conductor/danger of electrocution ; [3]

**[Total: 15]**

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- 9 (a) (i) scales ;  
fins ;  
operculum/gill cover ; [max 2]
- (ii) scales ; [1]
- (b) joining of, gametes/sex cells/nuclei ;  
ref. to male and female (gametes)/ref to formation of zygote ; [2]
- (c) (i) more testosterone in fish bred in captivity (mothers) ;  
detail, for example: both before and after eggs hatched/figures quoted/  
difference quoted ; [2]
- (ii) idea that results only show correlation, not cause ; [1]
- (d) testis ; [1]
- [Total: 9]**