

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

**0654 CO-ORDINATED SCIENCES**

**0654/33**

Paper 3 (Extended 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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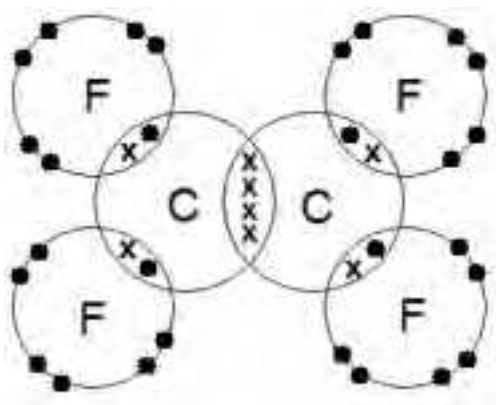
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- 1 (a) (i) line from cell **A** to leaf ;  
line from cell **B** to root ;
- (ii) cell **A** has chloroplasts / chlorophyll ;  
for photosynthesis ;  
cell **B** does not because it, is underground / gets no light ; [3]
- (b) tissue culture is asexual reproduction / producing seeds is sexual reproduction ;  
tissue culture produces identical plants ;  
plants grown from seeds show variation ;  
ref. genetically identical (for tissue culture) or genetically different plants (for seeds) ;  
seeds may not germinate / mature plants produced more quickly using tissue culture ; [max 3]
- (c) (i) higher yields / no need to spray, pesticides / insecticides ; [1]
- (ii) may harm beneficial or harmless insects that eat parts of the plant (e.g. butterflies or bees that eat nectar or pollen) / may affect ecosystem because fewer insects for other animals to eat / people may not like the idea of eating this maize / may make it difficult for farmers in developing countries to compete with those in developed countries ; [1]
- [Total: 10]**

- 2 (a) (i) (long) chain (molecule) ;  
made of repeating units / monomers ; [2]

(b) (i)



- bonding pairs ;  
non-bonding pairs ; [2]
- (ii) no hydrogen / hydrocarbons contain carbon and hydrogen (only) ; [1]
- (iii) four **C** and 8 **F** ;  
all single bonds ;  
indication that chain continues ; [3]

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(c) PTFE only weak attractive forces between molecules ;  
 molecules move past each other easily when heated ;  
 melamine molecules have cross-links/strong bonds holding molecules together ;  
 molecules locked in place/do not move past each other when heated ; [max

(d) (i)  $\rightarrow \text{CaCO}_3 + \text{CO}_2 + \text{H}_2\text{O}$  ; [1]

(ii) (hard) water passed through resin/beads/support/column ;  
 calcium/magnesium, ions stick to resin ;  
 sodium ions detach from resin/replace  $\text{Ca}^{2+}/\text{Mg}^{2+}$  ; [3]

[Total: 15]

3 (a) (i) mass and velocity ; [1]

(ii) velocity/momentum are vector quantities ;  
 direction has changed ; [2]

(b) (i) X at 2 seconds ; [1]

(ii) (deceleration =) change in speed/time (or gradient) OR 15/3 OR rise ÷ run ;  
 $= 5 \text{ m/s}^2$  ; [2]

(iii) area under graph ;  
 22.5 m ; [2]

(c) (i) (resistance =) voltage / current ;  
 $= 12/2.4 = 5 \Omega$  ; [2]

(ii)  $1/R = 1/R_1 + 1/R_2$  ;  
 $= 1/5 + 1/5$  ;  
 $(R = 5/2 =) 2.5 \Omega$  ; [3]

[Total: 13]

4 (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) calcium is in Group 2/atoms have two outer electrons ;  
 these/two/outer, electrons lost (when calcium ion forms) ;  
 ion has two more positive charges (protons) than negative charges  
 (electrons) ; [3]

(iii) single negative ;  
 working to show need for charge balance ; [2]

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- (c) (i) (use of moles = mass ÷ molar mass)  
 $M_r$  calcium oxide = **56** ;  
 $224 \div 56 = 4$  ;
- (ii) (look for direct proportion from equation with or without reference to moles, e.g.)  
 56 g of CaO react with 18 g water ;  
 224 g CaO will react with  $18 \times 224 \div 56 = \mathbf{72\ g}$  ;  
**OR**  
 1 mole of CaO reacts with 1 mole of H<sub>2</sub>O / 4 moles CaO react with 4 moles H<sub>2</sub>O ;  
 mass of 4 moles water =  $18 \times 4 = \mathbf{72\ g}$  ; [max 2]

[Total: 12]

- 5 (a) any **two** of: scales / fins / operculum ; [1]
- (b) (i) joining of male and female, gamete / sex cells / nuclei ;  
 outside the female's body ; [2]
- (ii) sperm / male gamete / male sex cell, would not be able to swim ;  
**OR**  
 gametes / sex cells / eggs / sperm / zygote, would dry out ; [max 1]
- (c) (accept reverse argument throughout for fish that do not have this behaviour)  
 idea that this behaviour, increases chance of survival / gives an advantage ;  
 young of fish who does this more likely to breed ;  
 and (more likely to) pass on genes for this behaviour to their offspring ; [3]
- (d) (i) both sets of fish kept in the same conditions / environment is the same for  
 both sets of fish (so not environment) ;  
 populations **A** and **B** genetically different ; [2]
- (ii) more testosterone in population **A** (mothers) ;  
 detail, for example: both before and after eggs hatched / figures quoted /  
 difference quoted ; [2]
- (iii) numbers too small (to draw any firm conclusions) ;  
 idea that results only show correlation, not cause ; [2]

[Total: 13]

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- 6 (a) (i) air particles ;  
vibrate ;  
compressions and rarefactions ;  
series of compressions and rarefactions ;
- (ii) frequency = pitch ;  
loudness = amplitude ; [2]
- (b) (i) (mass =) density × volume ;  
= 1.3 × 50 000 = 65 000 kg ; [2]
- (ii) (E =) mass × specific heat capacity × change in temperature ;  
= 65 000 × 1000 × 10 ;  
= 650 000 000 J / 6.5 × 10<sup>5</sup> kJ ; [3]
- (c) (i) distance between identical points on successive waves ; [1]
- (ii)  $v = f \times \lambda$  ;  
 $f = 300\,000\,000 / 0.000\,000\,75$  ;  
= 400 000 000 000 000 Hz / 4 × 10<sup>14</sup> Hz / 400 THz ; [3]
- [Total: 13]**

- 7 (a) (i) outer electrons show group number/all in Groups 1 or 2/  
all in groups on left of Periodic Table ; [1]
- (ii) 4 ; [1]
- (b) (i) hexane, cannot be electrolyte/is covalent/contains no ions/cannot conduct ;  
(sulfuric) acid, reacts with/dissolves, the, electrodes/metal ; [2]
- (ii) magnesium ;  
Y  
iron  
X ; [2]  
(magnesium shown as most reactive then other three correct)
- [Total: 6]**

- 8 (a) (i) alveolus/air sac ; [1]
- (ii) capillary ; [1]
- (iii) carbon dioxide movement ;  
diffusion ;  
more CO<sub>2</sub> in blood vessel than in alveolus/there is a diffusion gradient ;  
because respiration (in body cells) produces CO<sub>2</sub> ; [max 3]

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(b) from right ventricle ;  
heart/right ventricle/cardiac muscle, contracts ;  
(heart) produces pressure ;  
blood travels along pulmonary artery ; [max 2]

(c) both sets of muscles contract ;  
increase volume of, thorax/chest (cavity)/lungs ;  
decrease pressure (in thorax/chest (cavity)/lungs) ;  
air moves in down pressure gradient ; [max 3]

**[Total: 11]**

9 (a) 5 minutes ; [1]

(b) (i) (current =) power/voltage ;  
(current =)  $1000/250 = 4 \text{ A}$  ; [2]

(ii) charge = current  $\times$  time ;  
 $= 4 \times 120 = 480 \text{ C}$  ; [2]

(c) hot water rises/cold water sinks ;  
(because) hot water is less dense/cold water is more dense ; [2]

**[Total: 7]**