

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
International General Certificate of Secondary Education

**MARK SCHEME for the October/November 2012 series**

**0654 CO-ORDINATED SCIENCES**

**0654/32**

Paper 3 (Extended 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.

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- 1 (a) haemoglobin ;
- (b) (i) absorb, water / mineral ions named ions ;
- (ii) large surface area ;  
so more water can be absorbed (at the same time) ; [2]
- (c) (i) **A, B, C** ; [1]
- (ii) water moved out of the cell ;  
by osmosis ;  
through partially permeable (cell) membrane ;  
down a water potential gradient/high to low **water** concentration  
gradient/low to high (sugar) concentration ;  
reference to reduction in volume of cytoplasm / cell ; [max 4]
- [Total: 9]
- 2 (a) (i) 118 ;  
7 ; [2]
- (ii) (unreactive)  
it has a complete outer shell / 8 electrons in outer shell ;  
which is stable / which means bonding won't increase stability / owtte ; [2]
- (b) (i) accept yellow through orange and brown through black ;  
(reaction occurs because) chlorine, displaces / oxidises, the other halide /  
bromine / iodine formed ;  
because chlorine is more reactive / reactivity decreases down the group ; [3]
- (ii) (no)  
most vigorous would be between most reactive halogen and most reactive  
alkali metal ;  
most reactive alkali metal is rubidium / reactivity increases down Group 1  
(ORA) ;  
most reactive halogen is fluorine / reactivity increases up Group 7 (ORA) ;  
student should use rubidium (with fluorine) ; [max 2]
- (c)  $2K + Br_2 \rightarrow 2KBr$  ;;;  
[1 mark for KBr, 1 mark for Br<sub>2</sub>, 1 mark for balanced]  
(do not allow balance mark for  $K + Br \rightarrow KBr$ ) [3]
- [Total: 12]
- 3 (a) (i) loudspeaker cone vibrates / vibrations are passed on by  
particles / molecules ;  
makes regions of high pressure (compressions) and regions of lower  
pressure (rarefactions) ; [2]

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(ii) particles are closer together in liquid ;  
particles collide and transmit energy/sound more quickly in liquid ;

(b) greater amplitude ;  
same frequency ; [2]

(c) speed = frequency  $\times$  wavelength **OR** (wavelength=) speed/frequency ;  
=  $330 \div 2200 = 0.15 \text{ m}$  ; [2]

(d) (energy =) mass  $\times$  shc  $\times$  change in temperature ;  
=  $70\,000 \times 4200 \times 10$  ;  
=  $2940\,000\,000 \text{ J} = 2940 \text{ (MJ)}$  ; [3]

[Total: 11]

4 (a) (i) all organisms **and** their environment ;  
interacting together ; [2]

(ii) energy (flow) ; [1]

(iii) secondary consumer / 3<sup>rd</sup> trophic level ; [1]

(iv) reference to sexual reproduction ;  
pollination ;  
bees carry pollen from anther / to stigma / from one plant to another ;  
pollen contains male gametes ;  
reference. to fertilisation (following pollination) ;  
seeds formed ; [max 3]

(b) (i) caesium-137 has long half-life ;  
still large amounts of it producing  $\beta$  radiation ;  
still large amounts of it producing barium-137 ;  
therefore still a high level of  $\gamma$  radiation ; [max 3]

(ii)  ${}_{55}^{137}\text{Cs} \longrightarrow {}_{56}^{137}\text{Ba} + {}_1^0\text{e}$  [2]

(iii) organisms do not survive in high levels of radiation ;  
reference to, mutation / why damaged DNA may kill organism ;  
reference to reason for variability in number at any one radiation level ;  
spiders are carnivores / spiders feed on other organisms ;  
idea that other organisms killed so fewer spiders can get food ; [max 3]

[Total: 15]

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- 5 (a) goes cloudy / milky ;  
because solid / precipitate / calcium carbonate produced ;  
**OR**  
goes cloudy and then clears ;  
because precipitate / calcium carbonate forms and re-dissolves ; [max 2]

(b) (i) calculates  $M_r$  calcium carbonate as  $40 + 12 + (16 \times 3) = 100$  ;  
calculates number of moles as  $0.52 \div 100 = 0.0052$  ; [2]

(ii) 0.0104 ; [1]

(iii) the other components also neutralise some of the acid / owtte ; [1]

**[Total: 6]**

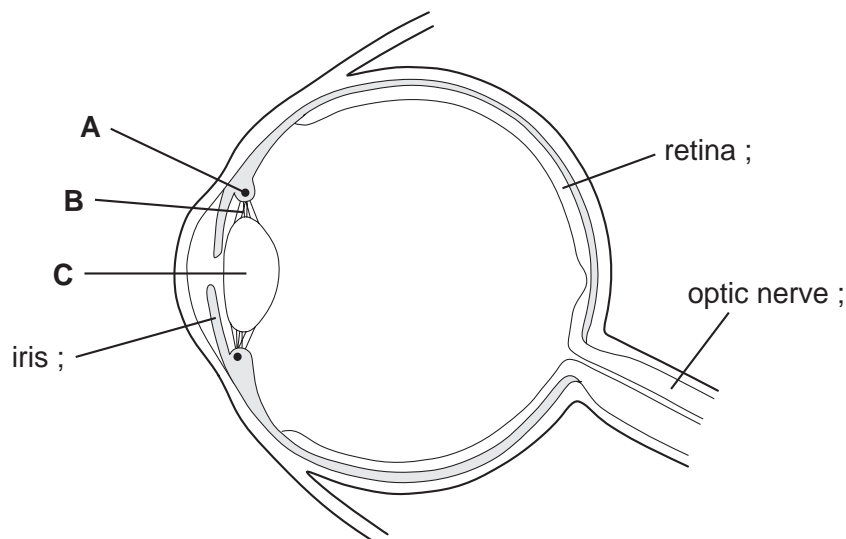
6 (a) (i) same alternating voltage ; [1]

(ii) stronger magnet ;  
more turns on coil ;  
increased speed of rotation ; [max 2]

(b) to change voltage / increase current ;  
so devices work at suitable voltage / avoid damage to devices ; [2]

**[Total: 5]**

7 (a)



[3]

(b) **A** / ciliary muscle, contracts ;  
reduces diameter of its ring ;  
loosens tension on, **B** / suspensory ligament / slackens ;  
allows lens to become more rounded ;  
reduces focal length of lens ;  
refracts light rays more strongly ; [max 4]

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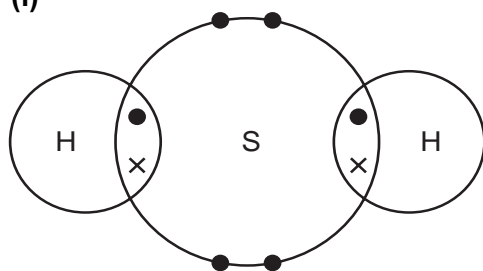
- (c) (i) retina ;
- (ii) as (electrical) impulses ;  
 along sensory neurone (in optic nerve) ;  
 to brain ;  
 along motor neurone (in optic nerve) ;

[max 3]

**[Total: 11]**

- 8 (a) (i) methane ;  
 methane + oxygen → carbon dioxide + water ;; (LHS,RHS) [3]
- (ii) (fuels) combusted burnt/oxidised ;  
 sulfur dioxide produced ;  
 reacts/dissolves to form acid rain ;  
 acidic water gathers in rivers and lakes/acid does not evaporate from lakes ; [4]

(b) (i)



- two shared pairs ;  
 lone pairs on sulfur ; [2]  
 (max 1 if chemical symbols missing or incorrect or extraneous electrons)

- (ii) (concentrated) sulfuric acid ; [1]

**[Total:10]**

- 9 (a) (KE) =  $\frac{1}{2} mv^2$  ;  
 =  $\frac{1}{2} \times 0.5 \times 0.5 \times 0.5 = 0.0625 \text{ J}$  ; [2]

- (b) friction ;  
 between materials/as/when wheels rub against plastic (conditional on friction) ;  
 electrons are lost from car/gained by plastic surface ;  
 reference to charge imbalance/unequal numbers of protons and electrons ; [3]

- (c) (i) **B to C**/5 to 7.5 and 0.4(m/s) ; [1]

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- (iii) area under graph ;  
 $= (\frac{1}{2} \times 0.4 \times 5) + (0.4 \times 2.5) + (0.4 \times 12.5 \times \frac{1}{2}) = (1 + 1.0 + 2.5) ;$   
 $= 4.5 \text{ m} ;$

[Total:9]

10 (a) (i) duodenum/ileum/small intestine ; [1]

- (ii) reference to emulsification ;  
 breaks fat into small globules/droplets ;  
 helps fat to disperse in water ;  
 increases surface area/idea of allowing lipase to make contact with fats ; [max 2]

(b) (i) fatty acids produced ;  
 pH falls below 5 ; [2]

- (ii) tube **B** was at a higher temperature ;  
 rate of reaction higher ;  
 because reactant particles colliding more frequently/more successfully ; [3]

(iii)

<i>tube C (30 °C)</i>
blue
blue
blue/yellow
blue/yellow

(note: if yellow in row four, then **must** also be yellow in row five) ; [1]

(c) (i) helps to keep body temperature constant ;  
 insulator/reduces heat loss from skin ;  
 energy store ;  
 protection around soft organs ;  
 make cell membranes ;  
 make myelin sheath round neurones ; [max 1]

- (ii) heart disease ;  
 reference to atherosclerosis/build-up of plaques/cholesterol/fatty deposits  
 in **arteries** ;  
 reference to obesity ;  
 (obesity leads to) greater risk of, diabetes ;  
 high blood pressure ; [max 2]

[Total: 12]

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- 11 (a) (i) 21(%) ;
- (ii) contains only one type of atom/or equivalent valid point ;  
compounds contain different atoms/elements bonded together ;
- (b) (i) (phosphorus oxide)  
alkali would neutralise an acidic solution ;  
non-metal oxides produce acidic solutions (ORA) ; [2]
- (ii) oxygen atoms converted into (negative oxide) ions ;  
by gaining electrons ;  
gain of electrons is reduction ; [max 2]
- (c) silicon(IV) oxide has giant structure ;  
reasonable description e.g. huge 3-D arrangement/contains  
large numbers of bonds/reasonable attempt at diagram showing Si : O ratio  
1 : 2 ;  
water is made of small molecules/is simple molecular ;  
only weak attractions between molecules ; [max 3]
- [Total 10]**
- 12 (a) circuit breaker operates when current in circuit exceeds certain limit ;  
explanation of how it works eg. RCCB or varying strength of electromagnet ;  
further explanation of how it works ;  
stops the current/flow of electricity in the circuit ; [max 3]
- (b) (i)  $R = V/I$  ;  
 $= 2/0.2 = 10 \Omega$  **and**  $= 4/0.31 = 12.9 \Omega$  ; [2]
- (ii) current not (directly) proportional/current does not increase as much ; [1]
- (iii) lamp/filament has got hotter ;  
resistance (of lamp/filament) has increased ; [2]
- (c) (i) angle of incidence labelled **and** angle of reflection labelled ; [1]
- (ii)  $45(^{\circ})$  ; [1]
- [Total: 10]**