

MARK SCHEME for the October/November 2012 series

0654 CO-ORDINATED SCIENCES

0654/32

Paper 3 (Extended Theory), maximum raw mark 120

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- 1 (a) haemoglobin ; [1]
- (b) (i) absorb, water / mineral ions named ions ; [1]
- (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 Br₂, 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 ; [2]

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

(c) speed = frequency × wavelength **OR** (wavelength=) speed/frequency ;
= 330 ÷ 2200 = 0.15 m ; [2]

(d) (energy =) mass × shc × change in temperature ;
= 70 000 × 4200 × 10 ;
= 2940 000 000 J = 2940 (MJ) ; [3]

[Total: 11]

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

(ii) energy (flow) ; [1]

(iii) secondary consumer / 3rd 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 β radiation ;
still large amounts of it producing barium-137 ;
therefore still a high level of γ 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]

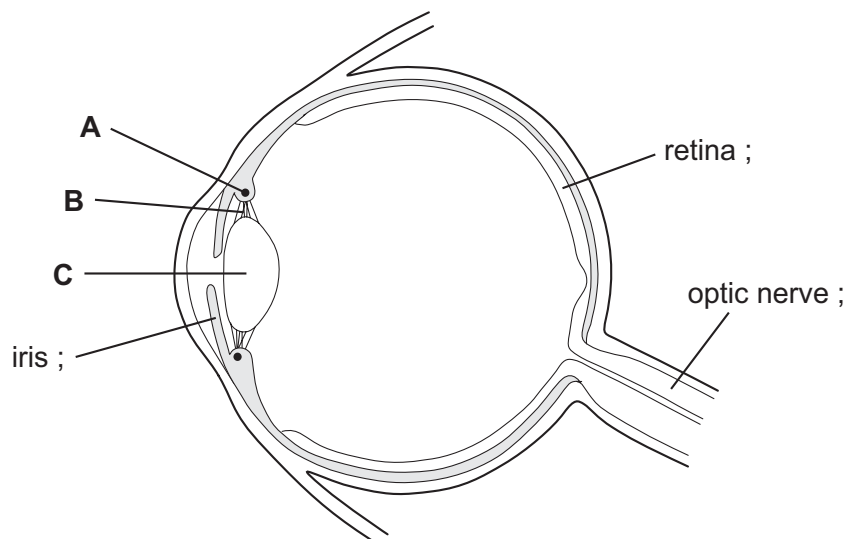
6 (a) (i) same alternating voltage ; [1]

(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 ; [1]

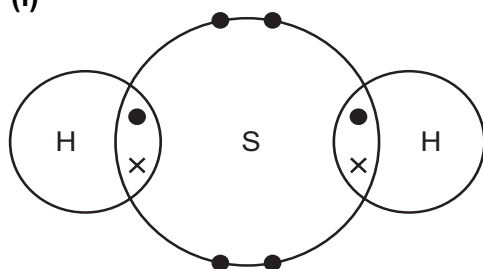
(ii) as (electrical) impulses ;
 along sensory neurone (in optic nerve) ;
 to brain ;
 along motor neurone (in optic nerve) ; [max 3]

[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 ;
 $= (\frac{1}{2} \times 0.4 \times 5) + (0.4 \times 2.5) + (0.4 \times 12.5 \times \frac{1}{2}) = (1 + 1.0 + 2.5)$;
 $= 4.5 \text{ m}$; [3]

[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(%) ; [1]
- (ii) contains only one type of atom/or equivalent valid point ;
compounds contain different atoms/elements bonded together ; [2]
- (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(°) ; [1]
- [Total: 10]**