

**MARK SCHEME for the May/June 2010 question paper  
for the guidance of teachers**

**0654 CO-ORDINATED SCIENCES**

**0654/32**

Paper 32 (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.

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- 1 (a) (i) haemoglobin ;  
(ii) insulin ;  
(iii) amylase ; [1]  
(iv) antibody ; [1]
- (b) (i) liver ; [1]  
(ii) (urea is) transported to kidneys ;  
dissolved in blood plasma ;  
filtration / urea passes into kidney tubule ;  
urine (containing urea) formed in kidney ;  
travels along ureter to bladder ;  
then along urethra (from bladder to outside) ; [max 3]
- (c) nitrogen, fixed / converted to a compound ;  
by, lightning / bacteria / Haber process ;  
ref. to nitrate / ammonium / ammonia ;  
(something containing nitrogen) taken up through plant roots ;  
used to make, amino acids / proteins (in plant) ;  
plant / animal that has eaten plant, eaten by person ;  
protein, digested / broken down to amino acids ;  
amino acids absorbed from gut (into blood) ; [max 4]
- [Total: 12]
- 2 (a) X – chlorine /  $Cl_2$  ;  
Y – hydrogen /  $H_2$  ;  
Z – sodium hydroxide / NaOH ; [2]  
(three correct = 2 marks, two correct = 1 mark)
- (b) (i) (nucleus contains) positive protons ;  
total positive charge = total negative / proton charge balances electron  
charge / there are also 17 protons / number of protons is the same as the  
number of electrons ; [2]
- (ii) (words and / or diagrams)  
potassium has one electron in outer shell ;  
outer electron transferred from potassium to chlorine ;  
reference to filling of outer shell(s) ;  
reference to ion formation ;  
reference to attraction between ions of opposite charge ; [max 3]

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- (c) (i)  $0.5 \times 0.01 = 0.005 \text{ g}$  ;
- (ii)  $M_r$  of sucralose =  $(12 \times 12) + (19 \times 1) + (16 \times 8) + (35.5 \times 3) = 397.5$  ;  
evidence of attempt to use moles = mass  $\div$  molar mass ;  
 $0.005 \div 397.5 = 0.0000126$  (accept 0.000013) ; (*not if g*) [3]
- (iii)  $1600 \times (0.5 \div 100) = 8 \text{ (kJ)}$  ; [1]
- (iv) can get the same sweetness with less energy ;  
reference to, weight loss / weight maintenance / less tooth decay / diabetes ; [max 2]

[Total: 14]

- 3 (a) (heat) turns water to steam ;  
(steam) drives turbine which drives generator ; [2]

- (b) no carbon dioxide emissions / greenhouse gases / global warming ;  
no sulfur dioxide emissions / acid rain ;  
**or allow one mark for** no atmospheric pollution / no polluting gases ;  
fossil fuels are running out but there is still plenty of uranium ;  
less solid waste produced ;  
idea that more energy released from similar quantity of fuel ; [max 2]

- (c) (i) correct substitution  $20\,000 \times 25\,000 / 400\,000$  ;  
1250 (turns) ; [2]

- (ii) (high voltage means) low current ;  
reduces, energy / power/heat, losses ;  
allows thinner wire to be used ;  
lower  $I^2R$  means less energy lost ; [max 2]

- (d) (i) nucleus splits ; [1]

- (ii) 38 ;  
52 ; 2

- (iii) yttrium / Y ; [1]

[Total: 12]

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- 4 (a) (i) energy ;  
to make carbon dioxide combine with water ;
- (ii) D ;
- (b) (i) (larger palisade cells means) more chloroplasts / more chlorophyll ;  
so more photosynthesis ;  
makes better use of the extra sunlight ; [max 2]
- (ii) thicker cuticle ;  
thicker / larger (cells in), upper epidermis ;  
larger / more, air spaces ;  
more spongy mesophyll cells / thicker spongy mesophyll layer ;  
thicker leaf ;  
less flat leaf ;  
more stomata ; [max 2]
- (iii) diffusion ;  
down concentration gradient ;  
through stomata ;  
through air spaces ; [max 3]
- (c) the environment ;  
leaves are from the same tree so have the same genes ; [2]

[Total: 12]

- 5 (a) 7 ;  
5 ; [2]
- (b) (i)  $Mg + 2HCl \rightarrow MgCl_2 + H_2$  ;;; [3]  
(reactant formulae ; product formulae ; balanced if all else correct ;)
- (ii) linking collision, frequency / chance, to rate ;  
linking, acid concentration / number of reacting particles / surface area of magnesium to, rate/collision frequency ;  
stating that acid concentration / number of reacting particles / surface area of magnesium, is greatest at the start ;  
and that (as acid reacts) acid concentration / number of reacting particles / surface area of magnesium, decreases ; [max 3]
- (iii) second line lies above existing line on the sloping part ;  
plateau at same level as existing line ; [2]

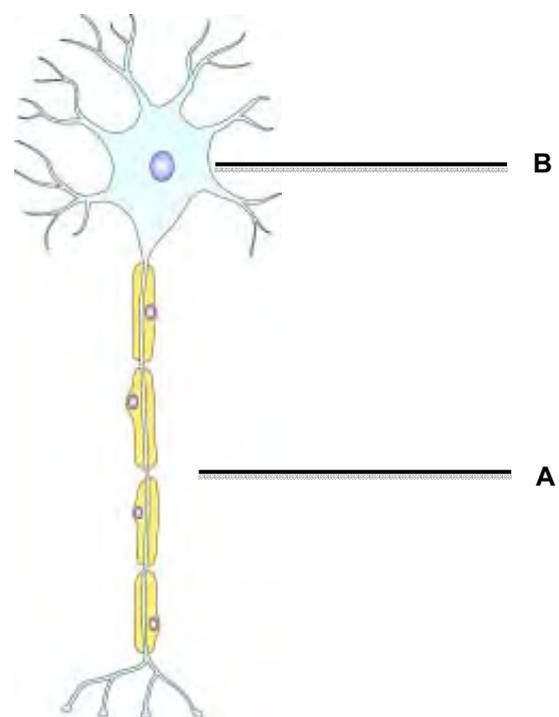
[Total: 10]

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- 6 (a) (i) (density =) mass / volume ;  
 $= 720 / 80 = 9 \text{ g / cm}^3$  ;
- (ii) energy = mass  $\times$  SHC  $\times$  temp change ;  
 $= 0.72 \times 400 \times 50$  ;  
 $= 14\,400 \text{ J / } 14.4 \text{ kJ}$  ; [3]
- (iii) force = mass  $\times$  acceleration ;  
 acceleration =  $100 / 0.72 = 139 \text{ m/s}^2$  ; [2]
- (b) components correct ;  
 correct circuit (including symbols) ; [2]

[Total: 9]

7 (a) (i)



- [2]
- (ii) (motor neurone) transmits, impulse / electrical signal / action potential ;  
 from, spinal cord / central nervous system / brain / relay neurone ;  
 to, muscle / effector / named muscle ; [3]
- (b) (i)  $2 \div 330$  ;  
 $0.006 \text{ s (6ms)}$  ; [2]
- (ii) ring around results for heat 5 ; [1]
- (iii) reaction time for lane 1 shorter than for lane 8 / the further from the gun the  
 longer the reaction time ;  
 takes longer for sound (to reach lane 8) / runner (in lane 8) hears sound  
 later ; [2]

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(c) impulse will take longer to travel from brain to (leg) muscles ;  
 because distance is 0.3m longer ;  
 time taken will be 0.004 s longer / both times calculated ;  
 this is not significant compared with other factors ; [max 2]

[Total: 12]

8 (a) (i) A to B ; [1]

(ii) acceleration = gradient (or use numbers) ;  
 = 50 / 8 = 6.25 m / s<sup>2</sup> ; [2]

(b) (i) (turning effect =) force × distance ;  
 = 0.3 × 300 = 90 Nm ; [2]

(ii) increase force ;  
 increase distance / use a longer spanner ; [2]

(c)  $\frac{P_1}{T_1} = \frac{P_2}{T_2}$  ;  
 120 000/400 = P<sub>2</sub>/300 (or other correct substitution) ;  
 P<sub>2</sub> = 90 000 N / m<sup>2</sup> ; [3]

[Total: 10]

9 (a) sea is warmed (by sun) ;  
 water evaporates / water vapour forms ;  
 (as water vapour rises) it cools ;  
 and condenses (to form clouds) ; [max 2]

(b) symbols and shared pairs correct ;  
 two lone pairs shown on oxygen ; [2]

(c) (i) calcium hydrogencarbonate / Ca(HCO<sub>3</sub>)<sub>2</sub> ; [1]

(ii) calcium (and magnesium) ions are dissolved in the hard water ;  
 these stick to the resin (beads) ;  
 and are replaced by sodium ions (from the resin) ;  
 this, softens the water / decreases the hardness of the water ; [max 2]

(iii) (if not passed through resin)  
 heating the water will cause, limescale / calcium carbonate, to form  
 limescale builds up on surface (somewhere inside machine) ;  
 reduces heating efficiency / causes damage / deterioration of dishwasher  
 mechanisms / must use more detergent ; [max 2]

[Total: 9]