

**MARK SCHEME for the May/June 2009 question paper
for the guidance of teachers**

0654 CO-ORDINATED SCIENCES

0654/02

Paper 2 (Core Theory), maximum raw mark 100

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Page 2	Mark Scheme: Teachers' version	Syllabus
	IGCSE – May/June 2009	0654

- 1 (a) (i) 5.1 (± 0.1);
- (ii) as radiation dose goes up so do incidences of leukaemia/radiation dose and incidences are (directly) proportional ;
- (iii) radiation burns/radiation sickness/death/genetic mutation ; [1]
- (b) alpha – stopped by paper etc ;
beta – not stopped by paper/only partially stopped by aluminium [2]
- (c) (i) time taken for half atoms to decay/time taken for count/rate to decrease by half ; [1]
- (ii) 3 half lives ;
12 days ; [2]
- [Total: 8]

- 2 (a) A evaporation ;
B condensation ;
C transpiration/evaporation ;
D precipitation ; [4]
- (b) less transpiration ;
less water vapour in the air ;
less rainfall ;
more runoff ;
more flooding ; [max 2]
- (c) (i) plasma ; [1]
- (ii) osmosis ;
moves/diffuses, through partially permeable membrane ;
ppm. is cell membrane
from where there is a lot of water to where there is less/high water
potential to low water potential ; [max 3]
- (d) kills, bacteria/micro-organisms/pathogens ;
that might cause illness/example of illness ; [2]
- [Total: 12]

Page 3	Mark Scheme: Teachers' version	Syllabus
	IGCSE – May/June 2009	0654

- 3 (a) a group of atoms ;
(covalently) bonded ;
- (b) the hard water/hardness in **A** reacted with the soap ;
soap precipitated as scum ;
less soap available to help washing/soap needed to improve washing ; [3]
- (c) (i) 11 ; [1]
- (ii) 2 ;
Ca in Group II/20 electrons with e.c. 2.8.8.2/calcium has valency of 2 ; [2]

[Total: 8]

- 4 (a) (i) voltmeter in parallel with lamp ;
variable resistor and ammeter in series ;
everything else correct ; [3]
- (ii) to vary current/voltage/potential difference (through/across lamp) ; [1]
- (iii) $R = V/I$;
= 5.3 ; (allow in working rather than in table) [2]
- (iv) filament gets hot ;
resistance is not constant ;
voltage and current are not directly proportional ; [max 2]
- (b) damaged outer insulation ;
short circuit/risk of shock/risk of fire/death ; [2]

[Total: 10]

- 5 (a) (i) feathers ;
beak ;
wings ; [max 2]
- (ii) **B** reptiles ;
C amphibians ; [2]
- (iii) *Rana temporaria* ; [1]
- (iv) webbed feet ;
(big surface area) for pushing against water (when swimming) ;

eyes near top of head ;
to see above water surface ;

strong hind legs ;
to push against water (when swimming) ; [2]

Page 4	Mark Scheme: Teachers' version	Syllabus
	IGCSE – May/June 2009	0654

- (b) (i) A, because the body temperature does not change ;
- (ii) mammals ;
- (iii) good environment for cells ;
enzymes have optimum temperature ;
idea of affecting rate of (metabolic) reactions ;
can be active in all temperatures ; [max 2]
- (iv) food used to generate heat/keep warm ;
in respiration ; [2]

[Total: 13]

6 (a) magnesium sulphate ; + hydrogen ; [2]

- (b) (i) (Expt. 2) shortest time to collect 30 cm³ gas/same volume of gas/OWTTE ; [1]
- (ii) reduce (acid) temperature ;
reduce acid concentration ;
decrease surface area of magnesium/use same mass of Mg but larger pieces ; [max 2]
- (iii) reaction ;
is exothermic ;
releases (heat) energy ;
which is transferred to the flask/surroundings ; [max 2]

[Total: 7]

- 7 (a) (i) working;
= 5000 N ; [2]
- (ii) 15 – 25 N/cm² ;
explanation e.g. uses 50 N/cm² at 40 m and 10 N/cm² at 0 m ; [2]

(b) momentum = m x v ;
= 1.2 x 10 = 12 kg m/s ; [2]

- (c) (i) any electromagnetic wave etc ; [1]
- (ii) vibrations at right angles to direction of wave ;
(transverse)
or vibrations in same direction as wave ;
(longitudinal) [1]

[Total: 8]

Page 5	Mark Scheme: Teachers' version	Syllabus
	IGCSE – May/June 2009	0654

- 8 (a) seedling **C**/no tip ;
(had no tip) and did not grow ;
- (b) both have grown (taller) ;
shoot **B** has bent towards the light but shoot **A** has grown straight up ; [2]
- (c) seedling **D**/tip covered ;
(had its tip covered) and has not grown towards the light ; [2]
- (d) for photosynthesis ;
light is energy source ;
plant can grow faster with more light ; [max 2]

[Total: 8]

- 9 (a) (i) electrode connected to negative side of power pack labelled ; [1]
- (ii) chlorine ; [1]
- (iii) hydrogen ; [1]
- (iv) because solution becomes alkaline ;
because sodium hydroxide is formed in the solution ; [2]
- (b) (i) (halogen) displacement/redox ;
chlorine is more reactive than iodine ; [2]
- (ii) chlorine + potassium iodide → potassium chloride + iodine ; [1]

[Total: 8]

- 10 (a) (i) the current alternates/is alternating ;
50 times per second ; [2]
- (ii) current = $5000/250 = 20\text{ A}$; [1]
- (b) efficiency = useful energy out/total energy in ;
half energy is wasted ; [2]
- (c) aluminium is a good conductor of heat ;
wood good insulator/heat cannot travel through (and burn hand) ; [2]

[Total: 7]

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	IGCSE – May/June 2009	0654

- 11 (a) (i) proteins/peptides/polypeptides ;
- (ii) N ;
- (b) (i) hexane has a lower boiling point/is more volatile/evaporates more easily ; [1]
- (ii) compound of only carbon and hydrogen ;
which contains only single (covalent) bonds ; [2]
- (iii) electrons are shared ;
in pairs/one electron from each atom is shared/OWTTE ;
reference to full outer shell ; [max 2]
- (c) (i) biodiesel is a renewable energy source ;
a "carbon neutral" energy source ;
carbon dioxide produced is removed from the atmosphere by growing (new)
soybeans/carbon dioxide is re-used/OWTTE ;
by the process of photosynthesis ; [max 2]
- (ii) sulfur compounds burn to produce SO₂/sulfur oxide ;
acid rain;
these cause damage to buildings/irritate respiratory systems ;
extra cost involved in removing sulfur from diesel ; [max 2]

[Total: 11]