

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

**MARK SCHEME for the May/June 2014 series**

**0654 CO-ORDINATED SCIENCES**

**0654/33**

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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Page 2	Mark Scheme	Syllabus	Paper
	IGCSE – May/June 2014	0654	33

- 1 (a) (i) *advantage* – uses renewable/sustainable (energy) resource/saves fossil fuels/free energy source/no pollution, CO<sub>2</sub>, waste etc.  
**and**  
*disadvantage* – visual pollution/noise/only works when it's windy/high capital investment costs/damage to wildlife/needs lots of land ; [1]
- (ii) (efficiency) =  $\frac{\text{power out}}{\text{power in}}$  ;  
=  $\frac{900}{1500} \times 100 = 60$  (%) ; [2]
- (b) (i) (nuclear to) thermal/heat energy ;  
heat water to produce steam ;  
(drives) turbine and generator ;  
reference to kinetic energy ; [max 3]
- (ii) (nuclear) fusion ; [1]
- (c) (current) =  $\frac{\text{power}}{\text{voltage}}$  ;  
=  $\frac{33\,000\,000}{132\,000} = 250$  (A) ; [2]
- (d) during cold weather cables will contract ;  
could snap cables/damage pylons etc. ; [2]
- (e) (i) **A** – smaller cross-sectional area/diameter ; [1]
- (ii) **D** ;  
nichrome, longest length, smallest cross-sectional area ; [2]
- (iii) resistance =  $\frac{\text{voltage}}{\text{current}}$  OR (I =)  $\frac{V}{R}$  etc. ;  
current =  $\frac{12}{0.15} = 80$  (A) ; [2]
- [Total: 16]**

Page 3	Mark Scheme	Syllabus	Paper
	IGCSE – May/June 2014	0654	33

- 2 (a) (i) cilia ; [1]
- (ii) cells secrete mucus ;  
mucus traps pathogens ;  
cilia push mucus (and pathogens) up / away from lungs / into throat ; [3]
- (b) (i) tar / smoke particles ; (allow nicotine) [1]
- (ii) (structures labelled **X**) paralysed / destroyed / clogged by (extra) mucus /  
mucus is not removed ;  
(cells labelled **Y**) secrete more mucus ; [2]
- [Total: 7]**
- 3 (a) (i) mixture of metals / metals and other elements ; [1]
- (ii) malleability ; [1]
- (iii) copper chloride and zinc chloride ; [1]
- (b) Na<sub>2</sub>O ;  
sodium atom loses one electron and oxygen atom gains two electrons ;  
two sodium atoms provide the two electrons / owtte ; [3]
- (c) P<sub>4</sub> + 5O<sub>2</sub> → P<sub>4</sub>O<sub>10</sub> ;;; [3]  
(LHS formulae ; RHS formula ; then balance ;)
- [Total: 9]**
- 4 (a) nitrate / magnesium / potassium / phosphate / sulfate ; [1]
- (b) leaching / runoff / washed through by rain / blown by wind ; [1]
- (c) (i) rapid / increased, growth / population increase (followed by death) ; [1]
- (ii) blocking of light so no photosynthesis / outcompeted by algae ;  
so die ;  
more growth initially due to increased nutrients ; [max 2]
- (iii) increase in numbers ;  
feed on the dead matter ; [2]
- (iv) run out of oxygen (so die) ; [1]
- (d) apply fertiliser at peak growing time / not when raining ;  
use appropriate amount / use less ; [2]
- [Total: 10]**

Page 4	Mark Scheme	Syllabus	Paper
	IGCSE – May/June 2014	0654	33

- 5 (a) (i) will repel/move away because like poles repels ; [1]
- (ii) attraction/moves towards ;  
magnetism induced in iron bar ; [2]
- (b) (i) positive – opposite charges attract ; [1]
- (ii) when rubbed with, a cloth/friction ;  
electrons are gained by ball Y ; [2]
- (iii) electrical charge experiences a force/the charge ‘moves’ towards  
the ball of opposite charge/owtte ; [1]
- (c) (density) =  $\frac{\text{mass}}{\text{volume}}$  ;  
 $\frac{3.97}{4.17}$  OR  $\frac{3.97 \times 10^{-3}}{4.17 \times 10^{-6}}$  ;  
=0.952 g/cm<sup>3</sup> OR 952 kg/m<sup>3</sup> ; [3]

[Total: 10]

- 6 (a) (i) 6 ;  
proton /atomic number is 6 and numbers of protons and electrons are equal ; [2]
- (ii) (Q)  
ethane contains two carbon atoms ;  
and six hydrogen atoms ; [2]  
[stating that ethane formula is C<sub>2</sub>H<sub>6</sub> scores both marks, max 1 if incorrect letter used]
- (iii) covalent ;  
non-metals are bonded/compounds exist as small molecules ; [2]
- (b) (i) M<sub>r</sub> H<sub>2</sub>O = 18 ;  
(18) × 5.75 = 103.5g (unit required) ; [2]
- (ii) 103.5 + 16 = 119.5g ; [1]
- (iii) methane is a greenhouse gas/adds to greenhouse effect/increases global  
warming ;  
global warming may cause methane hydrate to release more methane ;  
more methane may mean faster global warming/may go out of control ; [max 2]

[Total: 11]

<b>Page 5</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>IGCSE – May/June 2014</b>	<b>0654</b>	<b>33</b>

- 7 (a) more particles enter tyre ;  
particles are moving/vibrating/have kinetic energy ;  
increasing rate of collision with tyre wall ;  
increasing pressure ;  
other relevant point e.g. exert force/momentum change/bounce back/lots over  
an area ; [max 3]
- (b) current produces magnetic field around coil ;  
magnetic field produced interacts with other magnetic field ;  
force on current carrying conductor in magnetic field ;  
force acts on side of coil ;  
forces act in opposite directions on each side of coil ;  
current reverses every half turn ;  
keeps coil turning in same direction ; [max 4]
- [Total: 7]**
- 8 (a) genetically determined ;  
(two) distinct types ;  
use of information ; [2]
- (b) (i) 30, 9 ; [1]  
(ii) 3 :1 ; [1]
- (c) (i) purple ; [1]  
(ii) **Gg** ;  
**Gg** ; [2]
- (d) **Gg, gg** ;  
**G, g, g (g)** ;  
**Gg (Gg), gg (gg)** ;  
purple (purple), yellow (yellow) ;  
1:1/2:2 ; [5]
- [Total: 12]**

<b>Page 6</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>IGCSE – May/June 2014</b>	<b>0654</b>	<b>33</b>

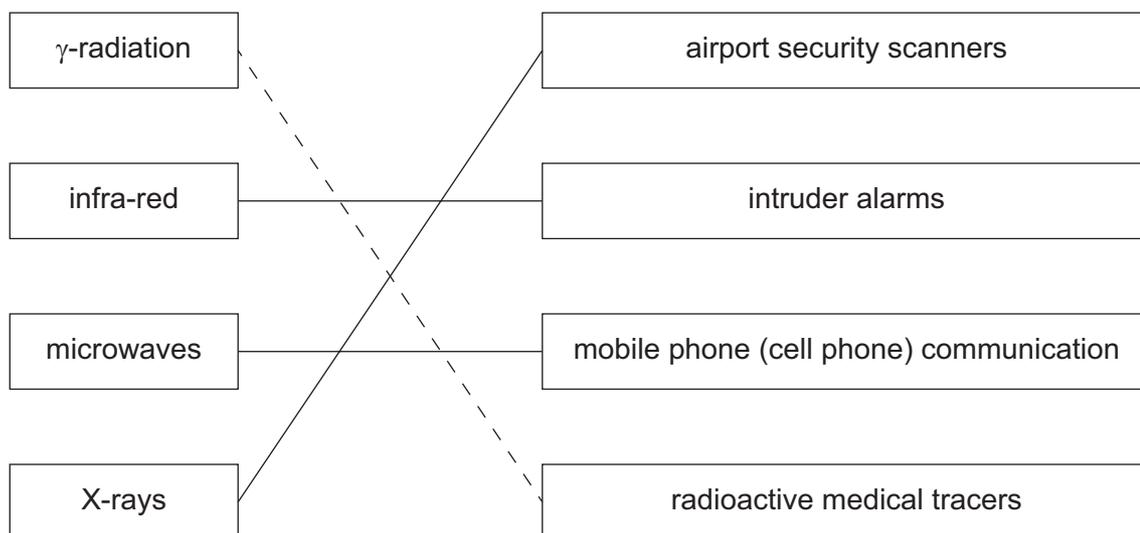
- 9 (a) (i) nitrogen ;  
78% ; [2]
- (ii) sulfur dioxide ;  
reference to acid rain reacting with building materials/plants/aquatic life ;  
damage to respiratory system if inhaled/AVP ;  
**OR**  
oxides of nitrogen/named oxide ;  
damage to respiratory systems if inhaled/reference to smog ; [max 2]
- (b) (i) flame ;  
pops ; [2]
- (ii) magnesium + hydrochloric acid → magnesium chloride + hydrogen ; [1]
- (c) (i) (chemical energy converted to) thermal/heat, energy/ releases,  
thermal/heat, energy ;  
reaction is exothermic ;  
increases particle kinetic energy; [max 2]
- (ii) no further reaction/no more heat energy is being released ;  
because, reactant(s)/acid, used up/magnesium in excess/owtte ; [2]

**[Total: 11]**

10 (a)

*electromagnetic wave*

*use*



[1]

- (b) *frequency*: number of waves produced per second/number of waves passing a fixed point per second ;  
*wavelength*: distance between two peaks/two troughs/two identical points on consecutive waves/correctly labelled diagram ; [2]

<b>Page 7</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>IGCSE – May/June 2014</b>	<b>0654</b>	<b>33</b>

(c) (i) alpha  
beta  
gamma (in that order) ; [1]

(ii) charged particles act like a current ;  
moving charged particles create magnetic field ;  
magnetic fields interact ;  
gamma has no charge so no deflection/gamma is, electromagnetic radiation/wave,/so no deflection/alpha and beta deflect because they have charge ;  
alpha and beta have opposite charges so deflected in opposite directions ;  
beta deflected more than alpha ; [max 3]

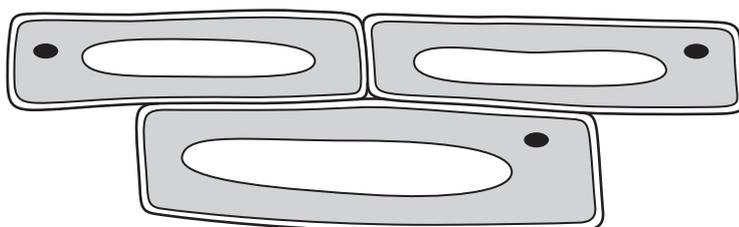
**[Total: 7]**

11 (a) diffusion of water (molecules) ;  
from, higher water concentration /higher water potential /more dilute solution, /  
down a water potential gradient ;  
through a partially/semi-permeable membrane ; [3]

(b) (i) cytoplasm/cell membrane has withdrawn from cell wall/vacuole smaller/  
plasmolysis ; [1]

(ii) water has left the cells (by osmosis) ;  
because sugar solution is more concentrated/has lower water  
concentration/potential ; [2]

(iii) three cells filled in showing larger vacuoles ;  
cytoplasm pressed against cell walls ;  
[i.e., as below – ]



[2]

(c) (i) elongated shape ;  
for larger surface area ;  
**OR**  
thin/permeable cell walls ;  
to allow water through ; [max 2]

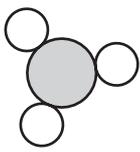
(ii) absorption of minerals/ions/nitrate/magnesium/other named mineral ion ; [1]

**[Total: 11]**

<b>Page 8</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>IGCSE – May/June 2014</b>	<b>0654</b>	<b>33</b>

12 (a) (i) 3 ; [1]

(ii) particle to be labelled **C** shown



[1]

(iii) molecule of a compound must contain different atoms (joined)/elements (combined) ; [1]

(b) transition elements/metals/series ; [1]

(c) (i) aluminium oxide/alumina/bauxite ;  
cryolite ; [2]

(ii) oxygen/carbon dioxide/carbon monoxide ; [1]

(iii) aluminium ions gain electrons ;  
each ion gains three electrons/is discharged ; [2]

**[Total: 9]**