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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CAMBRIDGE
International Examinations

1 (a) (i) *advantage* – uses renewable / sustainable (energy) resource / saves fossil fuels / free energy source / no pollution, CO_2, 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]

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_2O ;
sodium atom loses one electron and oxygen atom gains two electrons ;
two sodium atoms provide the two electrons / owtte ; [3]

(c) $P_4 + 5O_2 \rightarrow P_4O_{10}$;;; [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]

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 $\frac{3.97 \times 10^{-3}}{4.17 \times 10^{-6}}$;

$=0.952\ \text{g/cm}^3$ OR $952\ \text{kg/m}^3$; [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_2H_6 scores both marks, max 1 if incorrect letter used]

(iii) covalent ;
non-metals are bonded / compounds exist as small molecules ; [2]

(b) **(i)** M_r H_2O = 18 ;
(18) × 5.75 = 103.5 g (unit required) ; [2]

(ii) 103.5 + 16 = 119.5 g ; [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]

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]

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]

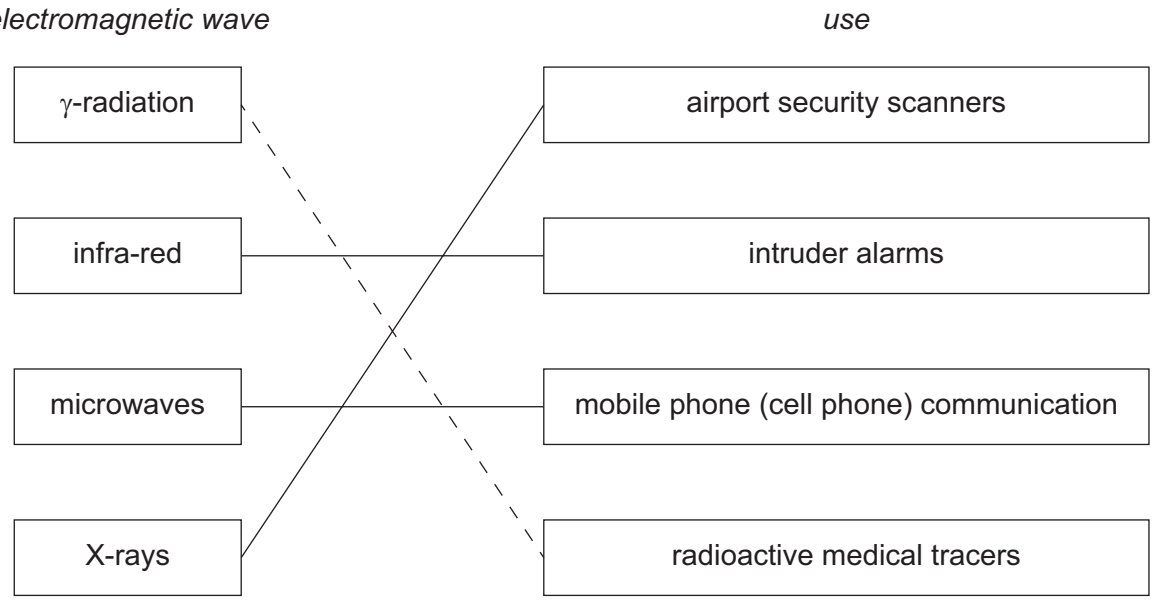
(ii) magnesium + hydrochloric acid → magnesium chloride + hydrogen ; [1]

(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)



[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]

(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]

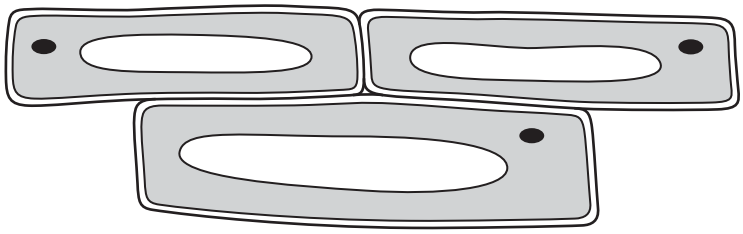
[Total: 7]

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

(b) (i) cytoplasm / cell membrane has withdrawn from cell wall / vacuole smaller /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

(ii) <u>water</u> 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]

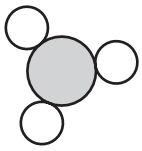
(c) (i) elongated shape ;
for larger surface area ;
OR
thin / permeable cell walls ;
to allow water through ; [max 2]

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

[Total: 11]

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]