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CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2014 series

0653 COMBINED SCIENCE

0653/31 Paper 3 (Extended Theory), maximum raw mark 80

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1 **(a)** **(i)** $Mg + 2HCl \longrightarrow (MgCl_2) + H_2$
formulae ;
balancing ; [2]

(ii) magnesium
X
copper ; [1]

(b) **(i)** solution turns blue to colourless / becomes fainter ;
brown deposit (of copper) (on metal X) ; [2]

(ii) **X** is less reactive than magnesium / magnesium is more reactive than X ; [1]

(c) **(i)** removal of oxygen / gain of electrons ; [1]

(ii) metal <u>ions</u> have a positive charge ;
cathode has a negative charge ;
opposite charges attract ; [max 2]

[Total 9]

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2 **(a)** ecosystem ; [1]

(b) an organism that feeds on other organisms (to get its energy) ; [1]

(c) oak trees → beetles → blackbirds → hawks
OR
oak trees → greenfly → frogs → hawks ;
arrows correct ; [2]

(d) heat ;
respiration / movement / muscle contraction ;
not all food digested / edible ;
some creatures die before being eaten ; [max 2]

(e) carbon dioxide level increased ;
oxygen level decreased ;
less photosynthesis / more decomposition / more decay / animals produce carbon dioxide by respiration ; [3]

[Total: 9]

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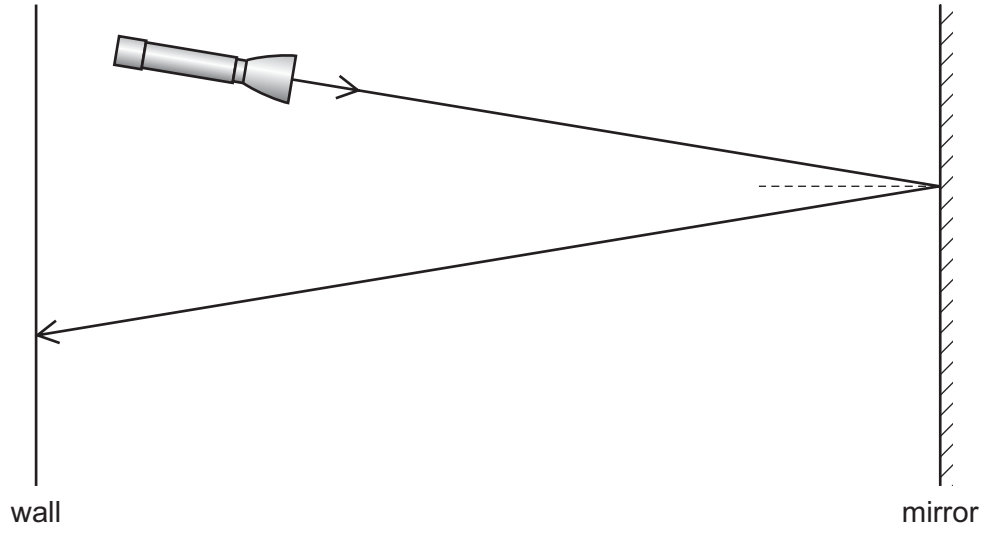
3 (a) (i) lamp says it needs 3 V, so needs 2 × 1.5 V cells (owtte) ;
OR
the p.d. from one cell does not supply enough energy to light the lamp (owtte) ;
OR
requires the p.d. provided by two cells to supply enough energy to light the lamp (owtte) ; [1]

(ii) lamp takes current of 1.2 A (when lit) (owtte) ; [1]

(iii) R = V / I ;
= 3 ÷ 1.2 = 2.5 ;
Ω ; [3]

(b) chemical ⟶ electrical ;
electrical ⟶ light and heat ; [2]

(c) (i)



incident ray in line with axis of torch, reflected off mirror, hitting wall ;
angle of incidence and angle of reflection reasonably equal on visual inspection ; [2]

(ii) speed of light much faster than eye / brain can detect change (owtte) ; [1]

[Total: 10]

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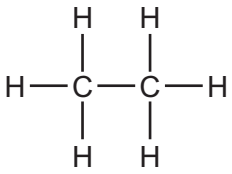
4 (a) (i) fractional distillation / fractionation ; [1]

(ii) the lower the boiling point, the higher up the tower it condenses / the higher the boiling point the lower in tower ; [1]

(iii) the longer the molecule the higher the boiling point ;
longer molecules exert greater intermolecular force ; [2]

(b) (increased CO_2) traps more solar energy by the greenhouse effect ;
leading to global warming ;
resulting in environmental / climate changes / weather changes / flooding / increase in sea level ; [max 2]

(c) (i)



two carbons and six hydrogens ;
correct structure ; [2]

(ii) double bond / unsaturation present in (the) smaller molecules ;
double bond is reactive / can (partially) break / can undergo (a variety of) addition reactions ;
only strong single bonds present in methane and ethane ; [max 2]

[Total 10]

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5 **(a)** **(i)** electrical (energy) ⟶ sound (energy) **;** [1]

(ii) notes lie within normal range <u>20 Hz – 20,000 Hz</u> ; [1]

(b) **(i)** PE = mgh ;
= 50 × 10 × 2 = 1000 (J) ; [2]

(ii) K) = ½ mv^2 ;
= ½ x 50 × 0.5 × 0.5 = 6.25 (J) ; [2]

(c) infra-red ;
in box between visible light and microwaves ; [2]

[Total 8]

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6 (a) (i) zygote / one of the ball of cells ; [1]

(ii) into uterus ;
implants / embed) in wall / lining ; [2]

(b) (i) contains antibodies / available when needed /
no sterilisation of bottles / bonding / cheaper / correct temperature / avp ; [1]

(ii) can use if mother does not have enough milk /
can get someone else to feed baby / can feed in public / avp ; [1]

(c) (i) total mass of protein + fat + carbohydrate = 12.6 g ;
mass of water = 100 – 12.6 = 87.4 g ; [2]

(ii) (energy released by fat) = $3.8 \times 37 = 140.6$ (kJ) ;
(energy released by carbohydrate) = $7.6 \times 16 = 121.6$ (kJ) ;

fat releases (19 kJ) more energy ; [max 3]

[Total 10]

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7 **(a)** one shared pair of electrons ;
three lone / non-bonding pairs on both atoms ; [2]

(b) any suitable pale colour AND gas ; [1]

(c) yellow / orange colouration ;
displacement of bromine / chlorine is more reactive than bromine ; [2]

(d) **(i)** (name)
practical use ; [1]

(ii) lack of reactivity ;
due to full outer electron shells ; [2]

[Total 8]

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8 (a) (i) touching in liquid ;
during evaporation becoming far apart ;
and becoming mixed with air molecules / leaving body of liquid ; [max 2]

(ii) molecules in hot air collides with molecules in cooled water surface ;
molecules in air slow down, so temperature drops / energy transferred from hot air molecules to cool water molecules / (owtte) ; [2]

(b) heating effect by radiation – infra-red ;
white surfaces good reflector / bad absorber of radiation / infra-red ; [2]

(c) (i) vibrations from fan (hit molecules in air) produce compressions and rarefactions / pressure waves in air ; [1]

(ii) compressions and rarefactions / pressure waves / sound waves travel in air (to ear) ; [1]

[Total 8]

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9 **(a)** blood passes through the heart twice (for each time around the body) ; [1]

(b) **(i)** right ;
pulmonary artery ; [2]

(ii) higher at **Q** than **P** (ora) ;
blood at **Q** has to go around body / blood at **P** only has to go to the lungs ; [2]

(c) **(i)** oxygen ; [1]

(ii) glucose ;
amino acid ;
fatty acid / glycerol ;
named vitamin ;
named mineral ;
water ;
carbon dioxide ; [max2]

[Total 8]

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