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

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)** $Mg + 2HCl \longrightarrow (MgCl_2) + H_2$
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 ions have a positive charge ;
cathode has a negative charge ;
opposite charges attract ; [max 2]

[Total 9]

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]

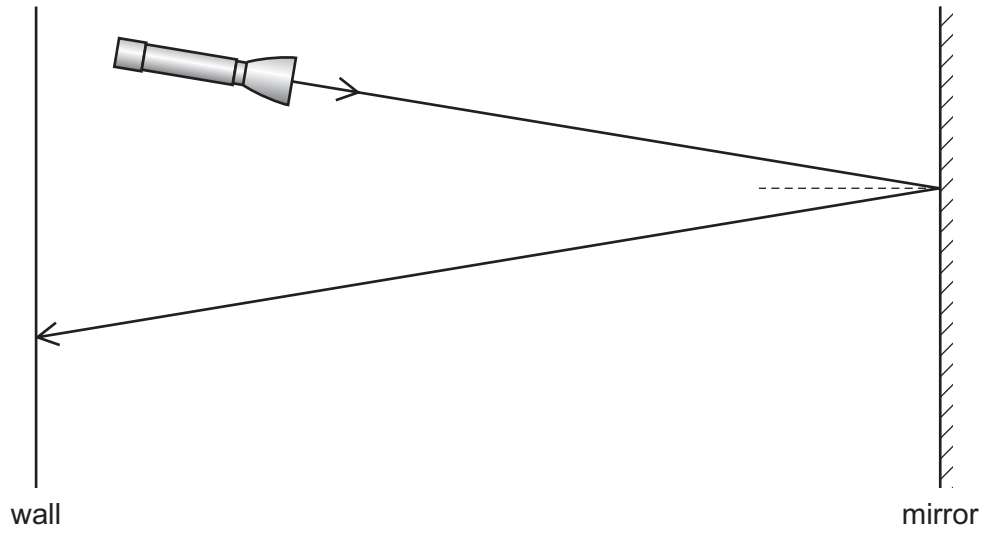
3 (a) (i) lamp says it needs 3 V, so needs 2 × 1.5 V cells (owtte) ;
OR
the p.d. from one cell does not supply enough energy to light the lamp (owtte) ;
OR
requires the p.d. provided by two cells to supply enough energy to light the lamp (owtte) ; [1]

(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]

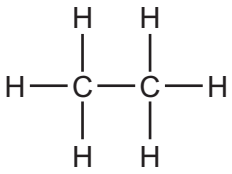
4 (a) (i) fractional distillation / fractionation ; [1]

(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]

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]

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 × 37 = 140.6 (kJ) ;
(energy released by carbohydrate) = 7.6 × 16 = 121.6 (kJ) ;

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

[Total 10]

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]

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]

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]