CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 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.

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International Examinations

1 (a) (i) reference to reactivity of elements / compound is more stable ; [1]

(ii) compound has elements in fixed proportions / has a formula ;
mixture has no fixed proportions ;

compound has new chemical properties ;
mixture retains the properties of the constituents ;

compound has all constituents chemically bonded ;
mixture does not have chemical bonds between all constituents ;

a mixture can be separated by physical means ;
a compound cannot / can only be separated by chemical means ;

a compound is formed by chemical reaction
a mixture is not formed by chemical reaction ; [max 2]

(b) (i) potassium and calcium (both required) /Ca^{2+} and K^{+} ; [1]

(ii) reference to charge balance / correct electron transfer shown ;
CaF_2 ; [2]

(c) (i) cathode is negative ;
reference to attraction between opposite charges ; [2]

(ii) ions gain electrons ;
each ion gains two (electrons) / is discharged ; [2]

[Total: 10]

2 (a) (i) arrow going downwards ; [1]

(ii) cooler air / gas contracts / particles closer together / particles are moving more slowly / particles have less kinetic energy ;
cold air is denser (therefore moves down) ; [2]

(b) (mass =) density × volume / 1.26 × 0.15 ;
= 1.26 × 0.15 = 0.19 kg / 0.189 kg / 189 g ; [2]

(c) (i) solid – all particles touching, regular arrangement particles of similar size ;
liquid – most particles touching, irregular arrangement particles of similar size ; [2]

(ii)

Description	S, L or G
It cannot flow.	**S**
It cannot transfer heat by convection.	**S**
It contains particles which are widely separated.	**G**
It expands the most when heated.	**G**
It fills a closed container.	**G**
It has a fixed volume but not a fixed shape.	**L**

1 mark for every three correct answers ; ; [2]

(d) refrigerator **D** (no mark)
white/light surfaces are worst absorbers / reflect most radiation ; radiation ;
shiny surfaces are worst absorbers / reflect most radiation ; [2]

3 **(a)** increased then decreased ;
increased more rapidly than it decreased ;
maximum 6.6 units / peak reached after 40 minutes ;
quote figures, e.g. returned to normal / 2 units by 100 minutes ; [max 3]

(b) starch digested / broken down to, sugar / glucose ;
by enzymes / amylase ;
sugar / glucose, absorbed into the blood in the small intestine (causing increase) ;
sugar / glucose, used in respiration (causing decrease) [max 3]

(c) **(i)** (blood glucose concentration) did not rise as high ;
maximum 4 units rather than 6.6 units ;
rose more slowly ;
fell more slowly ;
took longer to return to normal / does not return to normal by end / at end it is 0.2 units higher than at the start ; [max 3]

(ii) reduces, constipation / bowel cancer ; [1]

[Total: 10]

4 **(a)** silicon ;
in Group 4 (and third period) / (atoms has) four outer electrons ; [2]

(b) **(i)** Group 1 ;
reference to at least one of the proton numbers plotted on graph / all proton numbers match those of group 1 elements ; [2]

(ii) allow anywhere in range 34–20 °C ;
at proton number 55 ; [2]

(c) **(i)** carbon monoxide ; [1]

(ii) redox / reduction ;
oxygen removed from iron oxide ; [2]

(iii) iron oxide + carbon monoxide ⟶ iron + carbon dioxide ; [1]

[Total: 10]

5 **(a)** **(i)** area under graph/working/ ½ × 1000 x 30 + 3000 × 30 ;
105,000 m ; [2]

(ii) (acceleration =) gradient or 30 / 1000 ;
= 0.03 m / s^2 ; [2]

(b) **(i)** 10% ; [1]

(ii) 1,000,000 × 0.10 ;
× 0.70 = 70,000 J ; [2]

[Total: 7]

6 **(a)** **(i)** increases pressure / reference to high pressure ;
pushes blood out into the aorta / out of the heart ; [2]

(ii) closes it ; [1]

(b) **(i)** use energy for contraction ;
energy obtained by respiration ;
respiration uses oxygen ; [max 2]

(ii) most of area below the label line and to the left of the septum shaded ; [1]

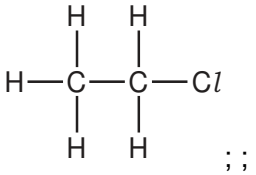
(iii) <u>eating</u> too much fat / high fat diet / eating fatty food ;
not enough exercise ;
stress / overwork ;
smoking ; [max 3]

[Total: 9]

7 **(a)** **(i)** orange / yellow to colourless ; [1]

(ii) addition ; [1]

(iii)



; ;

all single bonds ;
all else correct ; [2]

(b) $CH_4 + H_2O \rightarrow CO + 3\ H_2$; ; ; [3]
(LHS formulae ; RHS formulae: balanced – one mark)

[Total: 7]

8 **(a)** 2.0 A
14 A ; both required for the mark [1]

(b) 1/R = 1/R1 + 1/R2 + 1/R3 + 1/R4 ;
= 4 / 24 = 1 / 6 ;
R = 6 Ω ;
or
R = V/I ;
= 12/2 ;
=6 Ω ; [3]

[Total: 4]

9 (a) (i) palisade (mesophyll) ; [1]

(ii) photosynthesis takes place in chloroplasts ;
chloroplasts contain chlorophyll ;
chlorophyll absorbs, sunlight / energy from sunlight ;
starch grain stores products of photosynthesis ;
cell membrane allows water and carbon dioxide to enter the cell ;
detail, e.g. chloroplasts near edge of cell to obtain more sunlight ; [max 3]

(b) less photosynthesis ;
so less carbon dioxide removed from the atmosphere ;

burning / trees produces carbon dioxide ;

rotting trees produce carbon dioxide ;

carbon dioxide traps long wave / infra-red radiation / heat / thermal energy ;
reduces rate of loss of heat from the Earth's surface ; [max 3]

[Total: 7]

10 (a) (i) infrared ; [1]

(ii) microwaves ; [1]

(b) 3×10^8 m / s ; [1]

(c) 100 m ;
1.5 m ; [2]

[Total: 5]