CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0654 CO-ORDINATED SCIENCES

0654/21 Paper 2 (Core 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.

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CAMBRIDGE
International Examinations

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

(ii) element cannot be simplified / decomposed chemically ;
element contains just one type of atom ;
element is found in Periodic Table ; [max 1]

(iii) heat/boil solution ;
leave to evaporate / water evaporates leaving sodium chloride ; [2]

(b) **(i)** number of protons = number of electrons / charges in atoms are balanced ;

reference to number of protons – number of electrons = 1 ; [2]

(ii) idea that formula shows the ratio Ca:N particles is 3:2 ; [1]

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

(ii) bromine is formed ;
bromine (vapour) is orange ;
bromine evaporates / boils off ; [max 2]

[Total: 10]

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

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

(c) **(i)** solid – all particles touching, regular arrangement particles similar size ;
liquid – most particles touching, irregular arrangement particles 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

(2 correct = 1 mark, 4 correct = 2 marks, 6 correct = 3 marks) ;;; [3]

[Total: 8]

3 **(a)** **(i)** substance produced by a gland ;
carried in blood ;
affects activity of target organs ; [max 2]

(ii) increases heart rate / pulse rate / blood pressure ;
increases breathing rate / depth of breathing / width of airways ;
increases rate of respiration ;
heightens sensitivity / faster reactions ; [1]

(b) **(i)** increased then decreased ;
increased more rapidly than it decreased ;
maximum 6.6 units / peak reached after 40 minutes ;
returned to normal by 100 minutes ; [max 3]

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

(iii) (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 / at end is 0.2 higher ; [max 3]

(c) reduces, constipation / bowel cancer / risk of diabetes ; [1]

[Total: 13]

4 **(a)** **(i)** **Y** and **Z** ;
non-metals ; [2]

(ii) **Z** ;
it is a noble / inert gas / reference to filled shells in atoms ; [2]

(b) **(i)** Group 1 ;
reference to at least one of the proton numbers plotted on graph ; [2]

(ii) rubidium ; [1]

(c) **(i)** make a solution of the oxide and add indicator ;
blue / alkali shows metal oxide or red / acid shows non-metal oxide ; [2]

(ii) insoluble substance dissolved / disappeared ;
colour change / coloured substance produced ; [max 1]

(iii) (reactants→) copper sulfate ; + water ; [2]

[Total: 12]

5 **(a)** (speed) = distance ÷ time ;
$= \frac{3000}{30}$ = 100 km / hour ; [2]

(b) **(i)** accelerating ; [1]

(ii) (distance) = speed × time ;
= 180 km ; [2]

(c) **(i)** 1 000 000 × 0.10 × 0.70 ;
= 70 000J ; [2]

(ii) electrical to kinetic ; [1]

(d) **(i)** geothermal / tides / hydroelectric / waves / wind / biomass ; [1]

(ii) fossil fuels not wasted ;
no CO_2 produced ; [max 1]

(e) lateral inversion ;
upright ;
virtual ; [max 2]

(f) parallel rays of light brought to a focus ;
at 5 cm ; [2]

[Total: 14]

6 **(a)** **(i)** **A** (right) atrium ;
B (right) ventricle ; [2]

(ii) contracts ;
reduces volume of ventricle ;
increases pressure ; [max 2]

(iii) needs to produce more force ;
to push blood all round the body ;
not only to the lungs ; [max 2]

(b) **(i)** blood in artery is at higher pressure ;
blood in artery is pulsing ;
blood in artery is deoxygenated ;
blood contains more carbon dioxide ; [max 2]

(ii) artery has a thicker wall ;
artery has more elastic tissue ;
artery does not have valves ; [max 2]

[Total: 10]

7 **(a)** mixture of metals / mixture of solid elements most of which are metals ; [1]

(b) **(i)** zirconium + oxygen → zirconium oxide ; [1]

(ii) the idea that zirconium and oxygen atoms are now bonded ;
and that oxygen atoms have mass ; [2]

(iii) powder has higher surface area ;
which increase reaction rate / particle collision frequency / allows efficient contact between oxygen and metal ; [2]

(c) **(i)** 40 ; [1]

(ii)

isotope	*protons*	*neutrons*
Zr – 90	40	50
Zr – 96	40	56

(any 2 correct – 1 mark, all 4 correct – 2 marks) ;; [2]

(iii) isotopes ; [1]

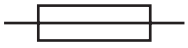
[Total: 10]

8 **(a)**

open switch 

resistor 

voltmeter 

fuse 

2 correct symbols for 1 mark ;; [2]

(b) damaged insulation / bare wires ;
danger of electrocution ; [2]

(c) **(i)** $\mathbf{A_1}$ = 0.5 A and $\mathbf{A_2}$ = 0.5 A ; [1]

(ii) $R_T = R_1 + R_2$;
= 10 Ω ; [2]

(d) (i) V = I × R ; [1]

(ii) 1300 ohms ; [1]

(iii) 12/1300 ;
= 0.009 A ; [2]

[Total: 11]

9 (a) (i) phenotype ; [1]

(ii) (parents' genotypes) **Aa** and **Aa** ;
gametes **A** and **a** from both parents ;
offspring genotypes **AA**, **Aa**, **Aa** and **aa** ; [3]

(iii) 1 : 2 ;
none of the **AA** zygotes develop ; [2]

(b) (i) fur traps air ;
fur / air, acts as an insulator ;
reduces heat loss by, convection / radiation ; [max 2]

(ii) white animals less camouflaged ;
more easily seen by predators ;
reference natural selection ; [max 2]

[Total: 10]

10 (a) *unsaturated:*
contains double bonds / not the maximum possible number of H atoms ;
hydrocarbon:
compound of hydrogen and carbon only ; [2]

(b) orange / yellow to colourless ; [1]

(c) (i) the temperature (inside kiln) is high / is 950 °C ;
exothermic means the reaction releases heat (energy) ; [2]

(ii) produced by complete combustion of propane / hydrocarbons ; [1]

(iii) produced by incomplete combustion of hydrocarbons ; [1]

(iv) carbon monoxide is poisonous (to humans) / risk of suffocation/poisoning if waste gases cannot disperse ; [1]

[Total: 8]

11 (a) removes electrons from atom / produces a charged particle ; [1]

(b) ultraviolet ;
fluorescent tubes / security marking / tanning / sterilising ; [2]

(c) (i) sine wave ;
amplitude correctly labelled ;
wavelength correctly labelled ; [3]

(ii) longitudinal ; [1]

[Total: 7]

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

(ii) takes place in chloroplasts ;
chlorophyll absorbs, sunlight / energy from sunlight ;
water combines with carbon dioxide ;
produces oxygen and glucose / sugar ; [max 3]

(b) reduction of habitat ;

area too small to support populations / reduction in biodiversity / extinction / species become endangered / lack of opportunity to find new medicines ;

flooding / leaching of minerals
due to rain falling directly on soil / lack of protection of tree canopy / increased runoff ;

soil erosion ;
due to lack of tree roots ;

drought ;
due to lack of transpiration by trees to form rain leading to desertification ;

fewer trees to photosynthesise/less photosynthesis ;
to remove carbon dioxide ;

burning trees produce CO_2 ;

rotting trees produce CO_2 ;
by respiration of microbes ;

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

[Total: 7]