UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

0654 CO-ORDINATED SCIENCES

0654/21 Paper 2 (Core Theory), maximum raw mark 100

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 must be read in conjunction with the question papers and the report on the examination.

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1 **(a)** steel / an alloy is a mixture (of metals and other elements) / contains more than one element ;
(mild steel) contains carbon (mixed with iron) ; [m

(b) **(i)** in **B**, air / oxygen and water are present (together) / air and water needed for rusting ;
no water in **A** ;
no air / oxygen in **C** ; [3]

(ii) oxidation ; [1]

(iii) not enough air / oxygen present / only water present ; [1]

(c) **(i)** **W** and **Y** ;
contain only hydrogen and carbon ; [2]

(ii) does not mix with water / air / oxygen ;
sticks to chain / steel ; [max 1]

(d) polymer molecule much larger / longer / heavier ;
idea that polymer is made from simple molecules / monomers linked into chain ; [max 1]

[Total: 10]

2 **(a)** **(i)** number of waves per second ; [1]

(ii) (distance =) speed × time ;
= 300 000 000 × 0.000 027 = 8100 (m) ;
so distance = 4050 (m) ; [3]

(b) (KE =) ½ mv^2 ;
= ½ × 140 000 × 100 × 100 = 7 × 10^8 (J) ; [2]

(c) **(i)** **C** = weight, **D** = drag / friction / air resistance ; [1]

(ii) constant speed / no acceleration (means balanced forces) ; [1]

(d) (deceleration =) change in velocity / time ;
= 85/40 or 2.125 (m / s^2) ; [2]

[Total: 10]

3 **(a)** (receptor) nose / cells in nose ;
(effector) salivary glands ;

(b) **(i)** catalyst ;
protein ;
speeds up / controls / catalyses, metabolic reactions ; [max 2]

(ii) to break down / digest starch to ;
sugar / maltose ;
that can be absorbed / that can move from gut into the blood ; [max 2]

(c) **(i)** grinding / crushing ;
increase surface area of food ;
idea of easier access for enzymes ; [max 2]

(ii) bacteria (on food residues) ;
produce acids ;
(acids) dissolve / react with, enamel ;
make holes through which bacteria can reach, dentine / pulp cavity / living cells ; [max 3]

(iii) contains calcium ;
needed to form enamel ; [2]

[Total: 13]

4 **(a)** **(i)** electrons ; [1]

(ii) negative ; [1]

(iii) length ;
temperature ;
cross sectional area / width / diameter ;
material / resistivity / conductivity ; [max 2]

(b) **(i)** red, green and blue ;; [2]

(ii) other colours produced by a combination of these ; [1]

(c) **(i)** heat / thermal ; [1]

(ii) increase temperature / produce convection current ; [1]

(iii) efficiency = useful energy output / energy input = 100 / 30 ;
= 33(%) ; [2]

[Total: 11]

5 **(a)** ceramics ;
chlorine ;
glass ;
paper ;

(b) **(i)** compound has formula / fixed proportions of elements ;
compound has different elements bonded together ;
compound has different properties from constituents ;
(significant) energy change when compound formed ;
(or corresponding statements for mixture) [max 2]

(ii) fractional distillation ; [1]

(c) increase temperature ;
increase pressure ;
use catalyst ; [max 2]

(d) acid ;
neutralisation ; [2]

[Total: 11]

6 **(a)** **(i)** 23 ;
chromosomes ; [2]

(ii) label to cell membrane ;
label to cytoplasm ; [2]

(iii) pointed head, reduces friction / streamlined ;
tail for swimming ; [2]

(b) testis/testicle ; [1]

(c) **(i)** oxygen use by one sperm / single sperm quantities too small to measure ; [1]

(ii) respiration ;
oxygen combined with sugar to release energy ;
more energy used when swimming ; [2 max]

[Total: 10]

7 **(a)** diagram showing second switch in parallel with first ;

(b)

switch X	*switch Y*	*lamp off or on*
up	up	**on**
up	down	**off**
down	**up**	off
down	down	on

;; [2]

(c) **(i)** heated water rises / cold water sinks ;
by convection ;
hot water less dense / cold water more dense ; [max 2]

(ii) 5000 (J) ; [1]

(d) (large current produces) strong electromagnet ;
(strong enough to) attract iron (on pivot) ;
contacts break ; [3]

(e) **(i)** coal / oil / gas / peat ; [1]

(ii) no CO_2 emissions / no addition to global warming / no use of fossil fuels / renewable ; [1]

(iii) turbines unsightly / turbines noisy / can't work if too windy / not enough wind / wildlife destroyed ; [1]

[Total: 12]

8 **(a)** respiration ;
carbon dioxide ;
stomata ;
photosynthesis ;

(b) nitrates absorbed by plant roots ;
used for making proteins ;
proteins used for making new cells ; [max 2]

(c) **(i)** to kill / destroy, insects ;
which eat / damage, crop / grass for grazing ;
increase yields ; [max 2]

(ii) kill dung beetles ;
so dung not buried / nitrates in dung do not get into soil ; [2]

[Total: 10]

9 **(a)** **(i)** 13 ; [1]

(ii) potassium feldspar ;
lilac shows potassium ; [2]

(iii) calcium / potassium ; [1]

(b) **(i)** no wind for sandblasting ;
no water for freeze / thaw ;
no water for chemical weathering ;
no plants / animals for biological weathering ; [max 2]

(ii) salts / minerals are released into the soil ;
which plants need for healthy growth / maintenance ; [2]

(c) **(i)** (thermal) decomposition ;
(heating) causes a substance to break down into simpler ones / a large substance is broken down into smaller ones / calcium oxide (and carbon dioxide) is (are) simpler substances than calcium carbonate ; [2]

(ii) (calcium oxide has lower mass)
mass due to carbon dioxide has been lost / part of the calcium carbonate has been lost / calcium oxide is only a part of calcium carbonate ; [1]

(iii) green to blue / purple ;
reaction produces an alkali / alkaline solution / calcium hydroxide ; [2]

[Total: 13]