UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

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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1 **(a)** (force =) mass × acceleration / (W =) m × g ;
= 10 × 4 = 40 N ; [2]

(b) distance = area under graph / ½ × b × h ;
height = 80 m ; [2]

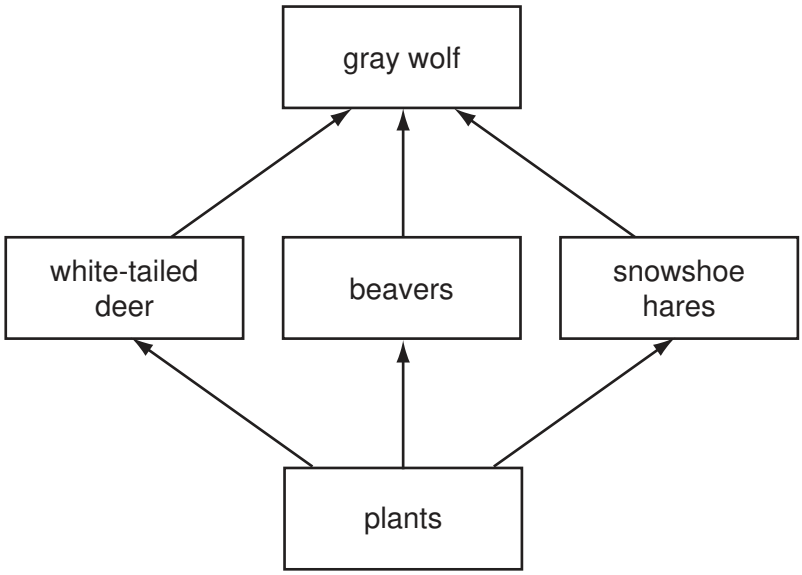
(c) use displacement can or measuring cylinder / graduated beaker ;
place object in and measure displaced water / difference in volume ;
this is the volume of the object ;
measure mass of rock using a balance ;
divide the mass by the volume / d = m / v ; [max 4]
(max 3 if final point missing)

(d) **(i)** Geiger counter / Geiger-Müller / GM tube / any other suitable ; [1]
e.g. scintillation counter / cloud chamber

(ii) ionises cell contents / ref. to cancer / kills / damages / mutates cells / changes / damages / mutates DNA / chromosomes / radiation burns / burns skin ;
(ignore refs. to eye damage) [1]

[Total: 10]

2 **(a)** **(i)**



all organisms included ;
all organisms correctly connected ;
all arrows (at least three required) are in correct directions ; [3]
(accept a named plant, ignore refs. to soil)

(ii) energy (flow / transfer) ; [1]

(iii) energy lost along food chains ;
80% to 90% energy (losses between trophic levels);
less energy available for, higher trophic levels / for wolves ; [2]

(b) maintain biodiversity ;
avoids extinction / depletion of wolves ;
idea that losing one species will affect others ;
ethical / moral / scientific / tourism, argument for conserving species ; [max 2]

any argument against conservation, e.g. wolves eat livestock / are danger to people ; [1]

[Total: 9]

3 **(a)** **(i)** coloured compounds / variable valency / ion charge / oxidation state ; [1]

(ii) Cu^{+} / +1 / 1;
working shows (or heavy implication of) need for charge balance ; [2]
(reject unexplained "criss-cross" diagrams)

(b) **(i)** anode and electrolyte clearly labelled ;; [2]

(ii) ions move towards / attracted to electrodes ;
because of opposite charges / opposite charges attract ;
(specifics e.g. copper ions are positive and move to negative electrode would score first two points)
ions discharged / become atoms (at the electrode) ;
correct details of electrons e.g. metal ions are positive and gain electrons / non-metals are negative and lose electrons ; (ignore incorrect refs. to redox)
chlorine atoms pair up into molecules ; [max 4]

[Total: 9]

4 **(a)** **(i)** reflected ray drawn at correct angle and has correct arrow ; [1]

(ii) normal drawn (ignore any arrow); [1]
(labelling – normal and / or reflected ray must be labelled)

(iii) angle of incidence correctly labelled ; [1]

(b) **(i)** two (and only two) complete waves drawn on grid (ignore amplitude change and wavelength variation) ; [1]

(ii) wave drawn with half amplitude ; (ignore a change of frequency if correctly half amplitude) [1]

(iii) **B** and **C** ; [1]

[Total: 6]

5 **(a)** **(i)** C_8H_{18} ; [1]

(ii) (octane +) oxygen → carbon dioxide + water ; [LHS + RHS] [2]
(words required)

(b) **(i)** 5 ; [1]

(ii) three shared pairs ;
one lone pair on both atoms ; [2]
(marked separately)

(c) (duralumin)
high strength for safety / to resist breakage / air resistance / because high forces on aircraft in flight ;
low density to reduce weight / mass / reduce fuel cost ; [max 2]

[Total: 8]

6 **(a)** **X** sensory (neurone) ;
Y relay / intermediate / association / connector (neurone) ;
Z motor / effector (neurone) ; [3]

(b) any muscle / muscles ;
jump / contract / any other suitable response (not necessarily a reflex action); [2]

(c) **(i)** changes starch ;
to maltose / sugar ; [2]

(ii) to produce small molecules (from large ones) ;
so that the (small) molecules / particles / nutrients can be absorbed ;
absorption is into blood / through gut wall ;
so they can be used by cells / to build new cells ; [max 2]

(iii) rises then falls ;
peak at somewhere between 30°C and 40°C ; [2]

[Total: 11]

7 (a)

switch position			lamp 'on' or 'off'		
S1	**S2**	**S3**	**L1**	**L2**	**L3**
closed	closed	closed	on	on	on
closed	closed	open	on	off	on
closed	open	open	on	off	off

(1 mark for each correct row) ;;; [3]

(b) (i) transformer ; [1]

(ii) $V_p / V_s = N_p / N_s$;
$V_s = 23 \times 200 / 20 = 230$ V ; [2]

(c) moving coil experiences changing magnetic field / coil cuts magnetic field lines owtte ;
this induces voltage / current ;
(every half turn) the coil experiences the opposite changing magnetic field / cuts the field in opposite directions ;
so this creates alternating voltage / current ;
slip rings allow a.c. to be collected / transferred / split ring / commutator would give d.c. ;

[max 4]

[Total: 10]

8 (a) (provides) energy ;
to allow carbon dioxide to combine with water ; [2]

(b) area covered by paper shown on diagram ;
orange-brown / yellow where paper was, blue-black elsewhere ; [2]

(c) respire all the time ;
during daylight, plants photosynthesise more than they respire ;
respiration takes in oxygen and produces carbon dioxide ;
photosynthesis takes in carbon dioxide and releases oxygen ; [max 3]

[Total: 7]

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

(ii) H^+ / H_3O^+ ; [1]

(b) (i) acid concentration ;
temperature (of acid) ;
degree of agitation ; [2]

(ii) time taken for (the same) volume of gas (to form) was greatest / was high ; [1]

(iii) rate is lower (with single piece) ;
surface area (of single piece) is lower ;
fewer collisions per second / lower collision frequency / chance / probability (between acid and metal surface) ; [3]
ora

(c) $Mg + 2HCl \rightarrow MgCl_2 + H_2$
formulae correct then look for balanced ;; [2]
(if balanced and 2H only mistake then allow balanced mark, ignore inclusion of correct ionic charges but incorrect charges loses formulae mark)

[Total: 10]