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

0654 CO-ORDINATED SCIENCES

0654/31 Paper 3 (Extended 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.

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1 (a) (i) hydrogen ;

   (ii) H^+ ; *allow* H_3O^+

(b) (i) acid concentration ;
temperature ;
degree of agitation ; *allow* size of test-tube   [max 2]

   (ii) time taken for gas to fill test-tube was greatest ;   [1]

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

(c) (i) $Mg + 2HCl \rightarrow MgCl_2 + H_2$;; (formulae then look for balanced)   [2]

   (ii) reference to the (granular) resin (beads) ;
magnesium <u>ions</u>, removed / stick to the resin ;
sodium / hydrogen, <u>ions</u> (detach from resin and) enter the water ;   [max 2]

[Total: 12]

2 (a) electrical energy to chemical energy ;
(also some of) electrical energy to heat ; *ignore light*   [2]

(b) less distortion ;
less interference ;   [2]

(c) (i) zero ; *ignore units*   [1]

   (ii) force = 1.2 / 0.03 ; *allow ecf from* **(i)**
= 40 N ;   [2]

rate of change of momentum slower
larger force from concrete / smaller force from carpet ;
stopping force acted / energy transferred, over a longer period of time ; [2]

[Total: 9]

3 (a) (i) X sensory (neurone) ;
        Y relay / intermediate (neurone) ; **A** association / connector (neurone)
        Z motor / effector (neurone) ;

    (ii) brain / spinal cord ; *allow suitable named parts, e.g. medulla, grey matter*   [1]

(b) any muscle ;
    jump / any other suitable response ;   [2]

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

    (ii) to produce small molecules (from large ones) ;
        so that the (small) molecules can be absorbed ;
        pass through gut wall / move into the blood ;
        so they can be used by cells ;   [2 max]

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

        [Total: 12]

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

    (ii)

(octane)	+	oxygen	→	carbon dioxide	+	water

        LHS ;
        RHS ;
        must be words – but allow one mark for completely correct balanced
        equation   [2]

(b) (i) 5 ;   [1]

    (ii) three shared pairs ;
        one non-bonding pair on both atoms ;   [2]

    (iii) very strong bond (between the atoms) ;
        much energy needed to break bond / insufficient energy to break the bond ;   [2]

(c) (i) high strength, for safety / resist breakage / because high forces on airframe in
        flight ;
        low density, to reduce weight / reduce fuel cost ;   [max 2]

    (ii) A_r of aluminium = 27 ;
        mass of aluminium = 1.73 × 27 = 46.74(g) ; *allow other methods of working*
        percentage in duralumin = (46.74 ÷ 50.00) × 100 = 93.4(2)%   [3]

        [Total: 13]

5 (a) (i) 0.47 A ;

    (ii) resistance = voltage / current ;
       = 6/0.47 = 12.8 Ω ; e.c.f.

(b) (i) magnets repel ;   [1]

    (ii) iron bar attracted to magnet ;   [1]

(c) (i) magnetic field produced by current flowing through aluminium foil ;
       this interacts with, other magnetic field / stronger magnet ;   [2]

    (ii) increase current / voltage ;
       increase magnetic field / stronger magnet ; *ignore bigger magnet*   [2]

(d) working, e.g. $N_s = N_p \times V_s / V_p = 100 \times 35000 / 240$
    = 14 583 (allow correct rounding to 2 significant figures)   [2]

                                                                         [Total: 11]

6 (a) (i) grasses / other plants → white-tailed deer → wolves ;   [1]

    (ii)
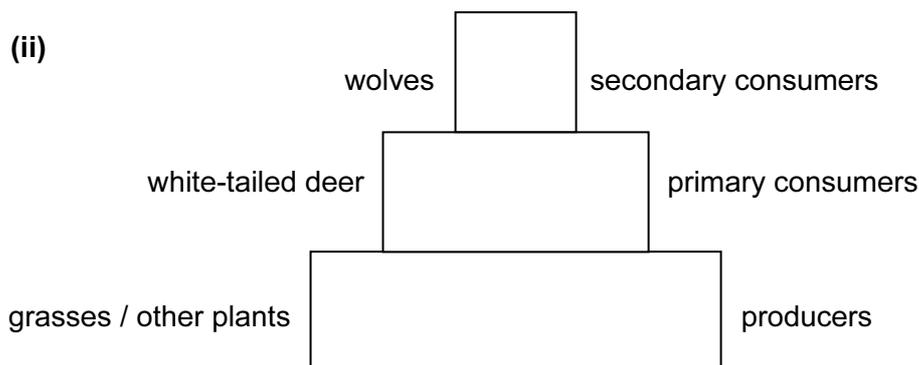
       three <u>rectangles</u> drawn as above ;
       each labelled with name of organism ;
       each labelled with name of trophic level ;   [3]

    (iii) energy lost along food chains ;
       (approx.) 90% lost / only 10% passed on ;
       less energy available for, higher trophic levels / for wolves ;   [2]

(b) (i) ref. to <u>limiting factors</u> ;
       e.g. not enough food / more disease / competition for space ;   [2]

    (ii) maintain biodiversity ;
       idea that loss of one species affects others in ecosystem ;
       ethical / moral reason / ref. tourism / scientific research ;   [2 max]

                                                                         [Total: 10]

7 **(a)** **(i)** coloured <u>compounds</u> *or* variable, valency / ion charge / oxidation state ;

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

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

   (ii) copper chloride ; *must be name, not formula*   [1]

   (iii) hydrogen ; *must be name, not formula*   [1]

   (iv) (**Y**)
   cathode gas is hydrogen ;
   so reactive metal present could be potassium ;
   bromide ions negative so go to anode ;
   bromine is orange (and would form from bromide and anode) ;   [max 2]

                                                                       [Total: 9]

8 **(a)** provides / is, energy ;
   to allow carbon dioxide to combine with water ; A to split water molecules   [2]

(b) **(i)** place leaf in boiling water ;
   place in hot alcohol (alcohol should be heated in a water bath for safety) ;
   dip in water (to soften) ;
   add iodine (solution) ;   [4]

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

(c) respire all the time ;
   during daylight, photosynthesise <u>more</u> than they respire ;
   respiration takes in oxygen and produces carbon dioxide, photosynthesis vice
   versa ;   [3]

                                                                       [Total: 11]

9 **(a)** (force =) mass × acceleration ; A weight = mass × gravity
= 9.8 × 2 = 19.6 N ;

(b) **(i)** KE = $\frac{1}{2}mv^2$;
speed is 40 m / s ;
= $\frac{1}{2}$ × 2 × 1600 = 1600 J ; [3]

(ii) distance = under graph / other suitable working ;
height = 80 m ; [2]

(c) **(i)** density = mass / volume ;
= 2000 / 700 = 2.86 g / cm^3 ; [2]

(ii) use, displacement can / measuring cylinder / graduated container ;
place object in and measure, displaced water / difference in volume ; [2]

(d) **(i)** Geiger counter / Geiger-Müller tube / any other suitable ; [1]

(ii) ionisation within cells / damages cells / kills cells / damages DNA / causes
mutation / radiation burns / cancer / radiation sickness ; [1]

[Total: 13]