UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2006 question paper

0654 CO-ORDINATED SCIENCES

0654/03   Paper 3 (Extended Theory), maximum raw mark 100

This mark scheme is published as an aid to teachers and students, 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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the report on the examination.
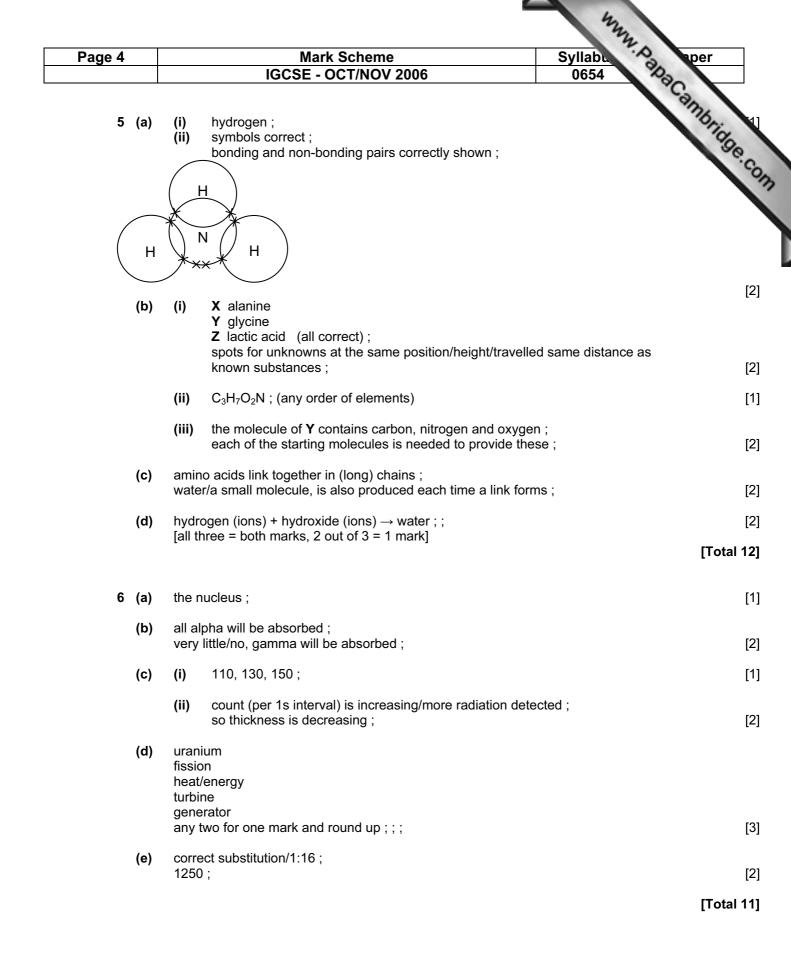
The grade thresholds for various grades are published in the report on the examination for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses.

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1 **(a)** key is made up of pairs of genuine choices ;
each choice could be made if only one organism in front of you (i.e. not just 'long beak. short beak) ;
completed in no more than four pairs ;
all birds key out correctly ;

(b) it is its Latin name ;
first word is its genus ;
second word is its species ; [2]

(c) idea that some birds might have features not possessed by others ;
birds that could begin to fly have better chance of survival ;
because they can escape predators ;
these birds most likely to reproduce ;
and pass their genes onto offspring ; [max 4]

[Total 10]

2 **(a)** <u>coal</u> <u>methane</u> ; [1]

(b) **(i)** M_r of heptane = (12 x 7) + (16 x 1) = 100 ;
moles of heptane = 684 ÷ 100 = 6.84 ; [2]

(ii) (car uses 6.84 moles of heptane)
moles of carbon dioxide = 6.84 x 7 = 47.88 ;
M_r carbon dioxide = (12 x 1) + (16 x 2) = 44 ;
mass of carbon dioxide = 47.88 x 44 = 2106.7g/2.1kg ; [3]

(iii) gasoline is not just heptane/combustion is not complete/data is only an average/actual will depend on driving conditions ; [1]

(c) **(i)** magnesium and copper ;
magnesium and copper have greatest reactivity difference ;
voltage/p.d./is greater the greater the difference in reactivity ; [3]

(ii) car battery is recharged (when engine working)/torch battery not recharged ;
chemicals in car battery are not used up/torch batteries contain chemicals which are used up ; [2]

[Total 12]

3 (a) (i) add object to known volume of water ;
             volume of water displaced/difference in volumes, is volume of object ;

        (ii) density = mass/volume ;
             0.25 kg/dm^3 ; *accept other correct units*

    (b) work = F x D ;
         = 40 000 J ;
         (4 x 10 x 1000)   [2]

    (c) electrons are transferred ;
         by friction ;
         from man/clothing, to tent ; *accept other way round*   [3]

    (d) Sun/heat, causes particles to move faster ; *not 'vibrate faster'*
         some particles will be moving faster than others ;
         fastest particles have enough energy, to escape/to overcome intermolecular forces ;
         wind carries away water particles ;   [max 3]

                                                                                  [Total 12]

4 (a) A   scapula /shoulder blade
        B   ulna
        C   humerus
        D   tendon
        any two correct for one mark ; ;   [2]

    (b) biceps relaxes ;
         triceps contracts ;
         triceps, gets shorter/pulls on **B**/pulls on ulna ;   [3]

    (c) (i) line to space within elbow joint or shoulder joint ;   [1]

        (ii) lubrication/reduce friction ;   [1]

    (d) (i) in central nervous system/in brain/in spinal cord ;   [1]

        (ii) long axon ;
             carries impulse quickly ;

             fatty sheath ;
             insulates/speeds impulse ;

             (many) dendrites/synapses, on cell body ;
             receive impulses from other neurones ;   [max 3]

                                                                                 [Total : 11]

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

(ii) symbols correct ;
bonding and non-bonding pairs correctly shown ;

[2]

(b) (i) **X** alanine
Y glycine
Z lactic acid   (all correct) ;
spots for unknowns at the same position/height/travelled same distance as
known substances ; [2]

(ii) $C_3H_7O_2N$; (any order of elements) [1]

(iii) the molecule of **Y** contains carbon, nitrogen and oxygen ;
each of the starting molecules is needed to provide these ; [2]

(c) amino acids link together in (long) chains ;
water/a small molecule, is also produced each time a link forms ; [2]

(d) hydrogen (ions) + hydroxide (ions) $\rightarrow$ water ; ; [2]
[all three = both marks, 2 out of 3 = 1 mark]

[Total 12]

6 (a) the nucleus ; [1]

(b) all alpha will be absorbed ;
very little/no, gamma will be absorbed ; [2]

(c) (i) 110, 130, 150 ; [1]

(ii) count (per 1s interval) is increasing/more radiation detected ;
so thickness is decreasing ; [2]

(d) uranium
fission
heat/energy
turbine
generator
any two for one mark and round up ; ; ; [3]

(e) correct substitution/1:16 ;
1250 ; [2]

[Total 11]

7 (a) has a cell wall ;
has a (large) vacuole ;

(b) (i) lime water ;
goes milky ;

(ii) respiration/fermentation ;
by yeast/fungus (cells) ;
glucose combining with oxygen ;   [max 2]

(c) (i) B and C ;   [1]

(ii) D and E ;   [1]

(iii) mark between 4.4 hours and 6 hours ;   [1]

(iv) (shortage of) glucose/oxygen ;   [1]

(v) add more glucose/add more oxygen ;
if number of yeast cells increases then this was a limiting factor ;
                                                                  [2]

                                                              [Total 12]

8 (a) rusting not expected in either tube ;
rusting requires, air/oxygen, <u>and</u> water (together) ;
nail in A has no water ;
nail in B has no, air/oxygen ;
                                                                  [max 3]

(b) one of the products is an alloy ;
alloys are formed by mixing molten metals ;
high temperatures required to obtain molten metals ;   [max 2]

(c) (i) Cr^{3+} ;
reference to balancing of charges e.g. 2 x 3+ and 3 x 2- ;   [2]

(ii) chromium oxide + sulphuric acid → chromium sulphate + water ;   [1]

(iii) (negative charge needed) to attract positive chromium <u>ions</u> ;   [1]

                                                               [Total 9]

9 (a) (i) R = V/I ; *do not accept symbol C for current*
= 12/2 = 6 ohms ;

(ii) energy (per second) = V x I ; *accept other correct and appropriate formulae*
= 24 J (/sec) ;

(iii) 4A ; [1]

(b) (i) straight line ; [1]

(ii) filament resistance <u>increases</u> with temperature ;
so smaller increase in current per added volt ; [2]

(c) (i) in correct position to control motor and other switches ; [1]

(ii) **X** has highest speed and **Z** lowest speed ;
explanation of either in terms of resistors/resistance ; [2]

[Total 11]