UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2007 question paper

0654 CO-ORDINATED SCIENCE

0654/03 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.

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1 **(a)** **A**;
least / less, voltage required (to pass current of 0.4A);

(b) R = V / I ;
= 0.3/0.4; = 0.75 Ω; [2]

(c) **(i)** Power = V × I;
= 6.2 × 0.4 = 2.48 W; [2]

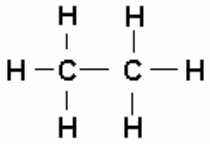
(ii) **C** gets hottest because most power is dissipated; [1]

(d) charge = current × time;
= 0.4 x 60 = 24 C; [2]

2 **(a)** **(i)** fractional distillation / fractionation ; [1]

(ii) cool and pressurise; [1]

(iii) two carbons and six hydrogens;



; *allow ecf if three carbons and eight hydrogens* [2]

(b) **(i)** so it does not melt / change shape during cooking / heating; [1]

(ii) polymer molecules are (long) chains;
in thermosets there are, strong bonds / crosslinks between, chains / molecules;
polymer molecules cannot move past each other (when heated) / diagram;
in thermoplastics there are only weak forces between, chains / molecules;
polymer molecules can move past each other (when heated) ; [max 4]

(c) **(i)** same sized atoms in a regular lattice; [1]

(ii) reference to, sideways / distorting / suitable force (causing layers to slip) ;
reference to, layers / atoms, slipping (without material breaking) ; [2]

3 **(a)** +3.8 kg and -1.4 kg
one mark for figures + unit ;
one mark for indicating (increase and) decrease ;

(b) cows with highest yield chosen ; *ignore references to genes*
and used for breeding ;
with bull whose, relatives / mother / sisters / daughter, had high milk yield ;
repeat in subsequent generations ; [4]

(c) *any reasonable suggestion, for example*
cows with high milk yield are, less successful at breeding / less healthy ; [1]

(d) **(i)** idea that selected line are less healthy because they have higher milk yields ;
producing a lot of milk puts a strain on the cow ;
more milk in / larger, udder makes it more likely it will be inflamed ;
more milk carried / more mass, puts more strain on the legs ;
idea that they have not been selected for health / may by chance
be genes for poor health in this group of cows ; [max 2]

(ii) more food needed ;
to provide, energy / materials, for making milk ; [2]

4 **(a)** **(i)** speed = distance/time;
= 320/20 = 16 m/s; [2]

(ii) KE = ½ mv^2;
momentum = m x v;
KE depends on velocity squared so × 4; [3]

(b) **(i)** current = power/voltage;
= 60/12 = 5 A; [2]

(ii) 60 ; [1]

5 **(a)** **(i)** nitrogen is too unreactive / bond in nitrogen molecule very strong;

(ii) (atmospheric) nitrogen converted into a nitrogen compound;

(iii) three shared pairs;
lone pairs on both atoms; [2]

(b) **(i)** $N_2 + 3H_2 \rightarrow 2\,NH_3$; [1]

(ii) two from: nitrogen/hydrogen/ammonia/named noble gas; [1]

(iii) reference to large surface area (increasing efficiency); [1]

(c) $(NH_4)_2SO_4$;
ref. to need for charges to be balanced; [2]

6 **(a)** label correct ; [1]

(b) **(i)** (male) nucleus / (male) gamete ; [1]

(ii) fertilisation ;
nucleus / male gametes, fuses with, egg cell (nucleus) / female gamete ;
to form a zygote ;
which develops into an embryo ;
ovule develops into a seed ; [max 3]

(c) sexual because it involves, gametes / fertilisation / zygote ; [1]

(d) anthers hang outside flower ;
stigma hangs outside flower ;
stigma is feathery ;
no petals / petals dull ;
no nectar ;
no scent ; [max 2]

(e) drawing shows a fruit with features that would favour dispersal by animals (e.g. hooks, edible flesh) ;
labels indicate how the fruit would be dispersed (e.g. stick to fur, flesh eaten) ;
detail of dispersal (e.g. drops off fur, seeds egested) ; [3]

7 **(a)** **(i)** an element which has atoms/nuclei containing the same number of protons b[ut] numbers of neutrons;

(ii) has shorter half-life / decays faster ;
therefore less radiation emitted / radioactive for a shorter time ;

no beta emission;
beta is more ionising / dangerous ; [4]

(b) proton number = 93;
nucleon number = 237; [2]

8 **(a)** palisade (mesophyll) ; [1]

(b) chloroplasts ;
contain chlorophyll ;
absorb (sun)light (energy) ; [max 2]

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

(ii) **A** more dilute than **B**, which is more dilute than **C** ;
water moves, from high <u>water</u> concentration to low / from low concentration to high; [2]

(d) **(i)** in xylem ;
through veins in leaf ;
ref. to idea of transpiration pull ; [max 2]

(ii) it would increase ;
because transpiration rate greater ;
because evaporation is faster / rate of diffusion is faster ; [max 2]

(e) turgor / cells push outwards on one another ;
xylem / lignin (provide strength) ; [2]

9 **(a)** **(i)** (transverse)
wave motion is at right angles to direction of movement of medium;

(ii) $v = f \times \lambda$;
$(\lambda = v/f) = 0.5 / 2 = 0.25$ m; [2]

(b) $E = m \times c \times \theta$;
$= 60000 \times 4200 \times 5 = 1\,260\,000\,000$ J [2]

(c) some molecules move faster than others / have more energy than others ;
fast particles / particles with enough energy, can escape;
overcome forces of attraction ; [2]

(d) straight line leaving the liquid to right of normal ;
bending away from normal; [2]

10 **(a)** **(i)** **A**;
carbon dioxide produced;
colourless solution / magnesium not a transition metal; [2 max]

(ii) **C**;
blue solution formed / copper solutions can be blue;
no gas / oxides do not produce gas with acid; [2 max]

(b) **(i)** limestone contains calcium carbonate ;
limestone / calcium carbonate, reacts with (sulphuric) acid ;
neutralises the acid;
igneous rock not able to neutralise the acid; [max 2]

(ii) total moles of acid = 10 000 000 × 0.01 *or* 100 000;
M_r of sulphuric acid = [(2 × 1) + (32 × 1) + (16 × 4)] = 98;
mass of sulphuric acid = 100 000 × 98 = 9 800 000g / 9.8 tonnes; [3]

(c) grease (is molecular and) does not mix with water;
detergent molecule allows grease and water to mix / ref to emulsion ;
ionic part / hydrophilic head, dissolves in / attaches to, water molecules;
covalent part / hydrophobic tail, dissolves in / attracted to, grease; [max 3]