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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

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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]

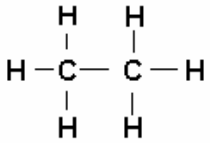
(ii) **C** gets hottest because most power is dissipated; [1]

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

2 **(a)** **(i)** <u>fractional distillation</u> / 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]

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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]

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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]

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

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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 × 4200 × 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]