UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2007 question paper

0654 CO-ORDINATED SCIENCES

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

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UNIVERSITY of CAMBRIDGE
International Examinations

1 (a) (i) (intercostal muscles) shorter / contracted;
(diaphragm) gone downwards / flattened / contracted ; [2]

(ii) ribs pulled up and out;
volume in thorax increased;
pressure reduced;
air moves, down pressure gradient / from higher pressure outside body; [max 3]

(b) goblet cells make mucus;
mucus traps, bacteria / viruses / particles;
cilia sweep them upwards; [max 2]

(c) (i) goblet cells make more mucus;
cilia, stop working / paralysed / destroyed ; [2]

(ii) walls break down ;
fewer / larger, alveoli ;
walls become thicker / tar deposited ; [max 2]

2 (a) (i) they contain different numbers of protons and neutrons; [1]

(ii) atoms have filled electron shells / outer shell is full; [1]

(iii) if they were then properties would not match other members of group / order had to be changed to preserve the pattern in properties / potassium would be in group 0 and argon in group 1 ; [1]

(b) (i) 0.96 ÷ 24 / 0.04; [1]

(ii) 0.5 mol in 1000 cm^3 so 0.05 in 100 cm^3 / 0.05; [1]

(iii) use of equation 1 mol Mg requires 2 mol HC*l* / 2 × 0.04 mol HC*l* needed ;
calculation plus logical conclusion ; [max 2]

(c) (i) (anode)
fluorine is a non-metal ;
anode is positive;
attractive force between positive anode and negative fluoride ions; [max 2]

(ii) fluorine is very reactive / most reactive halogen / very corrosive and reacted with body tissue / reacted with airway if breathed in / poisonous / toxic ; [1]

(iii) gold and platinum are very unreactive / reduces chance of reacting with fluorine;
low temperature reduces rate of reaction (between fluorine and container) ; [2]

3 **(a)** **(i)** work = force × distance ;
distance travelled = 20 × 30 = 600m / use of 600 in correct context ;
(800 × 600) 480 000J ; [3]

(ii) kinetic energy = ½ mv^2;
= ½ × 1200 × 20 × 20 = 240 000 J; [2]

(b) **(i)** deceleration = change in speed / time;
= 20/4 = 5 m/s^2; [2]

(ii) reaction distance = 24m; (or working)
braking distance = 40m; (or working)
total distance = 64m; [3]

4 **(a)** change in, genes / chromosomes / DNA; [1]

(b) **(i)** it increases;
more steeply at higher X-ray doses; [2]

(ii) ionising radiation;
removes electrons / damages DNA; [2]

(c) 7; [1]

(d) if in body cell, only one of many cells / other cells can carry out that function;
if in gamete-forming cells, can be passed on to offspring;
all cells in offspring have that mutation; [max 2]

(e) **(i)** pesticides can damage other organisms / humans;
so food chain disrupted;
insect pollinators killed;
pest's predators killed;
pests develop resistance to pesticide; [max 2]

(ii) X-rayed males may, be infertile / have one less chromosome / have mutated sperms;
their offspring may, be weak / die;
normal males produce fewer offspring (because of competition for mates with X-rayed males) ; [max 2]

5 **(a)** **(i)** 24; [1]

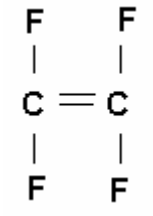
(ii) starch is a polymer / long chain molecule;
of unspecified / unknown length / whose length can vary / cannot (with certainty) tell how many atoms are in a starch molecule; [2]

(b) **(i)** test shows glucose present (inside tube);
glucose molecules have passed through the membrane;

colour results from (inter)action between starch and iodine;
shows iodine has moved through the membrane; [4]

(ii) (should not be blue-black)
starch does not pass through the membrane;
because starch molecules too large / membrane allows only small molecules to pass; [2]

(c) **(i)** double bond between carbons ;
all else correct ;



[2]

(ii) **A** was thermoplastic and **B** was thermosetting;
only weak forces between molecules in **A**;
strong cross-links / chemical bonds between molecules in **B**; [3]
(diagrams can gain marks)

6 **(a)** 0.5 (A) ; [1]

(b) $1/R = 1/R_1 + 1/R_2$;
$= 1/60 + 1/40$;
$R = 24\Omega$; [3]

(c) **(i)** current is induced;
when coil is in changing magnetic field; [2]

(ii) energy input / motion;
coil rotated (on axis); OR magnet rotated ;
in magnetic field; OR in coil ;
coil connected to split ring commutator;
effect of split ring; [max 4]

7 **(a)** one oak tree can, support / feed, many caterpillars ;
one small bird needs to eat many caterpillars / one hawk needs to eat many small birds;
loss of energy between levels;
less biomass at each level; [max 2]

(b) photosynthesis;
chlorophyll traps energy in sunlight;
carbon dioxide reacts with water;
produces, sugars / glucose / starch / carbohydrates;
contain, chemical energy / stored energy;
(energy) passes along chain as food is eaten; [max 4]

(c) water enters roots by osmosis;
transpiration (from leaves);
reduces pressure;
water moves up xylem;
down pressure gradient; [max 3]

8 **(a)** filtration;
sedimentation / treatment with aluminium sulphate;
boiling / sterilisation / treatment with chlorine / ozone; [max 2]

(b) **(i)** Ca^{2+}; [1]

(ii) boiling reduces hardness / not all hardness reduced by boiling ;
water contains both permanent and temporary hardness;
water contains calcium hydrogencarbonate; [max 2]

(c) **(i)** potassium correctly shown as 2.8.8;
chloride correctly shown as 2.8.8; [2]

(ii) particles, are (electrically) charged / are positive and negative ions;
which attract each other strongly;
ions form into a giant ionic structure;
much energy needed to separate the particles (during melting); [max 2]

9 **(a)** **(i)** vibrations / compressions and rarefactions;
of air molecules; [2]

(ii) louder; [1]

(iii) within 5000– 20 000Hz; [1]

(b) **(i)** speed (in vacuo) / transverse waves/can travel through a vacuum; [1]

(ii) wavelength / frequency; [1]

(iii) $v = f \times \lambda$;
= 10 000 000 x 30 = 300 000 000 m/s; [2]

(c) **(i)** particles collide, more frequently / more forcefully ;
with, tyre / wall; [max 2]

(ii) P1/T1 = P2/T2;
P2 = 200 000 × 303/283 ;
= 214 130 N/m^2; [3]