UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2006 question paper

0654 CO-ORDINATED SCIENCES

0654/03 Paper 3, maximum raw mark 100

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

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 minimum marks in these components needed for various grades were previously published with these mark schemes, but are now instead included in the Report on the Examination for this session.

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1 **(a)** defence against (infectious) disease ;
action of phagocytes described ;
action of antibodies described ; [2 max]

(b) muscles ;
contract ;
increase pressure / reduce volume ;
of ventricles ; [2 max]

(c) (arteries have) thicker wall ;
because blood is at high(er) pressure ;
stop them bursting ;

more elastic wall ;
able to expand / recoil ;
ref. to pulse / heart beat ;

small lumen;
maintains high pressure ;
so blood moves through faster ;

accept converse if referring to veins [3 max]

(d) transpiration ;
pulls water up ;
ref. pressure gradient / water potential gradient ;
transpiration happens faster on hot day ; [3 max]

[Total: 10]

2 (a) (i) (B)
water is neutral / has pH = 7; [1]

(ii) (A)
(sodium) hydroxide / alkali (produces the green precipitate);
pH 14 is alkaline; [2]

(iii) (C)
this means it is an acid and pH 1 is (strongest) acid; [1]

(b) (i) reaction is exothermic / gives out heat (energy); [1]

(ii) reaction is complete / finished / no more alkali;
so no more heat given out / cold acid cools the mixture; [2]

(iii) dissolved moles = volume (in dm^3) x concentration (in mol / dm^3);
dissolved moles = (15.0 ÷ 1000) x 0.5; [2]
(= 0.0075 moles)

(iv) reference to the 1:1 ratio HCl : KOH;
expression for moles of KOH e.g. (25.0 ÷ 1000) x C;
0.025 x C = 0.0075;
C = **0.3**;(mol / dm^3) [3 max]
(if volumes in cm^3 consistently not divided by 1000 then will still get 0.3 and could be worth all the marks i.e. ecf from (iii))

(v) $H^+ + OH^- \rightarrow H_2O$; [1]
(also $H_3O^+ + OH^- \rightarrow 2\ H_2O$)

[Total: 13]

3 (a) (i) (both release) energy generated from within atoms/ involve nuclei;

(ii) fission - atoms/ nuclei split and fusion - atoms join; [1]

(iii) uncontrolled chain reaction;
explosion;
release of radioactive materials;
radiation can harm, humans/animals;
detail – e.g. radiation burns / mutation / cancer;

radioactive waste produced;
problem of safe disposal;
remains radioactive for (very) long time;
radiation can harm, humans/animals;
detail – e.g. radiation burns / mutation / cancer;

[3]

(b) (i) high voltage means low current;
this reduces energy losses; [2]

(ii) 100 turns; [1]

(iii) alternating current in primary, causes alternating / changing magnetic field;
this produces alternating magnetic field around secondary;
this induces current in secondary; [3]

[Total: 11]

4 **(a)** hair / fur ;

(b) **(i)** nucleus ; [1]

(ii) all ; [1]

(c) sheep with largest horns killed ;
they do not reproduce ;
they do not pass their genes onto offspring ;
next generation has smaller horns ;
or all vice versa for those with short horns [4]

(d) **(i)** secrete sweat which evaporates ;
water in the sweat evaporates ;
explanation of cooling effect / latent heat of evaporation ; [2 max]

(ii) arterioles constrict ;
near skin surface ;
less blood carried close to surface ;
blood flows beneath, insulating layer / fat / adipose tissue ;
less heat lost by radiation ; [3 max]

[Total: 12]

5 **(a)** **(i)** series of, pulses / on offs;

(ii) less distortion/ need amplification less often; [1]

(b) OR;
NOT; [2]

(c) **(i)** rays of light brought to a focus;
on the principal axis;
at 10cm; [3]

(ii) red, green & blue; [1]

(iii) wavelength/frequency; [1]

[Total: 9]

6 **(a)** glass;
ceramics;
plastics; [3]

(b) silicon(IV) oxide is a giant structure;
in order to melt (many) strong bonds must be broken / much heat energy is required; [2]

(marks may come from labelled diagram which needs to show the idea of a giant structure even if not exactly SiO_2)

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

(ii) $C_2H_4 + H_2O \rightarrow C_2H_6O$; [1]

(iii) shake mixture with bromine / potassium manganate(VII);
unsaturation shown by orange to colourless / purple to colourless; [2]

(iv) <u>fractional distillation</u>; [1]

[Total: 10]

7 **(a)** **(i)** (airplane B)
no velocity / not moving; [1]

(ii) (airplane C)
velocity is increasing so momentum increases; [1]

(b) area under graph or working;
15 000 m; [2]

(c) KE = 1/2 mv^2;
= 0.5 x 120 000 x 100 x 100
= 600 MJ; [3]

[Total: 7]

8 **(a)** from sunlight ;
photosynthesis ;
light energy trapped by chlorophyll ;
transferred to, carbohydrate / sugar / glucose / starch ; [3 max]

(b) **(i)** the mass of living organisms ; [1]

(ii) C in the top two rectangles ; [1]

(iii) energy losses along food chain ;
less energy to support organisms at higher levels ; [2]

(c) to kill organisms that are, harming / eating, crops ;
increase yield ; [2]

(d) problem stated and food type involved ;
explanation related to specific health issue ;
detail ; [3]

[Total: 12]

9 (a) (i) potassium;

(ii) nitrogen / N and phosphorus / P;
same group / both in Group 5 / correct reference to electron configuration details; [2]

(b) (i) nitrogen and hydrogen; [1]

(ii) (symbols shown e.g. in centres of circles)
three shared pairs of electrons shown correctly;
lone pair shown on nitrogen; [2]
(if symbols not shown e.g. in centres of circles then 1 max)

(iii) PO_4^{3-};
total charge on three NH_4^+ ions has to be balanced so 3 negative charges required on phosphate; [2]

(iv) molecules have greater kinetic energy / are moving faster;
(at high temperature) collisions happen more often;
more of the collisions result in reaction / exceed activation energy; [2 max]

[Total: 10]

10 **(a)** gases expand when heated;
particles moving faster; hit tyre wall with greater force / more often; [2 max]

(b) large area means smaller pressure;
pressure = $\frac{\text{force}}{\text{area}}$;
stops skier sinking into snow; [2 max]

(c) earthquakes produce waves;
these are able to travel through the Earth's crust; [2]

[Total: 6]