UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2010 question paper

for the guidance of teachers

0654 CO-ORDINATED SCIENCES

0654/33   Paper 3 (Extended Theory), maximum raw mark 100

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International Examinations

1 (a) (i) reactants used up / no more chemical reaction possible ; [1]

(ii) car batteries are (re)chargeable / (re)charged by car engine ; [1]

(b) (i) it is a conductor / contains or provides electrolyte ; [1]

(ii) magnesium and copper ;
the higher the difference in reactivity the higher the voltage ; [2]

(c) (i) $11O_2$;; (formula and balanced) [2]

(ii) reference to one specified pollutant e.g. CO, CO_2, NO_x, SO_2, O_3, particulates, smog ;
effect of specific pollutant ;
no pollutants produced when normal engine switched off / electric motors do not pollute ;
more slow-moving traffic in towns so normal engine more likely to be switched off / owtte ; [3]

[Total: 10]

2 (a) (i) **A** chloroplast ; (accept nucleus)
B cell wall ; (accept cell membrane) [2]

(ii) have cell walls / **B** ;
have chloroplasts / **A** ;
(accept) have large vacuoles ; [max 2]

(b) (i) more leaves / more surface area, on **Q** ;
more transpiration / more water lost from leaves ;
so more water taken up (into the plant stem) ; [3]

(ii) water level would go down faster ;
(higher temperature) increases rate of transpiration ;
because faster diffusion / faster rate of evaporation ;
because higher kinetic energy of water molecules ; [max 3]

[Total: 10]

3 **(a)** **(i)** radioactive decay: breakdown of an unstable nucleus ;
half-life: time taken for half of (mass of) an isotope to decay / time taken for,
count rate / radioactivity, to halve ;   [2]

(ii) 4 half lives ;
so 4 × 105 seconds = 420 seconds / 7 minutes ;   [2]

(b) 1. use ;
2. description of effect of radiation;

e.g. cancer treatment ;
radiation destroys cancerous cells ;

e.g. tracers ;
radioactive substance can be followed around body ;   [2]

[Total: 6]

4 **(a)** **(i)** differences between individuals ;
distinct categories / words to that effect ;   [2]

(ii) genes alone ;
environment tends to give continuous variation ;
ref. to allele frequency / ref. to different blood groups in same environment /
other good detail;   [max 2]

(b) **(i)** any suitable ; (almost anything except age, sex and blood groups)   [1]

(ii) *y*-axis labelled, number / percentage / frequency, of people ;
x-axis labelled with name of feature and arrow on axis or scale with numbers ;
curve / histogram, drawn showing approximately normal distribution ;   [3]

(c) ref. to selection pressure / named agent of selection ;
idea that individuals with a particular variation more likely to survive ;
so (individuals with this variation) more likely to reproduce ;
genes / alleles, causing this variation more likely to be passed on to offspring ;
so this variation becomes more common, in successive generations / over time ;   [4]

[Total: 12]

5 (a) A_2 0.30 (A) and A_3 0.30 (A) ;
V_1 6 (V) and V_2 6 (V) ;   [2]

(b) (i) V/I ;
= 1 / 0.6 = 1.67 Ω ;
accept calculation from gradient   [2]

(ii) current is not proportional to voltage ;
the lamp gets hot / its resistance changes ;   [2]

(iii) a straight line through origin with positive gradient ;   [1]

(c) lamp does not light / flashes once ;
lamp lights ;
(somewhere –) a.c. needed for transformer to work ;   [3]

[Total: 10]

6 (a) (i) (**P**)
full outer shell ;   [1]

(ii) (**Q**)
metal because, it is a conductor / has 2e⁻ in outer shell / is in group 2 ;
liquid because melting point below 20 °C (but boiling point above 20 °C) ;
OR
(**S**)
metal because it is a conductor / has 1e⁻ in outer shell / is in group 1 ;
OR
(**R**)
liquid because melting point below 20 °C (but boiling point above 20 °C) ;   [2]

(iii) (**T**)
R is liquid but **T** is solid at room temperature / **T** has higher melting point and
boiling point / **T** is less volatile / vice versa ;
shows that **T** is below **R** in Group 7 / **T** from higher period number / has larger
atoms / vice versa ;   [2]

(b) (i) outer electron lost from **S** and transferred to outer shell of **R** ;
S is now a positive ion and **R** is a negative ion ;
ions (of opposite charge) attract / bond ;   [max 2]

(ii) compound has a giant (ionic) / lattice structure ;
strong, forces (of attraction) between ions / ionic bonds;
very many ions so very many bonds to be broken ;
much, energy / heat, needed to, separate ions / break the structure / overcome
forces ;   [max 3]

(c) electrolysis ;
potassium is a very reactive metal ;   [2]

[Total: 12]

7 **(a)** (distance covered in one minute =) 18 × 60 = 1080 m ;
(work = **F** × **d** =) 1000 × 1080 = 1 080 000 J ; ecf [2]

(b) **(i)** force = mass × acceleration / (acceleration =) force / mass ;
acceleration = 10 000 / 1200 = 8.3 m / s^2 ; [2]

(ii) acceleration = (change in) speed / time ;
time = 18/8.3 = 2.17 s ; ecf [or 2.2 s, A 2.16 s] [2]

(c) **(i)** 0.12 m^2 ; [1]

(ii) (pressure = force / area =) 18000 / 0.12 = 150 000 N / m^2 / Pa ; ecf [1]

(iii) (force =) 150 000 × 0.01 = 1 500 N ; ecf [1]

[Total: 9]

8 **(a)** **A** to intercostal muscle or diaphragm ;
B to somewhere within a lung (not bronchus or bronchiole) ;
C to diaphragm ; [3]

(b) leaves from right ventricle and returns to left atrium ;
from heart to lungs in pulmonary artery ;
through capillaries in lungs ;
from lungs to heart in pulmonary vein ; [3 max]

(c) in red blood cells ;
as oxyhaemoglobin / combined with haemoglobin ; [2]

(d) from mother's blood ;
by diffusion ;
through the placenta ;
to fetus, in umbilical cord / through umbilical vein ; [max 3]

[Total: 11]

9 **(a) (i)** (atmospheric) nitrogen converted into, nitrogen compounds / nitrate / ammonium / ammonia ; [1 point]
(nitrogen fixing) bacteria ;
in soil / on root nodules ;
OR
atmospheric nitrogen combines with oxygen / nitrogen oxides form ;
in thunderstorms / (using energy) from lightning ;
OR
nitrogen combines with hydrogen / converted to ammonia ;
in industry / in Haber Process ;   [max 3]

(ii) nitrogen too unreactive / too much energy needed to break bonds in nitrogen
molecules ;   [1]

(b) (i) 0.05 ;   [1]

(ii) states that mass = moles × molar mass / 0.05 × 132 ;
6.6 g ; (unit required)   [2]

(c) (i) glucose molecules join together / reference to glucose being a monomer ;
to form long chains / to form a polymer ;   [2]

(ii) solution is, transparent / see-through ;
starch solution is, not transparent / translucent / cloudy ;
light (rays) not, scattered / deviated, by the solution / are scattered by the
solution ;   [3]

[Total: 12]

10 (a) (kinetic energy =) $\frac{1}{2}$ mv^2 ;
= $\frac{1}{2}$ × 70 × 10 × 10 ;
= 3500 J ;   [3]

(b) (i) energy needed to turn liquid into gas ;
particles need to separate / overcome forces between them ;
energy / heat, gained from, surroundings / skin / body ;   [max 2]

(ii) shiny foil traps layer of air around body, stops convection ;
air is a good insulator / poor conductor ;
shiny foil is a poor radiator of heat ;
shiny foil reflects radiation back ;
heat can still escape by conduction ;   [max 3]

[Total: 8]