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

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, which would have considered the acceptability of alternative answers.

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

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

(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 ;

(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)** $\mathbf{A_2}$ 0.30 (A) and $\mathbf{A_3}$ 0.30 (A) ;
$\mathbf{V_1}$ 6 (V) and $\mathbf{V_2}$ 6 (V) ;

(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

(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 =) ½ mv^2 ;
= ½ × 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]