UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2012 question paper

for the guidance of teachers

0654 CO-ORDINATED SCIENCES

0654/31 Paper 3 (Extended Theory), maximum raw mark 120

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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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Cambridge is publishing the mark schemes for the May/June 2012 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

1 (a) (i) (KE =) ½ mv^2 ;
= ½ × 30 000 × 0.5 × 0.5 = 3750 J ;

(ii) (work done =) force × distance
= 1 000 000 × 1000= 1 000 000 000 J ; [2]

(iii) (power =) work / time ;
= 1 000 000 000 / 300 = 3 300 000 W ; [2]

(b) (i) 300 J **AND** all potential energy will be converted into kinetic energy / energy is conserved ; [1]

(ii) (temperature change =) energy / mass × shc ;
= 300 / 1 × 4200 ;
= 0.07 °C ; [3]

[Total: 10]

2 (a) (i) three shared pairs ;
one lone pair on both atoms ; [2]

(ii) two shells showing 2,8 configuration ; [1]

(iii) reference to positive protons and negative electrons ;
reference to 7 protons and 10 electrons / 3 more electrons than protons ; [2]

(iv) Mg_3N_2 ;
working / statement to show need for charge balance ; [2]

(b) (i) chlorine ; [1]

(ii) hydrogen ;
pops on ignition ; [2]

[Total: 10]

3 **(a)** label to root hair cell ;

(b) **(i)** osmosis ;
water moves down water potential gradient ;
through partially permeable cell membrane ; [max 2]

(ii) absorb, minerals / ions / named ion / salts ; [1]

(iii) large surface area ;
so more, (water / ions), can be absorbed (at the same time) ;
contain, cell sap / cytoplasm, that is more concentrated than water ; [max 2]

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

(ii) **A** in central area of root ; [1]

(iii) idea that red dye has mixed with water, not combined with it ;
idea that water molecules and dye molecules behave separately ;
(only) water evaporates / dye does not evaporate ;
other valid point ; [max 2]

[Total: 10]

4 **(a)** **(i)** *frequency* – number of waves produced / passing a point per second ;
wavelength – distance between, two consecutive peaks / troughs ; [2]

(ii) $(v =) f \times \lambda$;
$212\,000 \times 0.0016 = 339.2$ m / s ; [2]

(iii) *compression* – region of high pressure / lots of air particles ;
rarefaction – region of low pressure / fewer air particles ; [2]

(b) **(i)** normal drawn ;
angle of incidence labelled **AND** angle of refraction labelled ; [2]

(ii) angle of reflection drawn and labelled ; [1]

(iii) optical fibres / reflectors / periscopes ;
use described ; [2]

[Total: 11]

5 **(a)** respiration ;
glucose / carbohydrate ;
combined with oxygen / oxidised ;
energy released / heat produced ; [max

(b) **(i)** eat a lot ;
eat more / take in more energy, than they use ;
excess, carbohydrate / protein, converted to fat ; [max 2]

(ii) the greater the body mass, the greater the chance of survival ;
idea that effect is greater at lower body masses / levels off at higher body masses ;
use of figures ; [max 2]

(iii) poor conductor / insulator ; [1]

(c) addition of carbon dioxide to the atmosphere ;
deforestation + explanation ;
addition of methane to the atmosphere ;
one named source of methane, e.g. paddy field, cattle ;
idea that (long wave) radiation is trapped by greenhouse gases ; [max 3]

(d) **(i)** (mean body) mass is increasing ; [1]

(ii) marmots have more time to feed (from spring onwards) ;
marmots lose less weight during hibernation (as winters are shorter) ;
more food available earlier ; [max 1]

[Total: 13]

6 **(a)** temperature and surface area of magnesium ; [1]

(b) **(i)** (**B**)
higher concentration shown by higher rate / higher rate shown by steeper graph ; [1]

(ii) (maximum volume of gas is) 40 cm^3 **AND** (time of reaction is) 4.9 ± 0.1 minutes ;
average rate = 40 ÷ 4.9 = 8.2 / 8.0 to 8.3 ;
units: [cm^3 / minute] / [cm^3 / second] if consistent with calculation ; [3]

(c) **(i)** aqueous (solution) / dissolved in water / in solution ; [1]

(ii) A_r Mg = 24 ;
moles Mg = 6 ÷ 24 / 0.25 ; [2]

[Total: 8]

7 **(a)** split ;

(b) **(i)** electron ; [

(ii) 51 neutrons ;
39 protons ; [2]

(iii) ionisation occurs ;
electron(s) lost ; [2]

(c) **(i)** 47 ± 1 cps ; [1]

(ii) **Z** ; [1]

[Total: 8]

8 **(a)** **(i)** **P** Group 1 **Q** Group 0 **R** Group 7 ;
outer electrons determine group number / answer based on identifying the elements and looking up on PT ; [2]

(ii) (**Q**)
it is a noble gas / references to full shells ; [1]

(iii) (**P**)
it is a metal ; [1]

(b) **(i)** limestone / calcium carbonate ;
forms slag / removes impurities / removes silicon dioxide ; [2]

(ii) iron oxide + carbon monoxide → iron + carbon dioxide ;; [2]
[LHS + RHS]

(c) **(i)** question withdrawn [2]

(ii) zinc more reactive than <u>iron</u> ;
so zinc reacts (with water / oxygen) before / instead of <u>iron</u> ;
so zinc corrodes leaving the iron / steel unaffected / owtte ; [max 2]

[Total: 12]

9 **(a)** chemical ;
produced by a gland ;
carried by the blood ;
affects (specific) target organs ;
destroyed by the liver ; [max 3]

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

(ii) liver ;
removes glucose from the blood / changes glucose to glycogen ; [2]

(c) increases blood glucose concentration ;
more energy (for muscles) / more fuel for respiration (in muscles) ;
increases pulse rate / makes heart beat faster ;
more, oxygen / glucose, delivered to (muscles) ;
[max 3 if muscles not mentioned] [4]

[Total: 10]

10 **(a)** **(i)** ammeter in series ;
voltmeter in parallel ;
means of varying p.d. ;
[max 2 if not a usable circuit] [3]

(ii) (R =) V / I ;
= 3 / 0.3 = 10 Ω ; [2]

(b) **(i)** **D** because it is longer / resistance proportional to length ; [1]

(ii) **A** because it has a small cross-section area / it is thinner / resistance inversely proportional to cross-section area ; [1]

(iii) **C** – 20 Ω and twice as long ;
E – 5 Ω and double cross-section area ; [2]

[Total: 9]

11 (a) produces four cells, not two cells ;
produces genetic variation ;
halves chromosome number / number of chromosomes in new cells is haploid / new cells have half the DNA ; [max

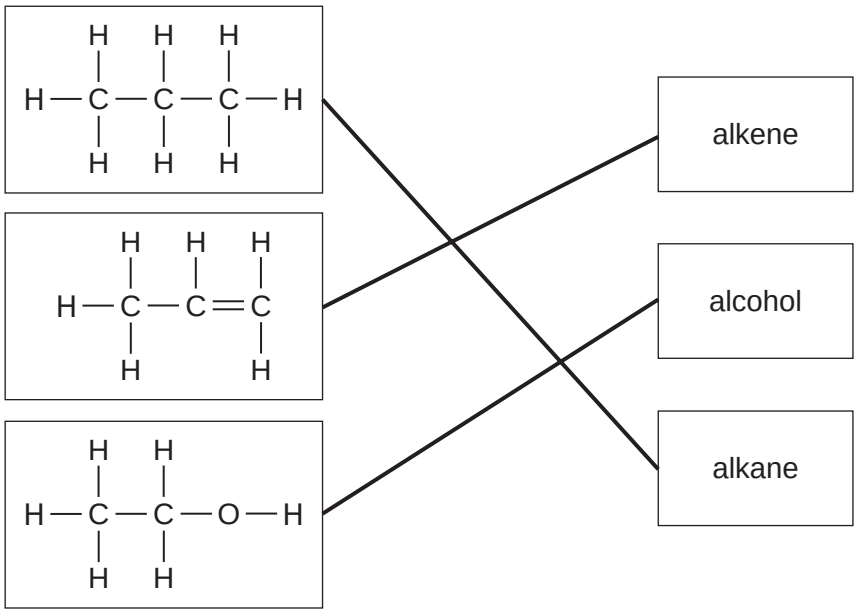
(b) (i) 1 in 4 / one quarter / 0.25 ; [1]

(ii) (parents' genotypes) both **Ff** ;
gametes **F** and **f** from both parents ;
offspring genotypes **FF**, **Ff**, **Ff** and **ff** ;
ff identified as having cystic fibrosis ; [4]

(c) idea of greater distance between alveoli and, blood / red cell / capillary ;
reference to diffusion ;
will take longer for, gases / oxygen / carbon dioxide, to travel across ; [max 2]

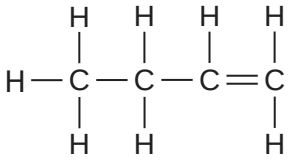
[Total: 9]

12 (a) (i)



(all correct = 2 one correct = 1) ;; [2]

(ii)



(double bond could be in middle) ;;
[credit cyclobutane with both marks] [2]

(b) idea that electricity comes from, power station / burning fuel ;
where greenhouse gases / carbon dioxide may still have to be produced / owtte ; [2]

(c) (i) heated ;
mixed / reacted with water ;
requires catalyst ; [3]

(ii) solvent / in foods / sterilisation ; [1]

[Total: 10]