CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0654 CO-ORDINATED SCIENCES

0654/32 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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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1 **(a)** Group 1 elements all metals **and** Group 7 elements all non-metals ;
Group 4 elements non-metals at top and metals at bottom / contain both types of element ; [2]

(b) as electrode e.g. in dry cell or electrolysis ;
because graphite is an electrical conductor ;
OR
as a lubricant ;
layers of carbon atoms easily slide / move past each other ; [max 2]

(c) **(i)** $PbO + H_2 \longrightarrow Pb + H_2O$;;
(LHS ; RHS ;) [2]

(ii) calcium has a high reactivity / too reactive ;
(calcium reactivity) greater than hydrogen / hydrogen cannot displace Ca ;
calcium too strongly bonded to oxygen ; [max 2]

[Total: 8]

2 **(a)** **(i)** (W =) F × D **or** F × d **or** F × s ;
= 1400 × 10 = 14 000 J ; [2]

(ii) (KE =) ½ mv^2;
= ½ × 5000 × 1.5 × 1.5 = 5625 J ; [2]

(b) (pressure =) force / area **or** F/A ;
= 50000 / 0.8 = 62500 N / m^2 ; [2]

(c) (density =) mass / volume **or** m/v ;
= 5000 / 5 = 1000 kg / m^3 ; [2]

[Total 8]

3 **(a)** (thread of) DNA ;
(contains) genes ; [2]

(b) four / 4 ;
two / 2 ; [2]

(c) produces (genetically) identical cells ;
for growth (**not** growth of cells) ;
for repair (**not** repair of cells) ;
for replacement of cells ; [max 2]

(d) (i) **HH** = no horns
Hh = no horns
hh = horns
(*all three correct 2 marks, one or two correct 1 mark)* ;; [2]

(ii) breed the bull with a cow with horns ;
if any offspring have horns then the bull has the **h** allele ;
possible genotypes of bull shown as **HH** or **Hh** ;
genotype of cow shown as **hh** ;
possible gametes of heterozygous bull shown as **H** and **h** ;
possible offspring of heterozygous bull shown as **Hh** and **hh** ; [4 max]

[Total: 12]

4 (a) energy is input throughout 5 minutes / at constant rate ;
up to 100 °C / for first 2 minutes increase in the kinetic energy of the particles (in liquid) ;
water boils at 100 °C / after 2 minutes ;
energy used to separate water molecules/break forces/bonds between molecules (not for more KE) ;
correct reference to Latent Heat ; [max 3]

(b) (energy =) mcΔT **or** msθ **or** mass × SHC × change in temperature ;
ΔT= 40 ;
energy = 0.5 × 4200 × 40 = 84000 J ; [3]

(c) (total power =) 1.8 (kW) / 1800 (W);
energy = power × time / 1800 × 30 × 60 ;
= 3 240 000 J ; [3]

(d) magnet (in door) turns reed relay on / attracts / pulls / repels relay / reed relay acts as switch ;
(which) completes the (microwave generator) circuit ;
magnet is only close enough to affect relay when door is closed / owtte ; [max 2]

[Total: 11]

5 (a) (i) sodium atom loses an electron / outer shell ;
oxygen atom gains two electrons / fills outer shell ;
idea that two electrons provided by two sodium atoms ;
reference to ions formed ;
attraction between positive and negative ions ;
(a diagram clearly showing the 'loss and gain' of electrons and correct symbols is worth 2 marks) [max 3]

(ii) ionic always solid (at room temperature) / covalent can be liquids and gases / ionic higher melting point or boiling point ;
ionic (often) soluble in water / covalent (tend to be) insoluble in water ;
ionic can form electrolytes / covalent cannot be electrolytes ; [max 2]

(b) (i) oxygen ; [1]

(ii) 24 ÷ 400 / 0.06 ;
cm^3 per second ; [2]

(iii) 12 ÷ 24000 ;
$0.0005 / 5 \times 10^{-4}$; [2]

(iv) when current less the rate of gas production is less ;
(at cathode) hydrogen ions gain electrons / hydrogen is discharged ;
current is rate of flow of electrons ;
so if electrons arriving at cathode (per second) is halved then H^+ discharging (per second) ;
is halved / rate of discharge is proportional to current ; [max 3]

[Total: 13]

6 (a) reference to haemoglobin ;
haemoglobin <u>combines with</u> oxygen ;
picks up oxygen in lungs / alveoli <u>and</u> drops it in tissues ; [max 2]

(b) very narrow ;
so red blood cell always close to, the wall / the body tissues ;
so red blood cell takes longer to pass (for better diffusion) ;
OR
thin / one cell thick <u>walls</u> ;
so oxygen can diffuse through quickly ; [max 2]

(c) protection against disease / destroys invading microorganisms / bacteria ;
phagocytosis / description of process ; [2]

[Total: 6]

7 (a) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ **OR** $(R =) \frac{R_1 \times R_2}{(R_1 + R_2)}$;

$= \frac{1}{1200} + \frac{1}{2400} = \frac{3}{2400}$;

R = 800 Ω ; [3]

(b) (i)

renewable resource	*non-renewable resource*
geothermal	coal
tidal	oil
wave	natural gas
wind	
hydroelectric	

;

[1]

(ii) (nuclear) fusion ; [1]

(iii) (conduction) requires particles / a medium ;
only radiation can pass through a vacuum ; [max 1]

(c) magnet moves through coil ;
magnetic field (around coil) ;
magnetic field changes, lines of magnetic force are cut by coils ;
this induces voltage ; [4]

[Total: 10]

8 (a) (i) *gamete* a sex cell ;
fertilisation joining of nuclei of, male and female gametes / sex cells ; [2]

(ii) (**A**) sepal ;
protects flower when in bud ;
(**B**) anther / stamen ;
produces pollen / male gametes ; [4]

(iii) ovary (wall) ; [1]

(b) (i) tropism ;
(negative) geotropism / gravitropism ; [2]

(ii) flowers held up ;
where insects can reach them ; [2]

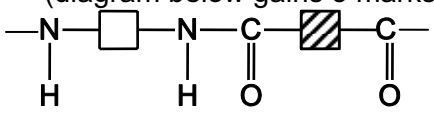
(iii) lower surface has grown more than upper surface ;
use of figures from first graph ;
auxin concentrates on lower surface / higher concentration lower surface ;
use of figures from second graph / deduction that auxin has moved away from upper surface ;
more auxin causes more growth ; [max 3]

[Total: 14]

9 **(a)** **(i)** monomers [1]

(ii) different monomers joined (in some way) ;
correctly joined (peptide type linkage) ;
bond continuation shown ;

(diagram below gains 3 marks)



[max 3]

(iii) condensation polymerisation ;
H_2O ; [2]

(b) **(i)** amino acids ; [1]

(ii) heat ;
aqueous acid / alkali ;
OR
enzymes / biological catalysts ;
at optimum temperature **or** pH ; [max 2]

(iii) (acid / alkaline) hydrolysis ; [1]

[Total 10]

10 **(a)** removes electrons from atoms / turns atoms into ions ;

(b) **(i)** 150 minutes ;
working ; [2]

(ii) 400 / 1280 ;
31.3(%) ; [2]

(c) **(i)** 5 cm ; [1]

(ii) measure separation / distance and record count rate ;
measure count for one minute ;
repeat reading and take mean ;
change separation / distance and repeat ;
reference to dealing with background radiation ; [max 3]

(iii) wear a photographic film badge / idea 3 ;
this only detects radiation / does not provide protection ; [2]

[Total: 11]

11 (a) photosynthesis ;
changes light energy to chemical energy ;
light energy absorbed by chlorophyll ;
water combined with carbon dioxide ;
carbohydrates produced ;
carbohydrates contain chemical energy ; [max 4]

(b) respiration ;
energy lost as heat ;
OR
not all organisms eaten / not all parts of organisms eaten / dies before eaten ;
e.g. sheep does not eat grass roots / human does not eat sheep's feet / other relevant example ;
idea that this energy goes into decomposer food chain ;
OR
not all food digested ;
so some not absorbed into organism's body / some lost in faeces ;
idea that this energy goes into decomposer food chain ; [max 2]

(c) respiration ;
glucose, oxidised / broken down / energy released from glucose ; [2]

[Total: 8]

12 (a) **T** ;
P Q R ;
R (**S**) ;
P ; [4]

(b) (i) decreases slowly (at start and end) ;
followed by rapid decrease / steep fall ;
use of data ; [max 2]

(ii) these are the volumes at pH 7 / owtte ; [1]

(iii) 5 mol / dm^3 ;
62.5 ÷ 12.5 = 5 (× the volume of **B** is required compared to **A**) ;
so acid **A** is five times more concentrated (allow stronger) ; [max 2]

[Total: 9]