

MARK SCHEME for the May/June 2013 series

0654 CO-ORDINATED SCIENCES

0654/32

Paper 3 (Extended Theory), maximum raw mark 120

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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 ;
- (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) $\text{PbO} + \text{H}_2 \longrightarrow \text{Pb} + \text{H}_2\text{O} ; ;$
(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) $(W =) F \times D$ **or** $F \times d$ **or** $F \times s ;$
 $= 1400 \times 10 = 14\ 000 \text{ J} ;$ [2]
- (ii) $(KE =) \frac{1}{2} mv^2 ;$
 $= \frac{1}{2} \times 5000 \times 1.5 \times 1.5 = 5625 \text{ J} ;$ [2]
- (b) (pressure =) force / area **or** $F/A ;$
 $= 50000 / 0.8 = 62500 \text{ N/m}^2 ;$ [2]
- (c) (density =) mass / volume **or** $m/v ;$
 $= 5000 / 5 = 1000 \text{ kg/m}^3 ;$ [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]

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(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 =) $mc\Delta T$ or $ms\theta$ or mass \times SHC \times change in temperature ;
 $\Delta T = 40$;
energy = $0.5 \times 4200 \times 40 = 84000 \text{ J}$; [3]

(c) (total power =) 1.8 (kW) / 1800 (W) ;
energy = power \times time / 1800 \times 30 \times 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]

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- (b) (i) oxygen ;
- (ii) $24 \div 400 / 0.06$;
 cm^3 per second ; [2]
- (iii) $12 \div 24000$;
 $0.0005 / 5 \times 10^{-4}$; [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 combines with oxygen ;
picks up oxygen in lungs / alveoli and 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 walls ;
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** $(R =) \frac{R_1 \times R_2}{(R_1 + R_2)}$;
 $= \frac{1}{1200} + \frac{1}{2400} = \frac{3}{2400}$;
 $R = 800 \Omega$; [3]

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(b) (i)

<i>renewable resource</i>	<i>non-renewable resource</i>
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]

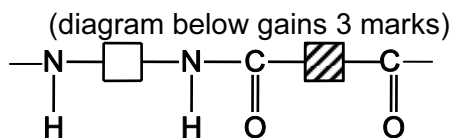
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9 (a) (i) monomers

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



[max 3]

(iii) condensation polymerisation ;
H₂O ;

[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]

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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 ;
 $62.5 \div 12.5 = 5$ (\times the volume of **B** is required compared to **A**) ;
so acid **A** is five times more concentrated (allow stronger) ;

[max 2]

[Total: 9]