

**MARK SCHEME for the May/June 2013 series**

**0654 CO-ORDINATED SCIENCES**

**0654/22**

Paper 2 (Core 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.

Cambridge will not enter into discussions about these mark schemes.

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- 1 (a) (i) potassium hydroxide ; [1]
- (ii) rate increases down the group ; [1]
- (b) (i) increases down the group ; [1]
- (ii) mixture becomes orange ;  
bromine is produced ;  
chlorine is more reactive than bromine / chlorine displaces bromine ; [3]

**[Total: 6]**

- 2 (a) force ;  
distance ; [2]
- (b) (density =) mass ÷ volume ;  
= 5000 / 5 = 1000 (kg / m<sup>3</sup>) ; [2]
- (c) (i) 20 Hz or below ;  
human lower threshold is about 20 Hz ; [2]
- (ii) number of vibrations per second ; [1]

**[Total: 7]**

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

(b) (i) **Hh** no horns and **hh** horns ; [1]

(ii)

phenotypes of parents                  bull with no horns                  cow with horns

genotype of parents                  Hh                  hh

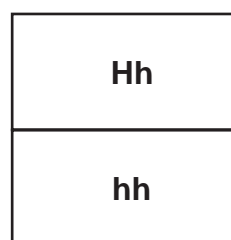
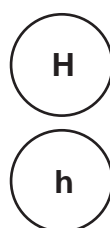
gametes



gametes from cow



gametes from bull



⋮

[3]

(iii) look to see if any offspring have horns ;  
if they do the bull has the **h** allele ; [2]

(iv) idea that the genetic diagrams show the chances of getting each kind of offspring ;  
bull could have **h** allele but all offspring get the **H** allele ;  
idea that the more offspring there are, the more likely that the **h** allele will show up ; [max 2]

**[Total: 10]**

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- 4 (a) thermal ;  
thermal and conduction ; [2]
- (b) energy input throughout 5 minutes ;  
up to 100 °C energy increase the KE of the particles (in liquid) ;  
water boils at 100 °C ;  
energy used to separate water molecules not for more KE ;  
reference to Latent Heat ; [max 3]
- (c) random arrangement ;  
mostly touching ; [2]
- [Total: 7]**
- 5 (a) (i) sodium chloride **and** sodium oxide ; [1]
- (ii) sodium atom loses an electron /outer shell ;  
chlorine atom gains an electron /fills outer shell ; [2]
- (iii) ions have opposite charges /opposite charges attract ; [1]
- (iv) ionic always solid (at room temperature), covalent can be liquids and gases ;  
ionic often soluble in water, covalent tend to be insoluble in water ;  
ionics can form electrolytes, covalent cannot be electrolytes ; [max 2]
- (b) (i) anode labelled ; [1]
- (ii) **P** oxygen ;  
**Q** hydrogen ; [2]
- (iii) (hydrogen)  
lighted splint ;  
pops ;  
**OR**  
(oxygen)  
glowing splint ;  
relights ; [max 2]
- [Total: 11]**

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- 6 (a) reference to haemoglobin ;  
haemoglobin combines with oxygen ;  
picks up oxygen in lungs and drops it in tissues ; [max 2]
- (b) protection against disease / destroys invading microorganisms;  
phagocytosis ;  
takes in and digests bacteria ; [max 2]
- (c) delivers, oxygen / nutrients ;  
removes waste materials / carbon dioxide ;  
to / from, body tissues / cells ; [max 2]
- [Total: 6]**
- 7 (a)  $R = R_1 + R_2$  ;  
 $= 1200 + 2400 = 3600 (\Omega)$  ; [2]
- (b) (i) lamp  
cell  
switch  
(3 correct = 2 marks 2 correct = 1 mark) ;; [max 2]
- (ii) correct series circuit and all symbols correct ; [1]
- (c) chemical ;  
electrical ;  
light ;  
thermal ; (any two for 1 mark) [max 2]
- (d) angle of reflection ;  
 $45^\circ$  ; [max 2]
- [Total: 9]**
- 8 (a) (i) (gamete) a sex cell ;  
(fertilisation) joining of nuclei of, male and female gametes / sex cells ; [2]
- (ii) sepal ;  
produces pollen / male gametes ; [2]
- (iii) ovary (wall) ; [1]
- (b) **B** and **C** ;  
they have warmth ;  
they have water ;  
light is not needed ; [max 3]

Page 6	Mark Scheme	Syllabus	Paper
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(c) (i) tropism ;  
(negative) geotropism/gravitropism ; [2]

(ii) reference to photosynthesis ;  
leaves can get more light ;  
flowers held up ;  
where insects can reach them ; [max 3]

**[Total: 13]**

9 (a) (i) H and C/elements contain only one type of atom ;  
compound contains different atoms that are bonded ;  
elements shown in Periodic Table compounds not shown ; [max 2]

(ii)  $1 \times \text{C}$  and  $4 \times \text{H}$  ;  
correctly bonded ; [2]

(iii) natural gas ; [1]

(b) (i) Z ; [1]

(ii) X, Z ;  
unsaturated molecules contain double bonds ; [2]

(c) (i) ethene molecules link together ;  
to form (long) chains ; [2]  
(*clear diagram could score both marks*)

(ii) addition ;  
polymerisation ; [2]

**[Total: 12]**

10 (a) gamma – killing cancer cells ;  
X-rays – photographing bones ; [2]

(b) removes electrons from atoms/turns atoms into ions ; [1]

(c) breaking up/splitting ;  
of nucleus (of atom) ; [2]

(d)

<b>stage</b>	<b>order</b>
A chain reaction happens in the core.	<b>1</b>
A generator is turned	<b>7</b>
A turbine turns	<b>6</b>
Electrical energy is generated.	<b>8</b>
Steam is produced.	<b>5</b>
Thermal energy is produced.	<b>2</b>
Thermal energy is removed from core.	<b>3</b>
Water is heated.	<b>4</b>

**1** in first box ;  
**7** in second box ;  
**5** in third box and **3** in fourth box ;

[3]

(e)

no carbon dioxide is produced	√
no dangerous waste produced	
no fossil fuels are used	√
no problems with the radioactive waste	
no thermal energy is wasted	

::

[2]

(f) (i) 5 cm ;

[1]

(ii) measure separation 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) **idea 3** ;  
this detects radiation (but does not reduce exposure) ;

[2]

**[Total: 16]**

Page 8	Mark Scheme	Syllabus	Paper
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- 11 (a) (i) chlorophyll ; [1]
- (ii) carbon dioxide ;  
water ; [2]
- (iii) oxygen ; [1]
- (b) an animal that gets its energy ;  
(from) only eating plants ; [2]
- (c) growth/repair ;  
for making, cell membranes/cytoplasm ;  
for making enzymes/haemoglobin/antibodies/other specific substance ; [max 2]
- (d) (*arterioles dilate*) (max 2)  
more blood carried close to the skin surface ;  
allows more heat to be lost ;  
by radiation ;  
**AND**  
(*more sweat produced*) (max 2)  
water in sweat evaporates ;  
reference to latent heat of evaporation ;  
heat lost ; [max 4]
- [Total: 12]**

- 12 (a) T ;  
P Q R ;  
R (S) ;  
P ; [4]
- (b) (i) 8 – 14 ; [1]
- (ii) (B)  
took the least volume to neutralise the alkali ; [1]
- (iii) reaction was exothermic/heat energy transferred to mixture ; [1]
- (iv)  $\longrightarrow$  salt ; + water ; [2]
- (v) volcanic activity ;  
burning (fuel containing) sulfur compounds ; [2]
- [Total: 11]**