



---

**CO-ORDINATED SCIENCES**

**0654/21**

Paper 2 Core Theory

**May/June 2016**

MARK SCHEME

Maximum Mark: 120

---

**Published**

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.

Cambridge is publishing the mark schemes for the May/June 2016 series for most Cambridge IGCSE<sup>®</sup>, Cambridge International A and AS Level components and some Cambridge O Level components.

Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0654	21

- 1 (a) kinetic to electrical ; [1]
- (b) black ;  
black surfaces absorb more (infra-red) radiation ; [2]
- (c) conduction ; [1]
- (d) tidal ;  
wave ;  
geothermal ;  
HEP ;  
biomass ; [max 2]
- (e) depends on amount of sunlight/will not work at night ; [1]
- (f) correctly positioned between visible light and microwaves ; [1]
- (g) (i) amplitude correctly indicated ; [1]  
(ii) wavelength correctly indicated ; [1]
- (h) lower volume ;  
same pitch ; [2]
- [Total: 12]**
- 2 (a) (i) sepal correctly labelled ;  
stamen correctly labelled ; [2]  
(ii) unable to pollinate (other flowers) ; [1]  
(iii) ovule ; [1]
- (b) (i) 31–33 ; [1]  
(ii) water ;  
oxygen ; [2]  
(iii) enzyme/chemical reactions too slow ;  
enzymes don't work at high temperatures/denatured ; [2]  
(iv) seeds are dead/damaged/diseased/too young/too old ; [1]
- [Total: 10]**

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0654	21

- 3 (a) (i) filtration / passed through a filter ; [1]  
(ii) reference to risk of disease ; [1]
- (b) (i) electrolysis ; [1]  
(ii) (damp) litmus / (Universal) indicator paper ;  
bleached / changes colour to white ; [2]  
(iii) becomes pink / brown / copper coloured (from black) ; [1]  
(iv) copper (metal) deposited ; [1]
- (c) (i) bromine ; [1]  
(ii) chlorine is more reactive than bromine ; [1]
- [Total: 9]**
- 4 (a) (i) constant speed ; [1]  
(ii) (constant) deceleration ; [1]  
(iii) 20 (m/s) ; [1]  
(iv) E or at 40 s ; [1]  
(v) (distance =) speed  $\times$  time or  $20 \times 10$  ;  
= 200 (m) ; [2]
- (b) (i) one arrow on windscreen / wheel going in opposite direction to direction of  
motion ;  
labelled air resistance / breaking force / friction ; [2]  
(ii) changed to thermal energy / sound ; [1]
- [Total: 9]**
- 5 (a) X = (plant) respiration ;  
Y = decay / decomposition / respiration ; [2]
- (b) (i) increased CO<sub>2</sub> in atmosphere ;  
CO<sub>2</sub> used in photosynthesis ;  
(because) less photosynthesis / less CO<sub>2</sub> absorbed ;  
combustion / decay of timber ; [max 3]  
(ii) increased, because combustion produces CO<sub>2</sub> ; [1]

Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0654	21

- (c) (i) from the Sun/as light ; [1]  
(ii) as heat ; [1]

[Total: 8]

- 6 (a) (i) nucleus ; [1]  
(ii) proton positive(ly charged) and electron negative(ly charged) ;  
proton has greater mass ; [2]

- (b) (i) thermal (heat) energy released during a reaction/  
reaction that caused an increase in temperature ; [1]  
(ii) reference to electron loss (from atom) ;  
extra detail e.g. loss of one/the outer electron/  
to leave filled outer shell ;  
ion is positively charged ; [3]

- (c) (i) the higher the temperature the greater mass of solid dissolves/  
the higher the temperature the greater the solubility ; [1]  
(ii)  $49 \pm 1$  (g) ; [1]  
(iii) phosphorus and nitrogen ; [1]  
(iv) reference to uptake by roots only of dissolved minerals/owtte ; [1]

[Total: 11]

- 7 (a) 1. plastic or glass  
2. iron  
3. glass or plastic  
4. copper/aluminium  
5. copper/aluminium/iron  
6. plastic  
6 correct = 3 marks, 4 or 5 correct = 2 marks, 1, 2 or 3 correct = 1 mark ;;; [3]

- (b) (i) 54 ; [1]  
(ii) 28 ; [1]  
(iii) 26 ; [1]

- (c) the temperature at which a solid changes to a liquid ; [1]

- (d) (A no mark)  
because particles are in a regular arrangement ; [1]

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0654	21

(e) density = mass/volume or 39/4.9 ;  
= 7.96 ;  
g/cm<sup>3</sup> ; [3]

[Total: 11]

8 (a) (i) energy storage/insulation ; [1]

(ii) protein;  
carbohydrate ;  
vitamins ;  
mineral salts/ions ;  
water ;  
fibre/roughage ; [6]

(b) (i) pancreas labelled on Fig. 8.1 ; [1]

(ii) lipase ; [1]

(iii) small intestine ; [1]

[Total: 10]

9 (a) (i) alloys ; [1]

(ii) stronger/harder/less malleable/resists rusting ; [1]

(iii) transition (metals/series) ; [1]

(iv) elements or their compounds can behave as catalysts ;  
compounds have colours other than white ; [2]

(b) (i) iron oxide + carbon monoxide → iron + carbon dioxide  
[LHS and RHS] ;; [2]

(ii) (iron oxide)  
oxygen removed ;  
(allow fully correct discussion of electron gain) [1]

(c) credit for stating anywhere that rust requires presence of air/oxygen and water together;

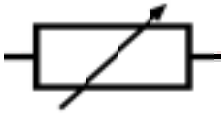
(A no rusting)  
water not present ;

(B no rusting)  
air/oxygen not present ;

(C no rusting)  
barrier prevents air and water from reacting with the steel ; [max 3]

[Total: 11]

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – May/June 2016	0654	21

- 10 (a) (i) angle of incidence correctly labelled ; [1]
- (ii)  $30^\circ$  ; [1]
- (iii) same size as object  
virtual  
upright  
any two correct for 1 mark ; [1]
- (b) (i) ammeter ; [1]
- (ii) (total resistance) = voltage / current or  $6 / 0.30$  ;  
=  $20 (\Omega)$  ;  
resistance  $R = 20 - 12 = 8 (\Omega)$  ; [3]
- (iii)
- 
- [1]
- [Total: 8]
- 11 (a) (i) FF and Ff ; [1]
- (ii) ff ; [1]
- (b) (i) (gametes) H, h, H, h ;  
(genotypes) HH, Hh, Hh, hh ;  
(phenotypes) short fur, short fur, short fur, long fur ;  
(ratio) 3.1 ; [4]
- (ii) long fur is homozygous/hh/recessive ;  
parents always pass on a recessive allele/offspring will always inherit  
recessive alleles ; [2]
- [Total: 8]
- 12 (a) (i) water (vapour)/carbon monoxide/carbon ; [1]
- (ii) gasoline ;  
(allow petrol/LPG) [1]
- (iii) (catalytic/thermal) cracking ; [1]
- (b) (i) (J)  
it contains carbon dioxide/statements such as:  
carbon dioxide molecules contain only three atoms ; [1]

<b>Page 7</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>Cambridge IGCSE – May/June 2016</b>	<b>0654</b>	<b>21</b>

(ii) (K)  
ethane molecules have the formula  $C_2H_6$  /  
ethane molecules contain eight atoms /  
ethane is a saturated hydrocarbon containing two carbons /  
other correct ; [1]

(c) (i) join together into chains / much larger molecules ; [1]

(ii) poly(ethene) ;  
(allow polyethene and polythene) [1]

(d) (M)  
reference to low reactivity of alkanes / sodium doesn't react with alkanes ;  
reference to reaction between water and sodium ; [2]

**[Total: 9]**

13 (a) palisade / mesophyll ; [1]

(b) xylem ;  
phloem ; [2]

(c) stomata ; [1]

**[Total: 4]**