

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International General Certificate of Secondary Education

**MARK SCHEME for the October/November 2014 series**

**0654 CO-ORDINATED SCIENCES**

**0654/33**

Paper 3 (Extended Theory), maximum raw mark 120

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

- 1 (a) variation ;  
adaptation ;  
survive ;  
selection ; [4]
- (b) (i) (in 1980) no (significant) difference ;  
(in 2010) higher in country **A**/ORA ; [2]
- (ii) mutation produces resistant variety ;  
some bacteria more resistant than others/some bacteria are resistant ;  
antibiotics in (frequent) use ;  
resistant bacteria more likely to survive/natural selection/ORA ;  
and reproduce to pass on this resistance ; [max 3]
- (iii) more/incorrect antibiotic use in country **A**/ORA ; [1]
- [Total: 10]**
- 2 (a) (i) 3000 (W) shown ;  
 $= \frac{3000}{250}$  (= 12 A) ; [2]
- (ii) (resistance =)  $\frac{\text{voltage}}{\text{current}}$  ;  
 $\frac{250}{12} = 20.8$  or 21 ;  
 $\Omega$  ; [3]
- (b) (i) (larger current so) wire moves (upwards) higher/quicker/with more force ; [1]
- (ii) (current reversed so) wire moves downwards/direction reverses/force acts downwards ; [1]
- [Total: 7]**
- 3 (a) (i) 1(%) ; [1]
- (ii) any noble gas ; [1]
- (b) (i) 24 dm<sup>3</sup> ; [1]
- (ii) reference to the idea that 1 mole of any gas at room temperature and pressure has a volume of 24 dm<sup>3</sup>/1 mole of any gas under same conditions occupies the same volume ; [1]
- (iii) nitrogen has lower/different mass/lower density ; [1]

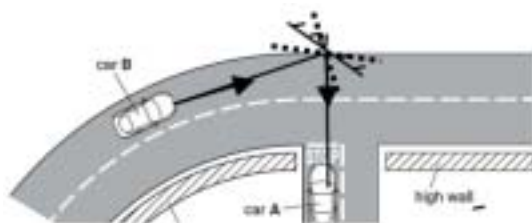
Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

- (c) (i) fractional distillation ; [1]
- (ii) hydrocarbon/named alkane/petroleum/water ; [1]
- (iii)  $1000 \div 17 = 58.8(24)$  or 59 ;  
 $58.8 \div 2 = 29.4(12)$  ;  
 $M_r \text{ N}_2 = 28$  ;  
 $29.4 \times 28 = 823.2 \text{ g}$  (unit required) ; [4]

[Total: 11]

- 4 (a) (i) (positive acceleration: driving force is greater than air resistance **OR**  
 negative acceleration: driving force is less than air resistance)  
 there is a resultant/net force/sum of forces is not zero ; [1]
- (ii) (force =) mass  $\times$  acceleration ;  
 acceleration =  $3.5 \text{ (m/s}^2\text{)}$  ;  
 =  $1200 \times (3.5) = 4200 \text{ (N)}$  ; [3]
- (iii) (KE =)  $\frac{1}{2}mv^2$  ;  
 initial KE = 153 600 and final KE = 540 000 (J) ;  
 difference =  $540\,000 - 153\,600 = 386\,400 \text{ (J)}$  ; [max 3]

- (b) mirror drawn at suitable angle ;



- ray of light drawn from car **B** reflects off mirror to car **A** indicated by arrow ;  
 angles between rays and mirror approximately correct ; [3]

- (c) engine vibration causes air particles to vibrate ;  
 energy/vibrations passed from particle to particle ;  
 compressions and rarefactions ; [max 2]

[Total: 12]

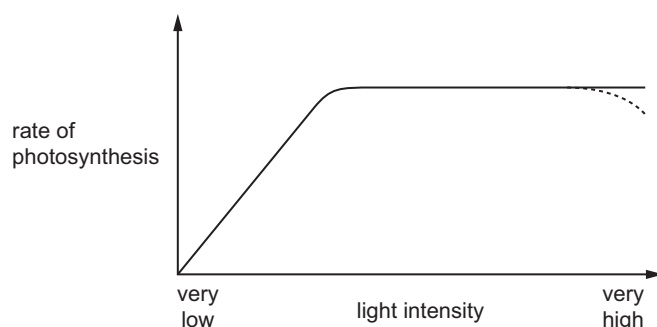
Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

5 (a) as an energy source ; [1]

(b) oxygen ; [1]

(c)  $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$   
formulae ; balancing ; [2]

(d) (i)



straight line for first part of graph ;  
levelling off at higher intensity ; [2]

(ii) (at low) more light means more energy available / more light energy speeds up rate ;  
(at very high) not enough  $\text{CO}_2$  / plant photosynthesising as fast as it can / another limiting factor / limiting factor ; [2]

(e) temperature ;  
 $\text{CO}_2$  concentration ;  
wavelength / frequency / colour of light ;  
rainfall / water / humidity ;  
lack of magnesium ; [max 2]

(f) (i) chlorophyll ; [1]

(ii) to absorb the light / energy ; [1]

**[Total: 12]**

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

6 (a)

element	physical state at 20 °C	colour	formula of molecules
chlorine	<b>gas</b>	(pale green)	<b>Cl<sub>2</sub></b>
bromine	(liquid)	<b>orange / brown</b>	<b>Br<sub>2</sub></b>
iodine	<b>solid / crystals</b>	<b>dark grey / black</b>	(I <sub>2</sub> )

⋮

(1 mark for each correct column)

[3]

(b) chlorine + sodium iodide → iodine + sodium chloride ;

[1]

(c) become ill/be poisoned/might die ;  
because harmful microorganisms would not be killed ;

[2]

(d)  $2F_2 + 2H_2O \rightarrow O_2 + 4HF$   
formulae ; balanced ;

[2]

**[Total: 8]**7 (a) **V** = testis ;  
**W** = ovum/egg ;

[2]

(b) fertilisation ;

[1]

(c) at **Y** = mitosis ;  
at **Z** = meiosis ;

[2]

(d) **W** = 23 ;  
embryo = 46 ;

[2]

**[Total: 7]**

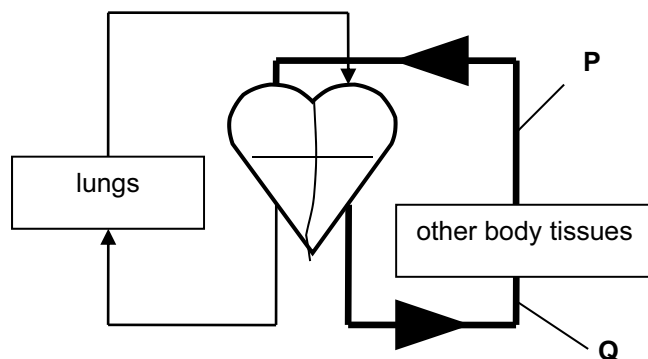
Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

- 8 (a) (i) 68(W) ; [1]
- (ii) working for **A OR B** ;  
**A** = 25% and **B** = 3.75% ; [2]
- (iii) **A** is more efficient than **B**/less energy consumed ;  
valid environmental statement e.g. less fossil fuels burned / non-renewable  
resources used / less CO<sub>2</sub> released ; [2]
- (b) nuclear ;  
kinetic ; [2]
- (c) (i) time taken for half the atoms / nuclei to decay / time for radioactivity to fall to  
half ; [1]
- (ii)  $\beta$  particles and  $\gamma$  wave ;  
 $\beta$  more ionising ;  
 $\beta$  less penetrating ;  
 $\beta$  has charge and  $\gamma$  has no charge ;  
 $\beta$  has mass and  $\gamma$  has no mass ; [max 2]
- [Total: 10]
- 9 (a) (i) with ethane no colour change / stays orange ;  
with ethene orange solution becomes colourless ; [2]
- (ii) x is 4 ;  
y is 8 ;  
alkenes ; [3]
- (b) (i) polymerisation ;  
addition (polymerisation) ; [2]
- (ii) poly(ethene) ; [1]
- (iii) carbon dioxide ;  
water ; [2]
- [Total: 10]

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

- 10 (a) (i) X = pulmonary vein ;  
Y = right atrium ; [2]

(ii)



- correct arrow on P ;  
correct arrow on Q ; [2]

- (iii) blood flows twice through the heart (for each complete circuit) ;  
through lungs, then through body tissues/v.v. ;  
idea of separate oxygenated and deoxygenated blood ; [max 2]

- (iv) blood has less far to travel/flows through fewer capillaries/organs ;  
right (ventricle of) heart has less muscle ; [max 1]

- (b) (i) artery ; [1]

- (ii) surge of blood/pressure into the vessel ;  
vessel wall stretches (and recoils) with each beat ; [max 1]

- (iii) more blood to muscles ;  
so more oxygen/glucose ;  
removes more CO<sub>2</sub> ;  
increased respiration ;  
increased energy released ; [max 2]

[Total: 11]

Page 8	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

- 11 (a) (i) poor (heat) conductor / idea of heat not passing through handle ; [1]  
(ii) shiny / silver surface poor heat emitter ; [1]

- (b) (in base of saucepan)  
increased particle movement / vibration / kinetic energy ;  
energy transferred by collision, vibration / energy, passed from particle to particle ;

(in water)  
water particles move further apart ;  
less dense water rises ; [4]

- (c) (pressure =)  $\frac{\text{force}}{\text{area}}$  ;  
 $= \frac{15}{300} = 0.05 \text{ (N/cm}^2\text{)} ;$  [2]

- (d) (c =)  $\frac{H}{m\theta}$  or  $\frac{H}{m\Delta T}$  ;  
 $\frac{63\,000}{(0.5 \times 30)}$  ;  
 $= 4200 \text{ (J/kg }^\circ\text{C)} ;$  [3]

[Total: 11]

- 12 (a) transition metals have high density ;  
transition metals (and compounds) can act as catalysts ;  
transition metals (often) form coloured compounds ;  
transition metals have high melting / boiling points ;  
reference to variable oxidation states / valency ; [max 3]

- (b) (i) (26)  
same as proton number ; [1]

(ii) 3 ;  
same as Group number ;  
electrons arranged in 2,8,3 ; [max 2]

- (c) (i) aluminium atom / Al ;  
becomes a positive ion ;  
(aluminium atoms) lose electrons (when they ionise) / electron loss is  
oxidation / electrons transferred to iron (ions) / oilrig explained ; [max 3]



<b>Page 9</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>Cambridge IGCSE – October/November 2014</b>	<b>0654</b>	<b>33</b>

- (ii) less ;  
reaction is exothermic ;  
chemical energy in reactants has been transferred to surroundings / changed  
to thermal energy (and so less in products) ;

[max 2]

**[Total: 11]**