

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 ;
 Ω ; [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 dm³ ; [1]
- (ii) reference to the idea that 1 mole of any gas at room temperature and pressure has a volume of 24 dm³/1 mole of any gas under same conditions occupies the same volume ; [1]
- (iii) nitrogen has lower/different mass/lower density ; [1]

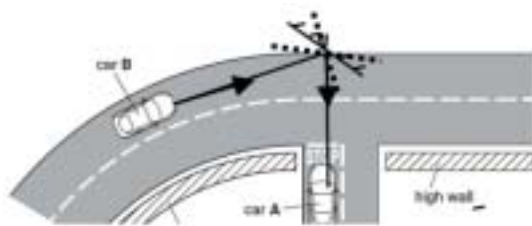
Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

- (c) (i) fractional distillation ; [1]
- (ii) hydrocarbon / named alkane / petroleum / water ; [1]
- (iii) $1000 \div 17 = 58.8(24)$ or 59 ;
 $58.8 \div 2 = 29.4(12)$;
 $M_r N_2 = 28$;
 $29.4 \times 28 = 823.2\text{g}$ (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]

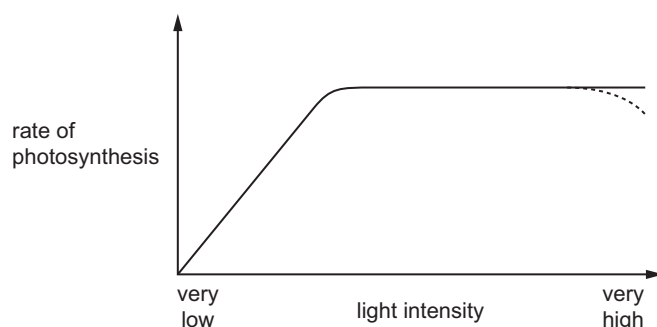
Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

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 CO_2 / plant photosynthesising as fast as it can / another limiting factor / limiting factor ; [2]

(e) temperature ;
 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]

6 (a)

element	physical state at 20 °C	colour	formula of molecules
chlorine	gas	(pale green)	Cl₂
bromine	(liquid)	orange / brown	Br₂
iodine	solid / crystals	dark grey / black	(I ₂)

⋮

(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]

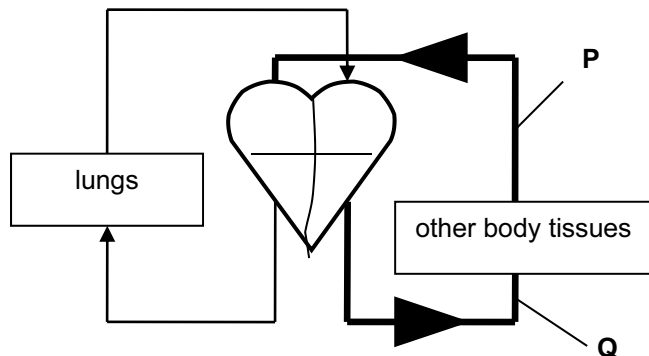
Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2014	0654	33

- 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 CO₂ 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) β particles and γ wave ;
 β more ionising ;
 β less penetrating ;
 β has charge and γ has no charge ;
 β has mass and γ 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 CO₂ ;
 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 (J/kg °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]

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

- (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]