

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

Cambridge International General Certificate of Secondary Education

**MARK SCHEME for the October/November 2015 series**

**0654 CO-ORDINATED SCIENCES**

**0654/32**

Paper 3 (Extended Theory), maximum raw mark 120

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0654	32

- 1 (a) (i) (named) decomposer ; [1]
- (ii) nitrate ;  
phosphate ;  
potassium ;  
magnesium ;  
other named essential mineral ion ; [max 2]
- (b) (i) carbon dioxide ;  
ethanol ; [max 2]
- (ii) keep the compost bin warm ;  
mix/aerate the compost ;  
break up compost into smaller pieces ; [max 2]
- (c) dead matter recycled/(nutrients in) crop not being removed ; [1]
- [Total: 8]**
- 2 (a) (i) magnesium  
zinc  
**J**  
hydrogen  
copper ;; [2]
- (ii) copper ions ;  
brown deposit made of copper atoms ;  
copper ions gain electrons ;  
gain of electrons is reduction ; [max 3]
- (b) (i) regular arrangement of gold atoms ;  
interspersed with fewer of the different atom ; [2]
- (ii) mass of diamond in grams =  $186 \times 0.2 = 37.2 \text{ g}$  ;  
moles C =  $\frac{37.2}{12} = \underline{3.1}$  (moles) ; [2]
- [Total: 9]**
- 3 (a) (i) distance = area under graph (or working on graph) ;  
=  $25 \times 100 + \frac{1}{2} \times 150 \times 25 = 4375$  ;  
m ; [3]
- (ii) (KE =)  $\frac{1}{2} mv^2$  ;  
=  $\frac{1}{2} \times 500\,000 \times 20 \times 20 = 100\,000\,000 \text{ (J)} = 100\,000 \text{ (kJ)}$  ; [2]

Page 3	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0654	32

- (b) (i) density decreases ;  
mass does not change ;  
kinetic energy of particles increases / speed of particles increases ;  
particles move further apart ; [max 3]
- (ii) volume = 125 000 cm<sup>3</sup> ;  
mass = 7.8 × 125 000 = 975 000 g ;  
= 975 (kg) ; [3]

[Total: 11]

- 4 (a) petroleum / crude oil ; [1]

- (b) reference to fractions having different boiling ranges / points ;  
reference to smaller molecules in materials with lower boiling points ;  
reference to the temperature gradient in the tower ;  
reference to collection of fraction at heights corresponding to boiling point ; [max 3]

- (c) (i) cracking ; [1]

- (ii) (react with) bromine (solution / liquid) ;  
decolourised if hydrocarbon is unsaturated ; [2]

- (iii) the idea of applying the test before and after the cracking ;  
the result that decolourisation only occurs following the cracking process ; [2]

[Total: 9]

- 5 (a) taking in nutrients / organic substances / mineral ions ;  
containing raw materials / energy ;  
absorbing / assimilating them ; [max 2]

- (b) (i) unbalanced diet / wrong amount of some part of the diet ; [1]

- (ii) too much energy / too much fatty food / too much carbohydrate / sugar so  
(human) body (makes /) stores as fat ; [1]

- (c) (i) increases ;  
after 1970 / no increase before 1970 ;  
from 5% to 21–22% / by 16–17% ; [max 2]

- (ii) more available / fast food ;  
people take less exercise ; [max 1]

- (iii) diabetes ;  
arthritis ;  
(coronary) heart disease ;  
high blood pressure / cholesterol ;  
reduced fertility ;  
cancer ; [max 2]

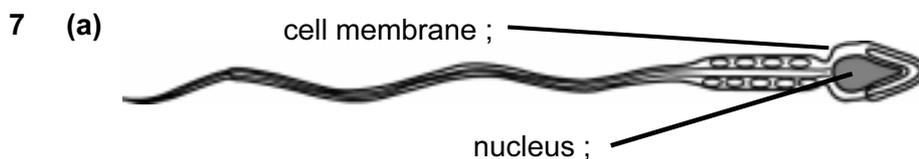
Page 4	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0654	32

- (d) (i) making/maintaining bones ;  
absorbing/using calcium ; [max 1]
- (ii) egg/liver/(oily) fish/milk/other milk products ; [1]
- (iii) rickets ;  
soft/brittle bones/'bending' of legs ; [2]

**[Total: 13]**

- 6 (a) mirror drawn at suitable angle ; [1]
- (b) total internal reflection/angle of incidence greater than critical angle; [1]
- (c) steel will be attracted to magnet/aluminium alloy will not be attracted; [1]
- (d) (i)  $P_1V_1 = P_2V_2$  ;  
 $V_1 = \frac{P_2V_2}{P_1} = 2 \times 10^5 \times \frac{1600}{1} \times 10^5 (= 3200 \text{ cm}^3)$  ; [2]
- (ii) number of strokes =  $\frac{3200}{90} = 35.55$  so 36 ; [1]

**[Total: 6]**



- (b) male gametes smaller/OR A ;  
male gametes produced in larger numbers/OR A ;  
male gametes elongated shape/OR A ; [max 3]
- (c) (i) 20 °C ; [1]
- (ii) lower rate of respiration/enzymes less active/less kinetic energy for  
enzymes ; [1]
- (iii) any suggestion below 62.5% ; [1]

Page 5	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0654	32

- (d) (i) less mobile, because too warm ; [1]
- (ii) sperms are more mobile as they are outside the body cavity and therefore cooler/owtte ; [1]
- (iii) reduced, because sperm mobility reduced ; [1]

[Total: 10]

- 8 (a) (i) radiation ; [1]
- (ii) car **A**/black car – black surfaces absorb heat more ; [1]

(b) (i)  $(R) = \frac{V}{I}$  ;  
 $= \frac{12}{4.8} = (2.5(\Omega))$  ; [2]

(ii)  $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$  ;  
 resistance ( $R_T$ ) = 1.25 ( $\Omega$ ) ; [2]

- (c) (i) 20(Hz) to 20 000 (Hz) ;  
*(both needed for mark)* [1]

(ii) (distance =) speed  $\times$  time ;  
 $= 34\,000 \times \frac{0.002}{2} = 34(\text{cm})$ ; [2]

(iii)  $v = f \times \lambda$  ;  
 wavelength =  $\frac{340}{40\,000} = 0.0085(\text{m})$  ; [2]

- (iv) compressions further apart ;  
 larger wavelength ; [2]

[Total: 13]

- 9 (a) (i) 2,5 ; [1]
- (ii) reference to completion of outer shell ;  
 so now 3 more electrons than protons/ion has 3 more negative electrons compared to the neutral atom ; [2]
- (iii)  $\text{Mg}_3\text{N}_2$  ;  
 reference to charge balance ; [2]

Page 6	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0654	32

(b) (i)  $N_2 + 3H_2 \rightarrow 2NH_3$ ; [1]

(ii) use of damp, red litmus paper / universal indicator paper ;  
colour change to blue / purple ;

**OR**

use of hydrogen chloride gas ;  
white smoke / ammonium chloride ;

[max 2]

(iii) increases the surface area (of the catalyst) ;

increases the frequency that gas molecules collide with the catalyst ;

[2]

**[Total: 10]**

10 (a) (i) (efficiency =)  $\frac{\text{useful energy (power) out}}{\text{useful energy (power) in}}$  ;

$$= \frac{800}{2400} = 0.33 \times 100 = 33(\%) ;$$

[2]

(ii) nuclear fusion / nuclei join together (to release energy) ;

[1]

(b) (i)  $\gamma$ -radiation ;

[1]

(ii) ( $\gamma$ -radiation / gamma – *no mark if **no** explanation given*)

not charged particles so not affected by electric field ;

[1]

(c) (i) to reduce energy / power losses ;  
high voltage means low current ;

[2]

(ii) number of primary coils less than number of secondary ;

reference to a.c. / alternating current ;

changing magnetic field induces secondary voltage;

reference to changing current leading to change in magnetic field ;

[max 3]

**[Total: 10]**

11 (a) (i) folded / large surface area ;  
thin / permeable ;  
moist ;

[max 2]

(ii) has blood vessels / (blood) capillaries ;

[1]

(b) (i) carbon dioxide ;

[1]

(ii) diffusion ;

[1]

Page 7	Mark Scheme	Syllabus	Paper
	Cambridge IGCSE – October/November 2015	0654	32

(c) (i) slower gas exchange / oxygen uptake ;  
(because) less surface area ; [2]

(ii) cancer ;  
bronchitis ;  
asthma ;  
coughing / excess mucus ;  
increased risk of colds / sore throat / etc. ;  
AVP ; (**do not accept** references to CHD etc.) [max 2]

[Total: 9]

12 (a) (i) (*element: K or H*)  
cannot be simplified / contains atoms with same proton number / contains only  
one type of atom ;  
(*compound potassium hydroxide or water*)  
made of different types of atom bonded together / can be simplified / broken  
into elements ; [2]

(ii) same numbers of each type of atom on both sides ; [1]

(iii) *state symbol: (l)* refers to a (single) liquid substance / (liquid containing only  
one type of molecule) ;  
*state symbol: (aq)* refers to a solution of a substance in water ; [2]

(iv) green to purple / blue ;  
potassium hydroxide is an alkali / solution becomes alkaline / pH increases ; [2]

(v) reaction is exothermic / heat given off ;  
hydrogen gas ignites ; [2]

(b) (i) line clearly drawn to any shared pair and labelled with an **S** ; [1]

(ii) each atom becomes stable if it can gain complete valence shell / owtte ;  
complete shells achieved by sharing electrons in pairs ;  
other detail e.g. H full shell has two electrons the other elements have eight ; [max 2]

[Total: 12]