



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

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**CO-ORDINATED SCIENCES**

**0654/22**

Paper 2 Core Theory

**May/June 2016**

MARK SCHEME

Maximum Mark: 120

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**Published**

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- 1 (a) (i) carbon dioxide ;  
reference to limewater ; [2]
- (ii) magnesium chloride ;  
hydrogen ; [2]
- (b) (i) (B or C)  
(reaction causes) temperature increase ; [1]
- (ii) no change in temperature (suggests) no reaction ;  
because copper (too) unreactive (to displace hydrogen from dilute acid) ; [2]
- (c) nitrous oxide covalent ;  
compound of two non-metals ;  
magnesium nitride ionic/eletrovalent ;  
compound of metal and non-metal ; [4]
- [Total: 11]**
- 2 (a) (i) leaves / stomata / mesophyll surface ; [1]
- (ii) transpiration ; [1]
- (b) (i) 15.30–16.30 ;  
17.00 ; [2]
- (ii) similar pattern / correlated ;  
water uptake lags behind water loss ;  
appropriate ref to figures in the graph ; [max 2]
- (c) (i) photosynthesis / turgor / support / solvent ; [1]
- (ii) transported / transports ions in solution ; [1]
- [Total: 8]**
- 3 (a) straight line ;  
from (0, 0) to (30, 60) ; [2]
- (b) (i) kinetic energy / (gravitational) potential energy ; [1]
- (ii) chemical energy ; [1]
- (c) (i) R ;  
Q ; [2]
- (ii) equal and opposite ; [1]

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- (d) friction between fuel and pipe ;  
electrons transferred ;  
from pipe to fuel ;

[max 2]

**[Total: 9]**

- 4 (a) (i) oxygen 21 (%) ;  
nitrogen 78 (%) ;

[2]

- (ii) reference to the combustion products of propane/hydrocarbons  
which rise into balloon mixing with air inside ;  
higher amounts of CO<sub>2</sub>/CO/H<sub>2</sub>O ;  
so lower amounts of oxygen ;

[max 2]

- (b) (i) fractional distillation ;  
compound ;  
mixture ;

[3]

- (ii) compound containing only hydrogen and carbon ;  
having only single bonds/containing as much hydrogen as possible/no  
double bonds ;

[2]

- (c) reference to helium being unreactive/greater reactivity of hydrogen/reference to  
safety/reducing fire risk ;

[1]

**[Total: 10]**

- 5 (a) total = 39 500 ;  
÷ 5 = 7900 ;

[2]

- (b) area of the country ;  
area of the forest ;  
any replanting (elsewhere) ;

[max 2]

- (c) (i) use land for agriculture/building/mining ;  
for fuel ;  
use wood for construction etc. ;

[max 2]

- (ii) extinction ;  
loss of animal habitat ;  
disruption of food chains/webs ;  
loss of soil ;  
flooding ;  
increased CO<sub>2</sub> (in atmosphere) ;

[max 2]

**[Total: 8]**

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- 6 (a) (i) visible placed to left of UV ; [1]  
(ii) right hand side/gamma end ; [1]
- (b) (i) radiation that causes atoms/molecules to ionise/lose electrons ; [1]  
(ii) cancer/mutations ; etc. [1]  
(iii) gamma more penetrating ;  
gamma has no charge, alpha has (positive) charge ;  
gamma is a wave, alpha is a particle ;  
gamma less ionising ; [max 2]
- (c) (i) B ; [1]  
(ii) E ; [1]
- (d) error labelled ;  
not total internal reflection/wave leaves fibre/  
angles of incidence and reflection not equal ; [2]
- (e) (i) principal focus correctly labelled ; [1]  
(ii) focal length correctly shown ; [1]
- [Total: 12]**
- 7 (a) maintaining constant ;  
internal environment ; [2]
- (b) (i) K = (named type of) receptor ;  
L = sweat gland ; [2]  
(ii) fat(ty) ; [1]  
(iii) arterioles ;  
vasoconstriction ;  
capillaries ; [3]
- [Total: 8]**
- 8 (a) (speed =) distance/time or  $70/1.2$  ;  
=  $58.3(3)$  (km/hr) ; [2]
- (b) (i) radiation ; [1]

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(ii) particles move faster / have more KE ;  
collide with type walls more often / hit tyre wall harder / with greater force ; [2]

(c) the temperature at which ;  
a solid turns into a liquid ; [2]

(d) use a magnet – steel as magnetic ; [1]

(e) (i) 20 (allow 10) (Hz) ;  
to 20 000 (allow 25 000) (Hz) ; [2]

(ii) high frequency ; [1]

**[Total: 11]**

9 (a) (i) a lead atom / nucleus contains 82 protons ;  
the total number of particles in the atom / nucleus is 207 /  
the total number of protons + neutrons in the lead atom is 207 ; [2]

(ii) isotopes ; [1]

(b) (i) label line goes to the negative electrode and nowhere else ; [1]

(ii) melt the lead bromide ; [1]

(iii) bromine is produced ;  
orange / brown ; [2]

(c) (i) 8 to 14 ;  
lithium hydroxide solution is alkaline [2]

(ii) hydrogen ; [1]

(iii) lithium hydroxide + carbon dioxide → lithium carbonate + water ; [1]

**[Total: 11]**

10 (a) two or more alternative forms of a gene ;  
only expressed when dominant allele is not present /  
not expressed when dominant allele is present /  
needs two present to show /  
not expressed when heterozygous ; [2]

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(b) P = Nn ;  
 Q = NN ;  
       or Nn ;  
 R = nn ;

[4]

(c) (i) (the physical or other) features / characteristics of an organism (due to both its genotype and environment ;

[1]

(ii) has genotype Nn / contains two different alleles ;

[1]

**[Total: 8]**

11 (a) (i) molecule ;

[1]

(ii) S<sub>8</sub> ;

[1]

(b) (i) reference to gain of oxygen (by sulfur atoms) ;

[1]

(ii) red / orange ;  
 solution is acidic / sulfur dioxide is acidic / non-metal oxides are acidic ;

[2]

(iii) reference to formation of sulfur dioxide ;  
 sulfur dioxide reacts forming acid rain ;  
 acid rain causes chemical damage to buildings ;  
 biological damage to plant / animal life ;  
 sulfur dioxide poses health risks for humans ;

[max 3]

**[Total: 8]**

12 (a) (i) all components present and the correct number ;  
 in series circuit ;  
 all symbols correct ;

[3]

(ii) voltmeter (correct symbol) connected in parallel across lamp ;

[1]

(b) (i) not a straight line ;

[1]

(ii) 0.7 (A) ;

[1]

(c) R<sub>T</sub> = R<sub>1</sub> + R<sub>2</sub> or 4 + 12 ;  
 R<sub>T</sub> = 16 (Ω) ;

[2]

**[Total: 8]**

13 (a) add Benedict's solution ;  
 heat ;  
 red (precipitate) ;

[3]

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(b) (i) nucleus ;  
cell wall ;  
chloroplast ; [3]

(ii) cell wall ; [1]

(iii) prevents constipation ; [1]

**[Total: 8]**