

CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0654 CO-ORDINATED SCIENCES

0654/33

Paper 3 (Extended Theory), maximum raw mark 120

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1 (a)	element	Group number in Periodic Table	Number of outer electrons in one atom	reactive / unreactive
	A	(1)	1	reactive
	B	(7)	7	(reactive)
	C	0	(8)	unreactive

(1 for each column correct) ; ; ;

[3]

(b) (D)

an alloy is a mixture of metals ;

E is not a mixture / is only one substance / is pure / single metal ;

F does not show metals / is a mixture of gases / is a mixture of compounds ;

[max 2]

(c) (i)

reaction rate is lower ;

(ethanol) molecules have lower average energy / are moving more slowly ;
so frequency of collision with sodium is lower ;

lower chance of successful collision ;

R: there are fewer collisions

[max 3]

(ii)

molar volume $24\,000\text{ cm}^3$;

$8.4 \div 24\,000 = 0.00035$;

(allow 1 mark for $8.4 \div 24 = 0.35$)

OR

volume of hydrogen 0.0084 dm^3 ;

$0.0084 \div 24 = 0.00035$;

[2]

[Total: 10]

2 (a) (i) 4.5 (V) ;

[1]

(ii) (charge =) current \times time ;

= 54 ;

coulombs (C) ;

[3]

(iii) conventional current flows from positive to negative ;

(electric current) is flow of negative charged

electrons / electrons / charge / electricity flow / s from negative to positive ;

[2]

(b) working or $1/R = 1/R_1 + 1/R_2$ or $(R =) R_1R_2/R_1+R_2$;

$R = 2.5(\Omega)$;

[2]

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(c) (i) **B** (angle of) incidence
C (angle of) reflection ;
(both required for mark) [1]

(ii) angle **C** will double ; [1]

[Total: 10]

3 (a) sex/exchange of sexual fluids ;
shared needles ;
(contaminated) blood transfusion/exchange of blood ;
mother to baby ; [max 2]

(b) (i) increased and then decreased ; [1]

(ii) increased ; [1]

(c) (i) response to infection/pathogen ; [1]

(ii) cells destroyed by virus/disease ;
A: killed [1]

(d) immune system is suppressed ;
more likely to suffer from other diseases/reduced resistance to infection ;
because less antibody production ; [2]

(e) education ;
screening blood transfusions ;
(encouraging) use of condoms/barrier contraception ;
free needles for drug addicts/(encouraging) not sharing ;
AVP ; [max 2]

[Total: 10]

4 (a) (i) electrons ; [1]

(ii) move apart/repel ;
because like charges repel each other ; [2]

(b) (i) sound waves are reflected ; [1]

(ii) compressions are regions where the particles in air are close
together/rarefactions are regions where the particles in air are spread out ;
compressions are regions with air at higher pressure than
normal/rarefactions are regions with air at lower pressure than normal ; [1]

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(iii) particles collide more quickly ;
particles closer together ; [2]

(c) (acceleration =) force/mass ;
acceleration = $350/785 = 0.45 \text{ (m/s}^2\text{)}$; [2]

[Total: 9]

5 (a) (i) ionic/electrovalent ; [1]

(ii) correct symbols show alternating sodium and chloride in both directions ;
indication that particles are positive sodium ions and negative chloride ions ; [2]

(b) (i) dissolve in water/make a solution ; [1]

(ii) hydrogen ;
sodium hydroxide ; [2]

(iii) chloride ions lose electrons ;
reference to ions discharged/(each loses) one electron ;
(resulting) chlorine atoms combine in pairs ;
chlorine atoms form covalent bond/share a pair of electrons ; [max 3]

(c) $\text{P}_4 + 6\text{Cl}_2 \rightarrow 4\text{PCl}_3$ [2]

all formulae ;
and then balanced ; [2]

[Total: 11]

6 (a) (i) arrow from cell and out through stoma ; [1]

(ii) stoma/stomata ; [1]

(b) (i) faster water loss ;
faster/more evaporation ; [2]

(ii) faster water loss ;
more escape routes (for diffusion) ; [2]

(c) smaller air spaces/fewer pores ; [1]

[Total: 7]

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- 7 (a) (i) rust ; [1]
- (ii) (K)
(rusting requires) air/oxygen and water present (together) ; [1]
- (b) (i) nitrogen ; ignore aluminium /copper
reference to pH 7 in water ; [2]
- (ii) (phosphorus oxide)
forms an acidic oxide ;
means that it must be a non-metal oxide and phosphorus is a non-metal ; [2]
- (c) (less)
reaction is exothermic/gives out heat/thermal energy ;
the idea that chemical energy (of reactants) is transferred to
surroundings/released as heat/thermal energy,
so less chemical energy remains ; [2]
- (d) sulfur dioxide + oxygen → sulfur trioxide
(reactants and products) ; ; [2]
- (e) (dilute) sulfuric acid ; [1]
- [Total: 11]**
- 8 (a) useful power output/total power input OR working (1.2/4.0)
- OR**
- useful energy output/total energy input OR working (1.2/4.0) ;
= 30 (%) ; [2]
- (b) (i) nuclei split ; [1]
- (ii) (nuclear) fusion ;
nuclei fuse/join together ; [2]
- (c) (i) to reduce current ;
to reduce power/energy losses ; [2]
- (ii) $V_s/V_p = N_s/N_p$;
output voltage = $500\,000 \times 33\,000/40\,000 = 412\,500$ (V) ; [2]
- (d) sulfur dioxide/nitrogen oxide ; [1]

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(e) damages leaves/kills animals ;
acidifies soils ;
leaches mineral ions from soil ;
acidifies water ;
toxic compounds soluble in acidic water ;
denatures enzymes ;

[max 2]

(f) ref to CO₂ ;
trap solar radiation/greenhouse effect ;
(re-)radiate it back to Earth ;

[max 2]

[Total: 14]

9 (a) both increasing ;
group 2 increasing faster/more ;

[2]

(b) (i) growth/repair ;

[1]

(ii) energy ;

[1]

(c) calcium ;
for bones ;

OR

iron ;
for blood ;

[2]

(d) (named) vitamin ;

[1]

(e) genetically similar/so this is not a variable ;

[1]

(f) (i) a control/
shows that the difference is due to the diet/not due to the mice ;

[1]

(ii) grow more slowly/decreases, because no milk/vitamins ;

OR

continue to grow (for a while), as Group 2 did ;

[1]

(g) taking in nutrients/organic substances and ions ;
containing raw materials/energy ;
absorbing/assimilating them ;

[max 2]

[Total: 12]

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- 10 (a) (i) (L or O)
contain only one type of atom / contain only carbon atoms ;
(M or N)
more than one type of atom / elements bonded together ; [2]
- (ii) (M)
idea that no hydrocarbon has less than five atoms / could be
butane / C₄H₁₀ / contains C and H atoms but could not be CH₂ or C₂H / N is
CO₂ / other logical deductive statement ; [1]
- (iii) (N)
this must be carbon dioxide ;
supporting detail, e.g. only one with three bonded atoms / fits the formula
CO₂ / double bonds ; [2]
- (b) (i) covalent ; [1]
- (ii) 10 ;
there are ten (single) bonds /
each (single) bond represents a shared pair ; [2]
- [Total: 8]**
- 11 (a) C₆H₁₂O₆ + 6O₂ = 6CO₂ + 6H₂O
(one mark for correct formulae, one mark for balanced equation) ; ; [2]
- (b) (i) does not use oxygen ; [1]
- (ii) releases less energy ; [1]
- (c) produces alcohol / ethanol ;
produces carbon dioxide / makes "fizzy" / AW ; [2]
- [Total: 6]**
- 12 (a) (i) speed / transverse waves / passes through vacuum ; [1]
- (ii) frequency or wavelength ; [1]
- (iii) wavelength = velocity / frequency ;
wavelength = $\frac{3.0 \times 10^8}{6.7 \times 10^{14}} = 4.5 \times 10^{-7} \text{ (m)}$; [2]
- (iv) *amplitude*: **B** and *wavelength*: **E** ;
(both required in this order) [1]

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- (b) (i) area under graph or evidence of working ;
 $= (90 \times 40) + (\frac{1}{2} \times 30 \times 40) = 3600 + 600 = 4200 \text{ (m)} ;$ [2]
- (ii) **A** written anywhere on section from $1\frac{1}{2}$ –2 minutes ; [1]
- (iii) (acceleration =) change in speed / time = $40/30 ;$
 $= 1.3 \text{ (m/s}^2\text{)} ;$ [2]
- (iv) (kinetic energy =) $\frac{1}{2} mv^2 ;$
 $= \frac{1}{2} \times 1200 \times 40 \times 40 = 960\,000 \text{ (J)} ;$ [2]

[Total: 12]