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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CAMBRIDGE
International Examinations

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 cm^3 ;
8.4 ÷ 24 000 = 0.00035 ;
(allow 1 mark for 8.4 ÷ 24 = 0.35)

OR

volume of hydrogen 0.0084 dm^3 ;
0.0084 ÷ 24 = 0.00035 ; [2]

[Total: 10]

2 (a) (i) 4.5 (V) ; [1]

(ii) (charge =) current × time ;
= 54 ;
coulombs (C) ; [3]

(iii) conventional current flows from positive to negative ;
(electric current) is flow of <u>negative</u> 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 (Ω) ; [2]

(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]

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

(c) (acceleration =) force / mass ;
acceleration = 350 / 785 = 0.45 (m / s^2) ; [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) $P_4 + 6Cl_2 \rightarrow 4PCl_3$ [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]

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) Vs / Vp = Ns / Np ;
output voltage = 500 000 × 33 000 / 40 000 = 412 500 (V) ; [2]

(d) sulfur dioxide / nitrogen oxide ; [1]

(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 CO_2 ;
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) <u>taking in</u> nutrients / organic substances and ions ;
containing raw materials / energy ;
absorbing / assimilating them ; [max 2]

[Total: 12]

10 (a) (i) (**L** or **O**)
contain only one <u>type</u> 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 / C_4H_{10} / contains C and H atoms but could not be CH_2 or C_2H / N is CO_2 / 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 CO_2 / 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) $C_6H_{12}O_6 + 6O_2 = 6CO_2 + 6H_2O$
(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 = $\frac{3.0 \times 10^8}{6.7 \times 10^{14}} = 4.5 \times 10^{-7}$ (m) ; [2]

(iv) *amplitude:* **B** **and** *wavelength:* **E** ;
(both required in this order) [1]

(b) (i) area under graph or evidence of working ;
= (90 × 40) + (½ × 30 × 40) = 3600 + 600 = 4200 (m) ; [2]

(ii) **A** written anywhere on section from 1½–2 minutes ; [1]

(iii) (acceleration =) change in speed / time = 40 / 30 ;
= 1.3 (m / s^2) ; [2]

(iv) (kinetic energy =) ½ mv^2 ;
= ½ x 1200 × 40 × 40 = 960 000 (J) ; [2]

[Total: 12]