

MARK SCHEME for the October/November 2013 series

0653 COMBINED SCIENCE

0653/21

Paper 2 (Core Theory), maximum raw mark 80

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Page 2	Mark Scheme	Syllabus
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- 1 (a) (i) reference to reactivity of elements / compound is more stable ;
- (ii) element cannot be simplified / decomposed chemically ;
 element contains just one type of atom ;
 element is found in Periodic Table ; [max 1]
 (or corresponding answers for compound)
- (iii) heat / boil solution ;
 water evaporates leaving sodium chloride ;
 leave to evaporate ; [max 2]
- (b) idea that formula shows the ratio Ca:F particles is 1:2 ; [1]
- (c) (i) electrolysis ; [1]
- (ii) bromine is formed ;
 bromine (vapour) is orange ;
 bromine evaporates / boils off ; [max 2]
- [Total: 8]**

- 2 (a) arrow going downwards ; [1]
- (b) mass = density $\times$ volume ;
 = $1.26 \times 0.15 = 0.19$ kg ; [2]
- (c) solid – all particles touching, regular arrangement particles of similar size ;
 liquid – most particles touching, irregular arrangement particles of similar size ; [2]

(d)

description	S, L or G
It cannot flow	S
It cannot transfer heat by convection	S
It contains particles which are widely separated	G
It expands the most when heated	G
It fills a closed container	G
It has a fixed volume but not a fixed shape	L

[2]

[Total: 7]

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- 3 (a) (i) substance produced by a gland
carried in blood
affects activity of target organs
destroyed by liver ;; [max 1]
- (ii) increases heart rate / increases breathing rate / sweating / pupil dilation / increases pulse rate / faster reactions / increases rate of respiration / increase in oxygen to muscles/brain ; accept any correct answer [1]
- (b) (i) increased then decreased
increased more rapidly than it decreased
maximum 6.6 units /at 40 minutes
quote figures, e.g. returned to normal by 100 minutes ;; [max 3]
- (ii) (blood glucose concentration) did not rise as high
maximum 4 units rather than 6.6 units
rose more slowly
fell more slowly
took longer to return to normal ;; [max 3]
- (c) reduces, constipation / bowel cancer / risk of diabetes ; [1]
- [Total: 10]

- 4 (a) (i) Y and Z ;
non-metals ; [2]
- (ii) Z ;
it is a noble / inert gas / ref to filled shells in atoms ; [2]
- (b) (i) Group 1 ;
reference to at least one of the proton numbers plotted on graph ; [2]
- (ii) rubidium ; [1]
- (c) (i) insoluble substance dissolved / disappeared
colour change / coloured substance produced ; [max 1]
- (ii) (reactants→) copper sulfate ;
+ water ; [2]
- [Total: 10]

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- 5 (a) speed = distance/time ;
= 3000/30 = 100 km/hr ;
- (b) (i) 120 km/hr ; [1]
(ii) changing speed / going faster / accelerating ; [1]
- (c) $1,000,000 \times 0.10 \times 0.70$;
= 70,000 J ; [2]
- (d) (i) geothermal/tides/hydroelectric/waves/wind/biomass ; [1]
(ii) fossil fuels not wasted
no CO₂ produced ; [max 1]
[Total: 8]
- 6 (a) A (right) atrium ;
B (right) ventricle ; [2]
- (b) contracts ;
reduces volume of ventricle ;
increases pressure ; [max 2]
- (c) needs to produce less force ;
to push blood into ventricle ;
not out of the heart ; [max 2]
- (d) uses more energy ;
energy obtained by respiration ;
respiration uses oxygen ; [max 2]
[Total: 8]

Page 5	Mark Scheme	Syllabus
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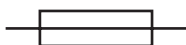
- 7 (a) (i) petroleum / crude oil / natural gas ;
(ii) compound of hydrogen and carbon only ;
(iii) $C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$; [2]
(allow Br_2 anywhere in product formula)
- (b) (i) the temperature (inside kiln) is high / is $950\text{ }^{\circ}\text{C}$;
exothermic means the reaction releases heat (energy) ; [2]
- (ii) carbon dioxide
carbon monoxide
water (vapour)
two of the above with
produced by combustion of propane / hydrocarbons ;;; [max 3]
(ignore refs to complete combustion)

[Total: 9]

- 8 (a) Correct symbol for
open switch 

resistor 

voltmeter 

fuse 

[2]

- (b) damaged insulation/bare wires ;
danger of electrocution ; [2]

- (c) (i) 0.5 A
0.5 A ; (need both) [1]

- (ii) $R = R_1 + R_2$;
 $= 10\ \Omega$; [2]

[Total : 7]

Page 6	Mark Scheme	Syllabus	0653
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- 9 (a) (i)** controls what enters / leaves the cell ;
- (ii)** cell wall ;
chloroplast ;
large permanent vacuole ;
vacuole membrane ; [max 2]
- (iii)** takes place in chloroplasts ;
chlorophyll absorbs / traps, sunlight / energy from sunlight ;
water combines with carbon dioxide ;
produces oxygen and glucose / sugar / carbohydrate ; [max3]
- (b)** extinction ;
soil erosion ;
flooding ;
build up of carbon dioxide ;
drought ;
increase in global warming ; [max 3]
- [Total: 9]**
- 10 (a) (i)** infrared ; [1]
- (ii)** microwaves ; [1]
- (b)** 100 m ;
1.5 m ; [2]
- [Total: 4]**

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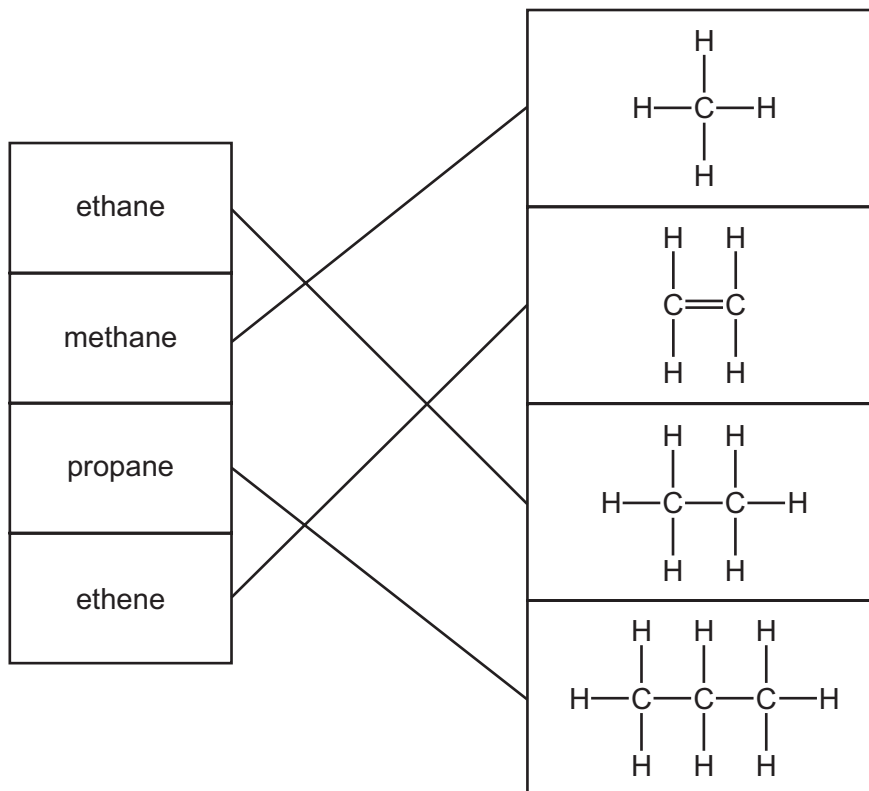
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- 1 (a) (i) **Q** conductor and **S** insulator ;
because iron is a metal ;
because sulfur is a non-metal ;
- (ii) chlorine ; [2]
copper ;
- (iii) electrolysis ; [1]

(b)



(all correct 2 marks, 1 correct 1mark);; [2]

- (c) (i) CF_2Cl_2 ; [1]
(allow elements in any order)
- (ii) (not hydrocarbon) [1]
contains elements other than carbon and hydrogen/owtte ;

[Total: 10]

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- 2 (a) (i) slow down ;
(ii) frequencies ;
(iii) frequencies ; [1]
(iv) amplitudes ; [1]
- (b) sound waves need a medium ;
as the air is sucked out there is less of a medium to convey the sound wave ;
no air means sound waves cannot pass through ; [3]

[Total 7]

- 3 (a) (i) label to xylem ;
label to phloem ; [2]
- (ii) transport (in either) ;
xylem:
transports water ;
transports, mineral (ions)/named ion ;
provides support ;
phloem:
transports nutrients made in the leaves ;
e.g. sucrose/sugar ; [max 4]
- (b) (i) more root hairs ;
shorter root hairs ; [2]
- (ii) increase in number in both types is the same/0.44 more root hairs
per unit area ;
decrease in length is much greater in B plants ; [2]
- (iii) reduced surface area ;
less able to take up water/mineral ions/named ion ;
reduced water causes reduced photosynthesis ;
less glucose made ;
glucose used for energy/respiration/growth ;
less mineral (ions), less growth ; [max 3]

[Total 13]

Page 4	Mark Scheme	Syllabus	0653
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- 4 (a) (i) increased ;
because mixture has become more alkaline/solid has reacted with water ;
- (ii) colour change (blue) to red ;
effervescence/(gas) bubbles produced ; [2]
- (b) (i) colour change of cobalt chloride paper shows water ;
and cloudy limewater shows carbon dioxide ; [2]
- (ii) paper covered with (layer of) sodium hydrogencarbonate/owtte ;
provides barrier between paper and air/oxygen ;
(if paper does burn) sodium hydrogencarbonate decomposes ;
to carbon dioxide/water which inhibits burning/owtte ; [max 2]
- [Total: 8]
- 5 (a) (i) series ; [1]
- (ii) ammeter in series ;
correct symbol ;
voltmeter in parallel ;
correct symbol ; [4]
- (iii) $R = R_1 + R_2$;
 $= 15 \Omega$; [2]
- (b) density = mass/volume ;
 $= 9000/3000 = 3 \text{ g/cm}^3$; [2]
- (c) water particles turn from liquid to gas ;
heat (energy) from body evaporates water particles ; [max 1]
- [Total: 10]

Page 5	Mark Scheme	Syllabus	
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- 6 (a) A penis ;
B sperm duct ;
C urethra ;
- (b) sperm cannot pass through ;
idea that sperm cannot fertilise an egg ; [2]
- (c) (i) human immunodeficiency virus ; [1]
- (ii) not have sexual intercourse/wear a condom ;
not sharing needles/not donating blood ; [max 1]
- 7 (a) (i) liquid
solid ; (both required) [1]
- (ii) iodine atom contains more protons, neutrons (and electrons) than bromine ;
iodine atom has more electrons shells than bromine ; [2]
- (iii) mixture becomes brown ;
with one of the following
because iodine is produced ;
iodine is displaced by chlorine ;
chlorine is more reactive than iodine ; [max 2]
- (b) to kill harmful bacteria/microorganisms ;
to make water safe (for humans) ; [2]
- (c) flask contains a mixture/chlorine and helium atoms have not bonded ;
because helium is noble gas/inert ; [2]
(allow refs to filled electron shells in helium)

[Total: 9]

Page 6	Mark Scheme	Syllabus	For
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- 8 (a) (i)** driving force forwards and friction forces backwards ;
- (ii)** air resistance/tyres on road/brakes ;
- (iii)** equal and opposite ; [1]
- (iv)** constant speed ; [1]
- (v)** gravity/weight ; [1]
- (b) (i)** speed = distance/time ;
= 400/25 = 16 m/s ; [2]
- (ii)** kinetic ; [1]
- (iii)** gravitational potential ; [1]

[Total: 9]

- 9 (a) (i)** producer ; [1]
- (ii)** carbohydrate/glucose/sugar/starch/other ; [1]
- (iii)** energy (flow/transfer) ; [1]
- (b)** more microscopic green plants ;
fewer of other animals/named animal ; [2]
- (c)** carbon dioxide ;
methane ; [2]

[Total:7]

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- 1** (a) A to cell membrane/membrane round vacuole ;
B to nucleus ;
C to cell wall/large vacuole ; [1]
- (b) water ;
mineral (salts)/named mineral ; [2]
- (c) (i) transport ;
of sugars/substances made in the leaves ; [2]
- (ii) roots have no sucrose/short of nutrients ;
no source of energy/cannot respire ; [2]
- [Total: 9]**
- 2** (a) (i) argon/Ar ; [1]
- (ii) calcium/lithium and oxygen/sulfur/fluorine ;
metal with non-metal ; [2]
- (b) (i) nucleus ; [1]
- (ii) 15 ;
same as number of electrons/3 shells = Period 3, 5 outer electrons means Group 5 so
must be phosphorus which has proton number 15 ; [2]
- [Total: 6]**
- 3** (a) change resistance (of circuit)/change current through resistor ; [1]
- (b) X – ammeters need to be in series in a circuit ; [1]
- (c) 13.3 ;
ohms ; [2]
- [Total: 4]**

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4 (a)

nutrient tested for	reagent	result	conclusion
protein	biuret	purple	contains protein
starch	iodine (solution)	blue black	contains starch
fat	ethanol (and water)	milky white	contains fat

one mark for any two correct ; ; ; [3]

(b) for growth
for repair
other use of protein ; ; [max 2]

(c) increases surface area ;
idea of making it easier for enzymes to make contact ; [2]

(d) soil erosion
flooding
increases carbon dioxide in atmosphere
extinction
drought
increase in global warming ; ; [max 2]

[Total: 9]

5 (a) (i) Q ;
orange layer is rust ;
formed when iron reacts with (dissolved) air and water ; [3]

(ii) calcium/magnesium/zinc ;
hydrogen ; [2]

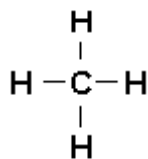
(iii) (acid) temperature was lower/metal in **P** was less reactive/metal in **P** had smaller surface area ; [1]

(b) (i) different boiling points ; [1]

(ii) (vehicle) fuel ;
burns easily/releases much energy when burnt ; [2]

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(c) (i)



;

[1]

(ii) (methane) + oxygen $\rightarrow$ carbon dioxide + water ; ;
(LHS and RHS)

[2]

[Total: 12]

6 (a) (i)

uses		type of radiation		effects on tissue
screening luggage		X-rays		activates sensitive cells in retina
security marking		microwave		kills cancerous cells
satellite communication		ultra violet		heats water in tissues
seeing		visible light		causes tanning of skin

Each side, 3 correct 2mk, 1 correct 1mk

[4]

(b) sine wave ;
amplitude correctly labelled ;
wavelength correctly labelled ;

[3]

(c) (i) same horizontal level as nose ;
same distance behind mirror that nose is from mirror ;

[2]

(ii) same size as object ;
upright ;
virtual ;

[3]

[Total: 12]

Page 5	Mark Scheme	Syllabus	
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- 7 (a) A trachea ;
B lung ;
- (b) (i) movement of molecules ;
from region of high concentration to low concentration/down a concentration gradient ; [2]
- (ii) plasma ; [1]
- (iii) more energy used/more muscle contraction ;
more carbon dioxide produced by cells ;
in respiration/by oxidation of glucose ; [max 2]
- (iv) increases/faster ;
greater diffusion gradient (from blood to alveolus) ; [2]

[Total: 9]

- 8 (a) (i) gas into limewater ;
goes cloudy ; [2]
- (ii) salt ; [1]
- (iii) 9 ;
3 ; [2]
- (b) (i) the higher the pH , the less acidic/the lower the acid concentration ;
lowering acid concentration decreases the rate ; [2]
(accept correct collision theory explanation)
- (ii) temperature
surface area of calcium carbonate
degree of agitation of the mixture ; ; [max 2]

[Total: 9]

Page 6	Mark Scheme	Syllabus	
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- 9** (a) (i) 80 m ;
- (ii) not moving ;
- (iii) unbalanced because speed is changing ; [1]
- (b) geothermal/hydroelectricity/waves/wind/biomass ; [1]
- (c) (i) kinetic energy ; [1]
- (ii) gravitational potential energy ; [1]
- (d) density = mass/volume ;
= 45/36 = 1.25 g/cm³ ; [2]
- (e) particles far apart ;
irregular arrangement ; [2]

[Total: 10]