

**MARK SCHEME for the October/November 2011 question paper
for the guidance of teachers**

0653 COMBINED SCIENCE

0653/31

Paper 3 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

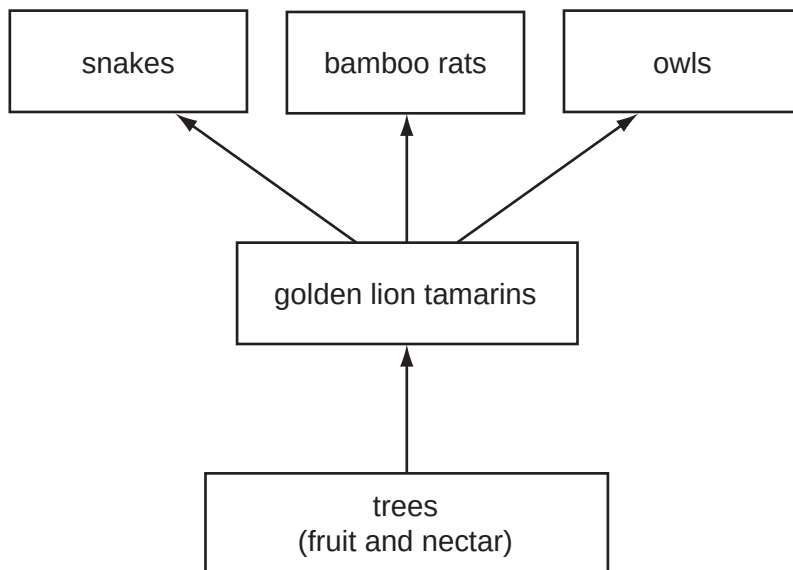
Cambridge is publishing the mark schemes for the October/November 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Page 2	Mark Scheme: Teachers' version	Syllabus
	IGCSE – October/November 2011	0653

- 1 (a) (i) speeds up reactions ;
provides lower (activation) energy route ;
without being chemically altered / owtte ;
(**reject** does not take part in the reaction) [m] [1]
- (ii) transition (elements) ; [1]
- (iii) $\text{Fe}_3\text{O}_4 + 4\text{H}_2 \rightarrow 3\text{Fe} + 4\text{H}_2\text{O}$;; [2]
(allow 1 mark for 4H_2 and $4\text{H}_2\text{O}$ and then 1 mark for 3Fe)
- (iv) reduced ;
reduction is electron gain ;
positive (iron) ions are discharged / gain electrons ; [max 2]
- (v) $56 \times 3 / 16 \times 4$;
= 232 ; [2]
- (b) symbols shown in correct atoms ;
three bond pairs around central atom ;
lone pair correctly shown ; [3]

[Total: 12]

2 (a) (i)



- plants and tamarins correct ;
all three predators correct ;
all arrows in right direction ; [3]
- (ii) energy lost, between trophic levels / as you go up the chain ;
as heat / in respiration / other way in which energy is lost ;
the idea that there is less energy for (top) predators ; [max 2]

Page 3	Mark Scheme: Teachers' version	Syllabus	
	IGCSE – October/November 2011	0653	

- (b) (i) fewer faeces further from tree ;
furthest distance from tree is 400 m ;
figures quoted, e.g. 31 % of faeces deposited within 50 m of tree ; [m]
- (ii) faeces provide nutrients for, young plants/seedlings (not seeds) ;
less competition (for seedlings) away from parent tree ;
example of factors competed for e.g. light, water, nutrients ;
help to colonise new areas ; [max 3]

[Total: 10]

- 3 (a) (i) (car **B** – no mark)
low to ground/low height ;
low centre of mass ; [2]
- (b) (speed =) distance / time ; (allow accepted symbols but reject use of units as symbols)
= 330 / 1.5 = 220 km / h ; [2]
- (c) (i) **B** – constant speed ;
C – decelerating (negative) acceleration ; [2]
- (ii) distance = area under graph / (6 × 40 × 0.5) + (4 × 40) ;
= 280 m ; [2]
- (iii) acceleration = change in speed ÷ time / ref. to gradient of **A** / 40 ÷ 6 ;
= 6.67 m/s² ; [2]
- (iv) force = mass × acceleration ;
= 1500 × 6.67 = 10 005 N ; [2]

[Total: 12]

- 4 (a) (i) **Q** ;
R ; [2]
- (ii) arrow going upwards on **R** (towards spinal cord) and downwards on **S** ; [1]
- (iii) label to spinal cord ; [1]
- (iv) faster/less time for damage to be done to hand ; [1]
- (b) (i) red blood cell ; [1]
- (ii) 46 ; [1]

[Total: 7]

Page 4	Mark Scheme: Teachers' version	Syllabus	0653
	IGCSE – October/November 2011		

- 5 (a) (i) rate increases / or implied e.g. gas given off more quickly ;
(ii) particles / ions / molecules move faster / have increased K.E. ;
reference to increased collision frequency with magnesium ;
- (b) (i) unreactive (with acid) / not brittle ; [1]
reject references to rusting
- (ii) (saturated hydrocarbons) heated / vaporised ;
contacted with catalyst ; [2]

[Total: 6]

- 6 (a) (i) $A_1 = 8 \text{ (A)}$, $A_4 = 2 \text{ (A)}$;; [2]
- (ii) energy = power $\times$ time ;
 $72 \times 20 = 1440 \text{ J}$; [2]
- (iii) $1 \div R = 1 \div R_1 + 1 \div R_2$;
 $= 1 \div 6 + 1 \div 2$;
 $(R =) 1.5 \Omega$; [3]
- (b) (i) reduce energy losses ; [1]
- (ii) $(N_p \div N_s =) 25000 \div 600000$;
 $= 1 : 24$; [2]

[Total: 10]

7 (a)

enzyme	one site of action	type of nutrient that is broken down	product that is formed
amylase	mouth	starch	maltose
protease / trypsin / pepsin	stomach / small intestine (see note below)	protein	amino acids

note: if protease given, allow either stomach or small intestine
if trypsin, must be small intestine
if pepsin, must be stomach

one mark for any two correct ;;;

[3]

Page 5	Mark Scheme: Teachers' version	Syllabus
	IGCSE – October/November 2011	0653

- (b) (i) (rice has) more protein ;
needed for growth ;
- (ii) add Benedict's solution / Fehlings solution ;
heat ;
brick red / orange colour indicates sugar present ; [3]
- (iii) as sugar / sucrose ;
in phloem ; [2]

[Total: 10]

- 8 (a) (i) 8 (%) ; [1]
- (ii) (89) answer related logically to number of elements in Periodic Table ; [1]
- (b) (i) so ions can move / if solid, ions could not move / so that it can be an electrolyte / so that it will conduct charge (not electrons) ; [1]
- (ii) anode is positively charged ;
attracts negative (oxide) ions / opposite charges attract / would be repelled from negative cathode ; [2]
- (iii) Al^{3+} (ions) gain electrons / O^{2-} (ions) lose electrons ;
 Al^{3+} gains three electrons / O^{2-} loses two electrons ;
some relevant logical statement linking to six electrons ; [3]
e.g. so if six electrons then number of Al atoms is $6 \div 3 = 2$
so six electrons must be provided by $6 \div 2 = 3$ oxide ions

[Total: 8]

- 9 (a) (i) (gamma able) to penetrate the food / packaging ; [1]
- (ii) 'the same number' and 'different numbers' (both required in this order) ; [1]
- (iii) to protect workforce / stop radiation escaping ; [1]
- (b) (i) use Geiger counter / other correct instrument to measure radiation emitted ; [1]
- (ii) radiation emitted by unstable radioactive atoms / (radiated) food does not contain unstable radioactive atoms ; [1]

[Total: 5]

**MARK SCHEME for the October/November 2011 question paper
for the guidance of teachers**

0653 COMBINED SCIENCE

0653/32

Paper 3 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Page 2	Mark Scheme: Teachers' version	Syllabus	
	IGCSE – October/November 2011	0653	

- 1 (a) (i) carbon dioxide ;
- (ii) (there is not enough evidence) result shows that:
carbonate present ;
but not calcium/ need to show it is calcium carbonate ; [2]
- (b) (i) carbon dioxide dissolves in/ reacts with (sea)water/ rain ;
makes water more acidic/ less alkaline;
non-metal oxides are acidic ; [max 2]
- (ii) accept any reasonable attempt at a scientific answer:
e.g. calcium carbonate may react with more acidic water/ lower pH makes it
more difficult for coral to extract ions from sea/ coral (polyps) does not
survive in more acidic water ; [1]
- [Total: 6]
- 2 (a) glucose + oxygen → carbon dioxide + water ;
(2 marks for all correct, one mark if any mistake) [2]
- (b) in the blood/ in an artery/ in a capillary ;
combined with haemoglobin/ as oxyhaemoglobin ;
in red blood cells ; [max 2]
- (c) (i) evaporation ;
(evaporation) takes heat from body ; [2]
- (ii) (assume answer refers to not drinking fluid unless otherwise stated)
rose higher ;
rose faster ;
use of comparative figures, e.g. 40.0°C and 38.7°C ; [max 2]
- (iii) less sweat produced when no fluids drunk/ or reverse argument ;
to maintain water content of body/ ref. to homeostasis ; [2]
- [Total: 10]
- 3 (a) traps layer of air ;
(air is a good) insulator ; [2]
- (b) does not deplete fossil fuel reserves/ non-renewable ;
idea that dung is carbon neutral/ renewable ;
kerosene is a hydrocarbon fuel ; [max 2]

Page 3	Mark Scheme: Teachers' version	Syllabus
	IGCSE – October/November 2011	0653

- (c) (i) allow 20 – 100 Hz ;
- (ii) vibration passes ;
 from particle to particle ;
 reference to rarefaction and compression / diagram ;
 a series of (compressions and rarefactions) / diagram ;

[max 2]

[Total: 7]

4 (a) iron ;

[1]

(b) (i) $\text{SnO}_2 + 2\text{C} \rightarrow \text{Sn} + 2\text{CO}$;; (symbols and balanced)

[2]

(ii) aluminium more reactive than carbon ;
 tin less reactive than carbon ;
 Al more strongly bonded to oxygen ;
 (allow max 1 for the simple statement: aluminium is more reactive)

[max 2]

(iii) reference to use of carbon electrodes ;
 aluminium oxide is melted / dissolved in cryolite ;
 aluminium ions are positive / are cations ;
 ions attracted move to negative electrode / cathode ;
 ions gain electrons from / are discharged at negative electrode ;

[max 3]

(c) (i) $64 + 56 + 32 \times 2 / 184$;
 (allow 183.5)

[1]

(ii) $7.80 \times 0.89 = 6.9(42)\text{g}$ (unit required) ;

[1]

[Total: 10]

5 (a) (i) X – stigma ;
 Y – anther / stamen ;

[2]

(ii) stigma, feathery / outside flower / large surface area ;
 stamen, dangling / outside flower ;
 no petals ; (allow small petals)

[max 2]

(iii) (assume answer refers to sexual reproduction unless otherwise stated)
 involves gametes ;
 involves fertilisation ;
 zygote produced ;
 offspring genetically different / not clones ;

[max 2]

(b) acid rain ;
 caused when nitrogen oxides, react with / dissolve in, (rain) water ;
 damages plants ;
 damages aquatic animals ;

[max 3]

[Total: 9]

Page 4	Mark Scheme: Teachers' version	Syllabus	
	IGCSE – October/November 2011	0653	

- 6 (a) group of cells ;
carrying out a particular or specific function/are similar cells ;
- (b) (i) proteins ;
amino acids ; [2]
- (ii) diffusion ;
ref to concentration gradient/from high concentration to low concentration ; [2]
- (c) (assume answer refers to animal cells unless otherwise stated)
look at cells (as opposed to whole organism) ;
no cell walls ;
no large vacuoles ;
no chloroplasts ; [max 2]
- [Total: 8]**
- 7 (a) (i) switch 1 and switch 2 ; [1]
- (ii) voltmeter in parallel and ammeter in series ; [1]
- (b) (i) to reduce energy losses ; [1]
- (ii) $V_p \div V_s = N_p \div N_s$;
 $5\,000 \div 400\,000 = 10\,000 \div N_s$ / ($N_s =$) 800 000 (turns) ; [2]
(1 mark for formula and 1 mark for substitution and answer)
- (iii) ref. to alternating or changing voltage or current ;
(in primary coil) produces alternating or changing magnetic field ;
reference to alternating or changing magnetic field in core ;
induces (alternating) voltage in secondary coil ;
idea that size of voltage change depends on (ratio of) turns ; [max 3]
- [Total: 8]**
- 8 (a) (i) formed as fossil fuel / decomposition of organic matter / from digestive
systems of ruminants / sources related to volcanism ; [1]
- (ii) 8 ;
four covalent bonds means four pairs of electrons ;
(correct bonding diagram alone gains both marks) [2]

Page 5	Mark Scheme: Teachers' version	Syllabus
	IGCSE – October/November 2011	0653

(b) (i) fractional distillation / fractionation ;

(ii) the larger / heavier / greater surface area of / greater number of atoms in molecules ;
the higher the boiling point ;

OR

unsaturation ;

lowers boiling point (for similar molecular size) ;

[max 2]

(iii) (shake liquid with) bromine / potassium manganate(VII) ;
mixture goes colourless if liquid is **D** ;
because **D** is unsaturated ;
(or reverse argument for **A**)

[3]

[Total: 9]

9 (a) (force =) mass × acceleration ;
acceleration = $1\,200\,000 / 400\,000$;
= 3 m/s^2 ;

[3]

(b) (i) to stop potato snacks oxidizing / reacting ;

[1]

(ii) pressure inside packet is greater than airplane pressure ;

[1]

(c) (i) speed has magnitude only / velocity has magnitude and direction ;

[1]

(ii) **A** to **B** / **C** to **D** ;

[1]

(iii) (no) not a straight line ;

[1]

(iv) **C** ;

[1]

(v) 50 m/s ;

[1]

(vi) the faster the skydiver travels the greater the air resistance ;
eventually the air resistance balances the gravitational force ;

[2]

(vii) parachute increases air resistance ;

[1]

[Total: 13]

**MARK SCHEME for the October/November 2011 question paper
for the guidance of teachers**

0653 COMBINED SCIENCE

0653/33

Paper 3 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

Page 2	Mark Scheme: Teachers' version	Syllabus
	IGCSE – October/November 2011	0653

- 1 (a) (i) liquid – particles touching but random arrangement ;
gas – particles well spaced out, random arrangement ;
- (ii) forces greater in a liquid than in a gas, ora ;
reference to forces of attraction / forces holding particles together ; [2]
- (b) (i) white surfaces reflect the radiation well (better than dark surfaces)/poor absorbers of radiation ; [1]
- (ii) metal base is a good heat conductor/wood/plastic handle is a good heat insulator/poor conductor ; [1]
- (iii) convection ;
hot water expands and becomes less dense ;
hot water rises (and displaces colder water) ; [max 2]

[Total: 8]

- 2 (a) (i) line from cell **A** to leaf ;
line from cell **B** to root ; [2]
- (ii) structure **X**, is a chloroplast/ contains chlorophyll/ absorbs energy from light ;
for photosynthesis ;
cell **B** does not have them because it, is underground/ gets no light ; [3]
- (iii) has a large surface area ;
for uptake of, water/ mineral salts ; [2]

(b) (i)

genotype	phenotype
RR	red
Rr	red
rr	white

;

- (ii) circle around **Rr** ; [1]
- (iii) 3 red : 1 white ; (if red and white not stated, assume first number refers to red) [1]

- (c) all new plants identical to parent plant ;
genetically identical/ clone;
if used seeds would produce variation/ not have unusual flowers ;
seeds may not germinate/ (mature) plants obtained more quickly ;
only one parent needed to produce the offspring ; [max 2]

[Total: 12]

Page 3	Mark Scheme: Teachers' version	Syllabus
	IGCSE – October/November 2011	0653

- 3 (a) (i) Q – oxygen ;
R – hydrogen ;
- (ii) (oxygen)
relights glowing (wooden) splint ;
OR
(hydrogen)
pops with application of flame ; [max 1]

- (b) (i) potassium hydroxide + sulfuric acid ;
(potassium sulfate +) water ; [2]

- (ii) addition of one reagent to the other ;
slowly / carefully (until neutral) ;
suitable method of testing neutrality ;
detail of indication of neutrality e.g. pH meter shows 7 / universal indicator goes green ; [max 3]

- (iii) $H^+ + OH^-$;
 $\longrightarrow H_2O$; [2]

[Total: 10]

- 4 (a) (i) beta radiation ; [1]

- (ii) gamma, infra-red, ultraviolet ;; [2]

- (iii) cancer treatment ;
tracer ;
food sterilization ;
surgical instrument sterilization ; [max 1]

(iv)

	alpha	beta	gamma
most penetrating			✓
most ionising	✓		
not deflected by an electric field			✓

(3 correct for 2 marks ; 2 correct for 1 mark)

[2]

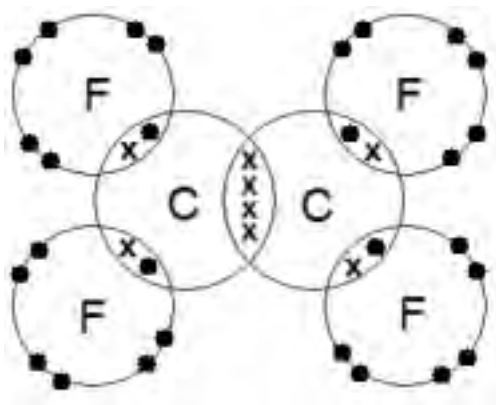
- (b) count rate decreased / decay curve ;
some randomness of results ;
half-life about 14 days ; [max 2]

[Total: 8]

Page 4	Mark Scheme: Teachers' version	Syllabus
	IGCSE – October/November 2011	0653

5 (a) (i) no hydrogen / hydrocarbons contain carbon and hydrogen (only) ;

(ii)



bonding pairs ;

non-bonding pairs ;

[2]

(iii) four **C** and 8 **F** ;

all single bonds ;

indication that chain continues ;

[3]

(b) (i) gas;
boiling point decreases up the group / increases down the group / description
of trend in physical state in group ;

[2]

(ii) (no reaction)

reactivity increases up the group ;

so bromine is less reactive than fluorine ;

[2]

[Total: 10]

6 (a) label to stomach ;
label to colon ;

[2]

(b) label to liver / pancreas / gall bladder / tongue / salivary gland ;

[1]

(c) protease / pepsin ;
breaks down proteins ;
to, amino acids / polypeptides / peptides ;
hydrochloric acid provides low pH / acid conditions for pepsin enzymes ;

[max 2]

Page 5	Mark Scheme: Teachers' version	Syllabus
	IGCSE – October/November 2011	0653

- (d) (i) put predatory wasps on the plants ;
- (ii) pesticides can harm people who eat the tomatoes ;
pesticides could harm other (beneficial) insects ;
whitefly could become resistant to pesticides ;
might need to apply pesticides often/only need to add wasps once ;

[max 2]

[Total: 8]

- 7 (a) calcium oxide and water react ;
(reaction is) exothermic/reaction produces heat ;
heat transferred to coffee ;

[max 2]

- (b) (i) calcium is in Group 2/atoms have two outer electrons ;
outer 2 electrons lost ;
ion has two more positive charges (protons) than negative charges (electrons) ;

[3]

- (ii) single negative ;
working to show need for charge balance ;

[2]

[Total: 7]

- 8 (a) (i) X = voltmeter and Y = ammeter ;
- (ii) changing/controlling voltage/current in circuit/across resistor ;
- (iii) resistance = voltage ÷ current / 1 ÷ gradient ;
= 4/2 (or other correct values) = 2 Ω ;

[1]

[1]

[2]

- (b) $1/R = 1/R_1 + 1/R_2$;
= $1/10 + 1/10$;
 $R = 10/2 = 5\Omega$;

[3]

- (c) (i) changes direction ;

[1]

- (ii) spins faster ;

[1]

- (iii) allows current to change direction in coil (every $\frac{1}{2}$ turn) ;
means force on coil stays in same direction ;
keeps coil spinning in same direction ;

[max 2]

[Total: 11]

Page 6	Mark Scheme: Teachers' version	Syllabus	
	IGCSE – October/November 2011	0653	

- 9 (a) voluntary
voluntary
reflex
voluntary
(one mark for any two correct) ;; [2]
- (b) (advantage) faster ;
(disadvantage) no choice / cannot make the best decision ; [2]
- (c) (receptor) receives stimulus / senses change in the environment / hears the sound ;
(motor neurone) transmits, nerve impulse / signal, to an, effector / muscle ; [2]

[Total: 6]