**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

International General Certificate of Secondary Education

# MARK SCHEME for the June 2004 question papers

## 0653 COMBINED SCIENCE

| | |
|---|---|
| **0653/01** | **Paper 1 (Multiple Choice), maximum raw mark 40** |
| **0653/02** | **Paper 2 (Core), maximum raw mark 80** |
| **0653/03** | **Paper 3 (Extended), maximum raw mark 80** |
| **0653/05** | **Paper 5 (Practical), maximum raw mark 30** |
| **0653/06** | **Paper 6 (Alternative to Practical), maximum raw mark 60** |

These mark schemes are published as an aid to teachers and students, to indicate the requirements of the examination. They show the basis on which Examiners were initially instructed to award marks. They do not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

- CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the June 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.

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**Grade thresholds** taken for Syllabus 0653 (Combined Science) in the June 2004 examination.

| | maximum mark available | minimum mark required for grade: | | | |
|---|---|---|---|---|---|
| | | A | C | E | F |
| Component 1 | 40 | 35 | 27 | 19 | 14 |
| Component 2 | 80 | - | 42 | 26 | 19 |
| Component 3 | 80 | 55 | 32 | 20 | 16 |
| Component 5 | 30 | 22 | 15 | 11 | 9 |
| Component 6 | 60 | 48 | 39 | 25 | 17 |

The threshold (minimum mark) for B is set halfway between those for Grades A and C.
The threshold (minimum mark) for D is set halfway between those for Grades C and E.
The threshold (minimum mark) for G is set as many marks below the F threshold as the E threshold is above it.
Grade A* does not exist at the level of an individual component.

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# MARKING SCHEME

## MAXIMUM MARK: 40

**SYLLABUS/COMPONENT: 0653/01**

**COMBINED SCIENCE**
**Paper 1 (Multiple Choice)**

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| *Question Number* | *Key* | *Question Number* | *Key* |
|---|---|---|---|
| 1 | **C** | 21 | **B** |
| 2 | **A** | 22 | **A** |
| 3 | **D** | 23 | **A** |
| 4 | **D** | 24 | **D** |
| 5 | **B** | 25 | **A** |
| 6 | **A** | 26 | **D** |
| 7 | **B** | 27 | **C** |
| 8 | **C** | 28 | **D** |
| 9 | **D** | 29 | **D** |
| 10 | **C** | 30 | **D** |
| 11 | **A** | 31 | **C** |
| 12 | **C** | 32 | **A** |
| 13 | **D** | 33 | **C** |
| 14 | **A** | 34 | **C** |
| 15 | **B** | 35 | **D** |
| 16 | **B** | 36 | **A** |
| 17 | **C** | 37 | **C** |
| 18 | **A** | 38 | **A** |
| 19 | **D** | 39 | **A** |
| 20 | **C** | 40 | **D** |

**TOTAL 40**

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# MARKING SCHEME

## MAXIMUM MARK: 80

**SYLLABUS/COMPONENT: 0653/02**

**COMBINED SCIENCE**
**Paper 2 (Core)**

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**1(a)** Q;
P;
Q; [3]

**(b)(i)** air contains other gases / substances / air not pure oxygen;
(so) oxygen less concentrated /diluted by other gases /
reasonable reference to collisions / reaction rate lower; [2]

**(ii)** hydrogen + oxygen → water; [1]
(reject → hydrogen oxide)

**Total 6 marks**

**2(a)** contains DNA ;
contains inherited information / genes;
controls the activities of the cell ;
[2] max

**(b)** drawing with two outer lines (not one as for animal cell) ;
cell membrane and cell wall correctly labelled (both required);
chloroplast (obviously) in cytoplasm and labelled ;
nucleus in cytoplasm and labelled ;
vacuole in cytoplasm and labelled ;
[4] max

**(c)** (sun)light energy is always falling on Earth / idea that sunlight won't run out ;
wood formed as a result of photosynthesis / energy in wood comes from sunlight ;
[2]

**Total 8 marks**

**3(a)(i)** (just over) 2 (km/h) (accept 2 to 2.4); [1]

**(ii)** 15 (km/h); [1]

**(b)** kinetic/ movement;
electrical (accept electric and electricity);
[2]

**(c)(i)** noise / eyesore / only effective over a certain range of wind speeds;
[1]

**(ii)** oil / gas (reject crude oil); [1]

**(iii)** carbon / hydrogen; [1]

**Total 7 marks**

**4(a)** carbon dioxide / $CO_2$ ;
limewater / calcium hydroxide solution; [2]

**(b)** more than one type of atom / element;
joined / bonded;
made of molecules containing different elements / types of atom;

[2] max

**(c)(i)** $H_2SO_4$; [1]

**(ii)** → sodium sulphate; + carbon dioxide; + water; (products) [3]

**(iii)** no more effervescence / other correct; [1]

**(iv)** dangerously explosive / owtte [1]

**Total 10 marks**

**5(a)(i)** the more cigarettes smoked the greater the percentage of babies with low birthweight ;
effect greatest between 0 and 15 (cigarettes per day) ; [2]

**(ii)** (no)
they only show there is a relationship;
not that one causes the other;
some low birth weight born to non-smokers;
other argument ;

[2] max

**(b)(ii)** (via) placenta ;
by diffusion ;
from mother's blood ; [3]

**(c)** paralyses / stops, cilia ;
which allows mucus to build up in, lungs / bronchi ;
and allows bacteria to get into the, lungs /bronchi ;
bacteria breed in the mucus ;

[2] max

**Total 9 marks**

**6(a)(i)** gamma; [1]

**(ii)** gamma; [1]

**(iii)** X – rays; [1]

**(iv)** radiowaves / microwaves; [1]

**(b)(i)** distance = speed x time / d = s x t / other sensible symbols;
300 000 000 x 0.00004 ÷ 2;
= 6000(m); [3]
(only lose one mark if all correct except no division by 2)

**(ii)** energy is lost (as signal travels);
so less energy enters the receiver than was sent out;
signal scattered / not all reflected back; [2]

**(iii)** (strips) reflect microwaves / radar signal;
produce false image in addition to the plane's image / owtte;
[1] max

**(c)(i)** wavelength correctly labelled; [1]
(penalise careless indication of wavelength)

amplitude correctly labelled; [1]

10 waves (pass a point) per second; [1]

**Total 13 marks**

**7(a)** two from malleable, ductile, good conductor of electricity,
good conductor of heat, high density;; [2]
(must indicate that metals tend to these properties or lose one mark)

**(b)(i)** <u>heat</u> energy given out; [1]

**(ii)** hydrogen;
magnesium oxide; [2]

**(c)** ionic / electrovalent;
covalent; [2]

**(d)(i)** unreactive / doesn't corrode / react with food; [1]
(reject references to rusting)

**(ii)** name;
correct use;
(e.g. argon in light bulbs / helium in balloons (allow air balloons)
/ neon in lighting)
[2]

**Total 10 marks**

**8(a)** A - aorta ;
B - pulmonary vein ;
C - right atrium / auricle;
[3]

**(b)** valve will not close;
nothing to stop blood flowing backwards / the wrong way;
back into (left) atrium ;
[2] max

**(c)(i)** in the lungs / alveoli ;
oxygen diffuses (from air into blood) /oxygen combines with haemoglobin ;
[2]

**(ii)** oxygen is needed for respiration ;
to provide energy ;
(muscles need) a lot of oxygen when exercise is done ;
lack of oxygen may cause anaerobic respiration / formation of lactic acid;
muscle cramps / pain;
[2] max

**Total 9 marks**

**9(a)** weight is a force depending upon gravity;
mass depends on the amount of matter in an object; [2]

**(b)** (high voltage means) lower current;
reduces energy losses; [2]

**(c)** sound waves need a medium to travel / move via vibration of particles;
no matter in a vacuum / nothing to vibrate; [2]

**(d)** (some) beta radiation can travel through metal;
thickness controls the amount of radiation passing through / owtte
[2]

**Total 8 marks**

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# MARKING SCHEME

## MAXIMUM MARK: 80

**SYLLABUS/COMPONENT: 0653/03**

**COMBINED SCIENCE**
**Paper 3 (Extended)**

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**1(a)(i)** (compound) containing carbon and hydrogen ;
only ; [2]

**(ii)** air / oxygen, limited ;
incomplete combustion ;
soot / carbon, produced *or* black material is soot ; [2] max

**(iii)** combustion / fire, needs, oxygen / air ;
foam blocks air from fire ; [2]

**(b)(i)** $C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$ ; ;
*lose one mark for each error* [2]

**(ii)** equal numbers of each type of atom on both sides ; [1]

**(iii)** B on any bond on LHS ; [1]

**(iv)** M on any bond on RHS ; [1]

**Total 11 marks**

**2(a)** (lake Y)
more species present ; [1]

**(b)(i)** higher pH in lake Y / pH closer to neutral /less acidic / higher species diversity in lake Y ;
*not pH in Y is more alkaline* [1]

**(ii)** acid neutralised by limestone / acid reacts with limestone ; [1]

**(c)** combustion / burning ;
correct reference to sulphur oxides ;
which are acidic ;
*ignore refs to acid rain* [2] max

(d) reduces photosynthesis ;
less production / fewer producers / fewer plants / less food produced;
less food for, herbivores / consumers / animals ;
*not 'organisms' or 'creatures'* [3]

**Total 8 marks**

**3 (a)(i)** work = force x distance *or* work = weight x distance ;
1600 x 2 = 3200 J ; *allow Nm* [2]

**(ii)** power = work ÷ time *or* power = energy ÷ time ;
= 3200 ÷ 0.5 = 6400 W ; *allow J/s* [2]

**(b)(i)** (gravitational) potential (energy) ; [1]

**(ii)** kinetic ; [1]

**Total 6 marks**

**4(a)** (chlorine is) harmful to humans ;
*not 'dangerous' allow 'dangerous to humans'*
*not 'chlorine produces a harmful gas'* [1]

**(b)(i)** chlorine is more reactive than iodine / chlorine displaces iodine /
chlorine oxidises iodide ; [1]

**(ii)** the darker the colour the more iodine produced ;
the more iodine produced the more chlorine there was in the bleach ;
*allow one mark for darker brown meaning more chlorine* [2]

**(c)(i)** one shared pair ;
all other outer electrons correct ;
*ignore inner shells* [2]

**(ii)** covalent ; [1]

**Total 7 marks**

**5(a)(i)** AA ; [1]

**(ii)** both AA and Aa crossed with aa ;
gametes shown correctly in one diagram ;
offspring shown correctly in one diagram ;
stated or highlighted that Aa parent will produce some low vitamin C offspring ;
*if many other crosses shown, mark <u>one</u> correct one, but do not give 1st mark* [4]

**(b)** *yes* (no mark)
1 (asexual reproduction) (from AA or Aa) produces identical offspring ;
2 <u>genetically</u> identical / clones ;
3 so he can use either AA or Aa as parents / can also use Aa ;
4 sexual reproduction, will produce variable offspring / may produce aa ;
5 he may get more plants more quickly using asexual reproduction ; [2] max

**(c)** needed for, making collagen / strong gums / healthy skin / wound healing /immunity ;
lack causes scurvy ; [2]

**Total 9 marks**

**6(a)** solid - particles touching and regularly arranged ; *must use same symbols*
gas - no more than six particles in the box, widely separated ; [2]

**(b)(i)** to allow for expansion ;
in high temperatures ;
avoids damage to bridge ; [2] max

**(ii)** time = distance ÷ speed ;
50 ÷ 20 = 2.5 seconds ; [2]

**(c)(i)** poor conductor / good insulator ; [1]

**(ii)** reference to radiation ;
black surfaces absorb heat (radiation) ;
white surfaces reflect heat (radiation) ;
*if answer given in terms of light, allow first marking point only* [2] max

**(iii)** reference to convection ;
cold air denser than warm air ;
cold air (from freezer) sinks / warm air rises ; [2] max

**Total 11 marks**

**7(a)** $N_2$ ;
$O_2$
78 to 80 % and 20 to 22 % ; [3]

**(b)(i)** 1 push air from one syringe into the other ;
2 several times / back and forth ;
3 until the volume of air shows no further change ;
4 allow apparatus to cool ;
5 percentage of oxygen is the decrease in volume / correct ref to volume decrease ; [3] max

**(ii)** 2, 6 for oxygen atom ;
2, 8 for oxide ion ;
*if inner shells incorrect, allow one mark* [2]

**(iii)** 2 - ; [1]

**(iv)** atom gains electrons ; [1]

**Total 10 marks**

**8(a)** water moves out of the cells ;
cells shrink (*not* plasmolyse) ; [2]

**(b)(i)** insulin ;
secreted by pancreas ;
causes liver to, take up / use, more glucose ; [3]

**(ii)** homeostasis ; [1]

**(c)** starch (molecules) broken down / digested / changed, to sugar / glucose ;
by amylase / carbohydrase ;
glucose / sugar, absorbed into the blood ;
in the small intestine / ileum ;
through villi ; [3] max

**Total 9 marks**

**9(a)** CD is 3 V ;
FG is 6 V ;
*max 1 if no units* [2]

**(b)** four symbols present and correct ;
variable resistor in series with motor ;
motor in parallel with lamp ; [3]

**(c)(i)** place 2 Ω and 4 Ω ;
in series ; [2]

**(ii)** place 2 Ω and 2 Ω ;
in parallel [2]

**Total 9 marks**

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# MARKING SCHEME

## MAXIMUM MARK: 30

**SYLLABUS/COMPONENT: 0653/05**

**COMBINED SCIENCE**
**Practical**

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**Question 1**

**(a)** good quality drawing of both leaf sections, both showing areas with and without chlorophyll [2]

**(b)** drawing a leaf section A with no blue/black area
(may be labelled brown)
drawing of leaf section B with blue/black area clearly shaded and labelled [2]

If reversed but fits first drawing, allow

**(c)** Plant B unless it follows from **(b)** that A is correct
Leaf section turned blue/black [2]

**(d) (i)** heat/boil;
in Benedict's solution;
positive result goes green/yellow/red [3]

**(ii)** green part because chlorophyll is needed for photosynthesis or making starch/sugar [1]

**Total 10 marks**

**Question 2**

**(a) (i)** value for h within 0.4 mm of supervisor [1]

**(ii)** brief description of how volume was found

volume within 10 $cm^3$ of supervisor [1]

**(b)** *Table*

Six pairs of values

Good spread to include a value equal to 150 $cm^3$

Values in mm and decreasing with volume of water [3]
(penalise 1 mark when all intervals are exactly the same)

**(c)** *Graph*

Sensible scales for the plotted points

Plotting correct for 4 values

Best straight line drawn [3]

Volume correctly read needs evidence of extrapolation

Within 10% of recorded volume [2]

**Total 10 marks**

**Question 3**

**(a)** gas/vapour burns

brown or charring/smoke/smell [2]

**(b)** goes out NOT 'nothing' [1]

**(c)** UI goes red

pH about 1-4

acid present [3]

**(d)** effervescence or gets cold [1]

**(e)** brief description [1]

diagram [2]

**Total 10 marks**

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# MARKING SCHEME

## MAXIMUM MARK: 60

**SYLLABUS/COMPONENT: 0653/06**

**COMBINED AND CO-ORDINATED SCIENCE**
**Alternative to Practical**

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**Question 1**

**(a)** Clear drawing of strip from leaves A and B (1)
green areas/chlorophyll correctly labelled (1) [2]

**(b)** light brown/brown/yellow on leaf A (1)
blue/black area on leaf B (1) [2]

**(c)(i)** Leaf A: because no starch present/has been used up (1)
no photosynthesis /light is needed to make starch (1) [2]

**(ii)** starch found in green areas/where chlorophyll is found (1)
chlorophyll is necessary for starch synthesis/photosynthesis (1) [2]

**Total 8 marks**

**Question 2**

**(a)** 1.8V(1), 150 mA
2.4V(1), 250 mA
+/- 0.1V, +/-10 mA
(1 mark for both current readings) [3]

**(b)** 2 points correctly plotted (2)
line drawn (can be straight or curved)(1) [3]

**(c)(i)** the bulb becomes brighter as resistance decreases [1]

**(ii)** the filament of the bulb melted OWTTE [1]

**(d)** No, since it is not a straight line/V and I are not proportional.
OR yes, graph is a straight line /(they are proportional) [1]

**Total 9 marks**

**Question 3**

**(a)(i)** 53.4 g, 60.0 g (Must say 60.0), no tolerance (2)

**(ii)** 6.6 g (ecf) (1) [3]

**(b)** blue litmus (U.I) paper turns red in the gas (reject add indicator) [1]

**(c)(i)** 56.8 g (no tolerance)

**(ii)** 3.2 g (ecf) both correct for 1 mark [1]

**(d)** evaporate to remove some water (1) leave the solution to cool (1)
OR evaporate solution(1) over a boiling water bath (1) [2]

**(e)(i)** 62.9 g, (no tolerance) (1)

**(ii)** 9.5 g (ecf) (1) [2]

**(f)** some copper nitrate left in the solution during crystallisation/
water of crystallisation was lost/copper nitrate decomposed/
other suitable answer based on experimental details [1]

**Total 10 marks**

**Question 4**

**(a)** 0.8, 0.5 (no tolerance) [2]

**(b)** 42, 37°C (no tolerance) [2]

**(c)(i)** 17, 12 °C (errors carried forward) [2]

**(ii)** ring: $\frac{50 \times 17 \times 4.2}{0.8}$ (ecf) (1) = 4462.5 (1)

cheeso: $\frac{50 \times 12 \times 4.2}{0.5}$ (ecf) (1) = 5040 (1)

joules/J (kJ accepted if energy totals divided by 1000) (1) [5]

**(d)** respiration [1]

**Total 12 marks**

**Question 5**

**(a)** box 1 colourless (clear) to cloudy/milky (1) carbon dioxide /carbonate (1)
box 2(a) carbon dioxide (suspected)/gas will not support combustion/
no oxygen/no hydrogen/may be nitrogen(1)
Box 2(b) carbon dioxide confirmed (1)
Box 3 turned from green(1) to red (1)
Box 4 turned to yellow/orange (1) [7]

**(b)** reaction vessel with delivery tube (1)
gas collected over water or in syringe(1)
means of measuring gas volume/graduations shown (1) [3]

**Total 10 marks**

**Question 6**

**(a)(i)** Use a pipette/dropper/burette [1]

**(ii)** 103 (no tolerance) (1) 147 (ecf) (1) [2]

**(b)** 28mm, 14mm (+/- 1 mm) [2]

**(c)(i)** correct axes labelled and scale correctly shown (1)
all points from Fig.6.3 plotted correctly (1)
straight line drawn extended to cut horizontal axis (1) [3]

**(ii)** From candidates' own graph (approx 147 $cm^3$) [1]

**(iii)** it will sink OWTTE [1]

**(d)** Yes/ comparison of **(a)** and **(c)(ii)** shows that mass in cup is numerically similar to (or greater than) its volume
OR No/ cup sank before its mass (g) exceeded the volume ($cm^3$) (depends on candidate's graph)
(mark for explanation) [1]

**Total 11 marks**