UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the June 2004 question papers

0654 CO-ORDINATED SCIENCES

0654/01	**Paper 1 (Multiple Choice), maximum mark 40**
0654/02	**Paper 2 (Core), maximum mark 100**
0654/03	**Paper 3 (Extended Paper), maximum mark 100**
0654/05	**Paper 5 (Practical), maximum mark 45**
0654/06	**Paper 6 (Alternative to Practical), maximum 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.

Grade thresholds taken for Syllabus 0654 (Co-ordinated Sciences) in the June 2004 examination.

	maximum mark available	minimum mark required for grade:			
		AA	CC	EE	FF
Component 1	40	34	26	19	16
Component 2	100	-	41	24	18
Component 3	100	66	42	24	18
Component 5	45	32	22	14	10
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.

JUNE 2004

INTERNATIONAL GCSE

MARKING SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 0654/01

CO-ORDINATED SCIENCES
Paper 1 (Multiple Choice)

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

TOTAL 40

JUNE 2004

INTERNATIONAL GCSE

MARKING SCHEME

MAXIMUM MARK: 100

SYLLABUS/COMPONENT: 0654/02

CO-ORDINATED SCIENCES (DOUBLE AWARD)
Paper 2 (Core)

1 (a) (i) C;
D;
B;

(ii) C and D (both required);
A, B & E (all required); [2]

(b) (i) 30; [1]

(ii) 25; [1]

(iii) different because of different numbers of electrons;
electrons have no mass; [2]

Total [9]

2 (a) (i) synovial fluid;
provides lubrication ;
cartilage ;
provides smooth surface ; [3] max

(ii) pleural fluid / pleural membranes ; [1]

(b) trapping bacteria / dust ;
in respiratory system / trachea / nose / bronchus ;
so that they can be removed by cilia ; [2] max

(c) this diet increases blood cholesterol content ;
increases chances of deposits building up inside, blood
vessels supplying heart / coronary arteries ;
blood clot then prevents blood flowing through/increases
blood pressure ;
deprives heart <u>muscle</u> ;
of, oxygen / nutrients ;
so that part of heart stops working ; [3] max

Total [9]

3 (a) 6000(kg); [1]

(b) KE = 1/2 mv^2;
= 1/2 x 6000 x 30 x 30 = 2 700 000; (allow ecf) [

(c) 60 000(N); [1]

(d) work = force x distance;
= 60 000 x 55 = 3 300 000 J; [2]

(e) power = work/time so time = work/power;
= 3 300 000/100 000 = 33s; [2]

(f) energy is lost/friction; [1]

(g)(i) air particles vibrate;
as series of compressions and rarefactions; [2]

(ii) water waves, any electromagnetic wave; [1]

Total [12]

4 (a)(i) carbon dioxide; [1]

(ii) dilute hydrochloric acid/any acid; [1]

(iii) limestone mainly calcium carbonate;
carbon dioxide is evidence of carbonate;
idea that no proof of limestone only of carbonate; [2] max

(b) flame test;
some detail of how to do test e.g. HC*l* & nichrome wire;
brick red colour indicates calcium; [2] max

(c) reference to scarring of landscapre/air pollution from dust or vehicle exhaust/excessive noise or danger from blasting/damage to habitats; [1]

Total [7]

5 (a) protein / DNA / other correct molecule ; 1]

(b) bacteria ;
in root (nodules) ;
of legumes / description of type of plant ;
convert nitrogen (from air) to ammonium ;

or

Haber process ;
nitrogen and hydrogen reacted;
nitrogen from air ;
using iron catalyst ;

or

lightning ;
nitrogen and oxygen react ;
in air ;
high temperature / high energy (from lightning) ; [3] max

(c) denitrification / denitrifying ; [1]

(d)(i) through root hairs;
by active transport / by diffusion ;
in solution;

[2] max

(ii) xylem ; [1]

Total [8]

6 (a)(i) friction;
gain of electrons;
from cloth;
nylon is an insulator/prevents charge leaking; [2] m

(ii) rod was also negatively charged;
like charges repel; [2]

(iii) charge would not have built up/would have leaked away etc;
doesn't move away; [2]

(b) (i) gas expands;
becomes less dense; [2]

(ii) reduce radiation of heat; [2]
so less energy lost /less heating of gas needed;

(c) accelerates;
friction;
falls at a steady speed [3]

Total [13]

7 (a)(i) polymer is very much larger/heavier/consists of a long chain of molecules linked together; [1]

(ii) glucose; [1]

(b)(i) (green material) more soluble in ethanol/less soluble in water; [1]

(ii) place some solution onto the start line;
dip into solvent;
avoid solvent covering spot of solution;
allow solvent to soak up paper;
reference to closed environment;
remove when solvent reaches upper line; [3] max

(iii) coloured material is a mixture/containing four components; [1]

Total [7]

8 (a)(i) proteins, fats and carbohydrates ; [1]

(ii) as fat ;

(b)(i) insulin ; [1]

(ii) pancreas ; [1]

(iii) higher concentration / low water potential, in blood ;
water moves out of cells (by osmosis) ;
cells become dehydrated / explanation of damage to cells ; [2] max

(c)(i) by diffusion ;
from red blood cells ;
down concentration gradient / into area of low oxygen concentration ; [2] max

(ii) anaerobic respiration ;
lactic acid produced ; [2]

Total [10]

9 (a) nucleus;
splits; [2]

(b) atoms with same number of protons but different numbers of neutrons; [1]

(c) Cs-137 in milk [1]

(d) radiation from grass (if any) won't penetrate human (unless gamma);
once inside body will penetrate more;
sheep meat will contain large amounts of radioactive material;
mutations; [2] max

(e) cosmic radiation/ rocks etc; [1]

(f) less CO_2 emission/global warming etc/fossil fuels running out etc; [1]

Total [8]

10 (a)(i) flask becomes warm / temperature of mixture increases;

(ii) magnesium + sulphuric acid ⟶ magnesium sulphate + hydrogen; [1]

(iii) ignite gas;
pops; [2]

(b)(i) 8 minutes; [1]

(ii) everywhere above the existing line after start;
levels off earlier and at the same final volume; [2]

(iii) reaction rate greater;
graph steeper because more gas produced per minute;
powder has greater surface area;
same final volume because amounts of reactants same; [3] max

Total [10]

11 (a) one mark per correct label ; ; ; [3]

(b) oxygen ; [1]

(c)(i) (unidirectional) light ; [1]

(ii) obtain more light ;
for photosynthesis ; [2]

Total [7]

Total for Paper = [100]

JUNE 2004

INTERNATIONAL GCSE

MARKING SCHEME

MAXIMUM MARK: 100

SYLLABUS/COMPONENT: 0654/03

CO-ORDINATED SCIENCES (DOUBLE AWARD)
Paper 3 (Extended)

1(a) **P** key made up of pairs of statements ;
C each pair of characters genuinely contrasting and usable ;
A all animals key out correctly ;
F (no more than) four pairs of characters used ; 4

(b) hair / fur ; 1

(c)(i) no teeth ;
lay eggs ; *not 'only lay a single egg'* 2

(ii) internal fertilisation / fertilisation in oviduct ;
feed young on milk / have mammary glands ; 2

Total [9]

Acceptable pairs for C:

has tail / has no tail
has long tail / has (very) short tail
stands on 4 legs / stands on two legs
spots / no spots
spikes / no spikes
only end of tail furry / fur all along tail
blunt snout / long pointed snout
whiskers / no whiskers

Not acceptable:

large eyes / small eyes
long legs / short legs
big ears / small ears

2(a) wave ;

use ;

gamma rays	viewing body organs medical imaging / tracing checking structures – e.g. bridges treating cancer sterilising food
X rays	viewing bones / body organs / medical imaging / CT scanning security checks (at airports)
ultraviolet	fluorescent lights sterilising things
infrared	cooking security sensors carrying signals (in optical fibres) remote controls (e.g. television) night-viewing scopes
microwaves	cooking mobile phones transferring information (as radio waves) satellite communication

(b) travel at same speed / transverse waves/ can travel through vacuum ; 1

(c) ref to static electricity ;
screen acquires negative charge / electrons have negative charge ;
dust particles have, opposite / positive, charge /attraction between positive
and negative charges ;
max 1 if reference to magnetic field 2 max

d(i) red, green and blue ; ; *1 mark for two correct, 2 marks for all correct* 2

(ii) (all) other colours can be made from these ;
ignore refs to white, or to e.g.s of pigment mixing 1

Total [8]

3(a) `low density / light(weight) ;
keep mass of aircraft down / increase fuel efficiency ;

(b)(i) $MgCl_2$;
reference to charge balance ; 2

(ii) (liquid) so it can conduct / transfer charge / allow current to flow ;
ions in solid cannot move ;
ions free to move when molten ;
if described in terms of electrons flowing, only first point available

or

if it were in solution ;
hydrogen would form instead of magnesium ; 2 max

(iii) ions move to, cathode / negative electrode / steel electrode ;
gain electrons (from cathode) ;
gain two electrons each ; 2 max

(iv) <u>chlorine</u> is produced and is toxic ;
not just 'dangerous' *'dangerous to health' is OK* 1

(c) the greater the difference in reactivity, the higher the voltage ;
explanation of how results show that X is less reactive than iron ; 2

Total [11]

4(a)(i)	1 as temperature increases, movement / kinetic energy, of molecules increases ; 2 more collisions ; 3 more energetic collisions ; 4 between, enzyme and substrate / lactase and lactose ;	3 max
(ii)	(high temperatures) destroy (shape of) / denature, enzyme ; progressively / more enzymes destroyed the higher the temperature ; all enzyme destroyed by ~95 ^{o}C ;	2 max
(b)	curve the same shape as the first one ; lower optimum temperature (between 30 and 40 ºC) ;	2
(c)(i)	<u>catalysts</u> ; not used up in the reaction ;	2
(ii)	the milk product does not contain lactase / no need to remove lactase ;	1
(d)	small intestine / ileum ; through villi ; by diffusion / active transport ;	2 max
		Total [12]

5(a) wavelength = velocity ÷ frequency ; *ignore triangles*

1500 ÷ 50 000 ;

0.03 m / 3 cm ; *unit essential*

(b) distance travelled is 2400 (m) ;

time = distance ÷ speed ;

1.6 s ; *unit essential*

doubling may occur at any stage of the calculation

maximum 2 marks if no doubling - answer then 0.8 s 3

(c) ultrasound is not ionising / X rays are ionising ;

less possibility of harm / X rays can harm, mother / baby,

cells ; 2

(d) 20 000 / 23 000, Hz ; *unit essential* 1

Total [9]

6(a)(i) animal waste / pesticides / fertilisers/ nitrates, from farmland ;
chemicals / waste / reasonable named substance from industry ;

(ii) 1 microorganisms / pathogens / bacteria / microbes / viruses, may be present ;
2 dissolved substances may be present ;
3 which pass through filter / only solids stopped by filter ;
4 may make you ill / may be toxic ; 3 max

(iii) chlorination / ozone ; 1

(b)(i) removes dissolved calcium / calcium carbonate, is not soluble / precipitates ; 1

(ii) 1 formula mass of calcium carbonate is 40 + 12 + (16 x 3) = 100 ;
2 number of moles of calcium carbonate = 0.25 ÷ 100 = 0.0025 ;
3 this is the number of moles of hydrogencarbonate in 0.5 dm^3 ;
4 so concentration = 0.0025 ÷ 0.5 = 0.005 mol dm^{-3} ;

if a different approach taken, look for equivalents to points 2 and 3 3 max

Total [10]

7(a)(i) A_1 and A_2 are both 2.0 A ;

A_5 is 0.5 A ;

unit essential - maximum 1 mark if no units

(ii) 2 ; 1

(b) both 6V ;

unit essential, but do not penalise again if have already done so in (a)(i) 1

(c) water conducts electricity ;

danger of, electrocution / electric shock / short circuit ; 2

Total [6]

8(a)(i) 1 to make it a fair test ;
2 to control a variable ;
3 leaves near end of branch different age from those near the trunk ;
4 leaves near trunk more shaded / leaves at end get more sunlight ; 2 max

(ii) *support*
mean length is longer on the shady side / vice versa *or*
longest leaf is longer on the shady side ;

not support
shortest leaf is shorter on the shady side / vice versa ; 2

(iii) all the leaves have the same genes ; 1

(b)(i) random / unpredictable ;
change in, DNA / gene / chromosome ; 2

(ii) cell division / mitosis ;
during growth ;
chromosomes / genes / DNA/ mutation, passed from one cell to its offspring ;
new cells formed are identical with parent cell ; 2 max

(iii) 1 lack of chlorophyll / green leaves contain chlorophyll ; *allow chloroplasts*
2 which absorbs (sun) light ;
3 correct and relevant reference to photosynthesis ;
4 link made between, carbohydrates / food / equivalent, and growth ; 3 max

Total [12]

9(a)(i) contains hydrogen and carbon only ; 1

(ii) C_8H_{18} ;

(iii) alkanes ; 1

(b) 1 molecules in diesel are larger than those in gasoline ;
2 stronger intermolecular forces in diesel ;
3 therefore more energy needed to separate molecules (hence high boiling point) ;
4 therefore more energy needed to drag molecules past each other (hence high viscosity) ;
2 max

(c)(i) molecules contain a double (carbon-carbon) bond ; 1

(ii) mix with, bromine / potassium permanganate ;
mixture turns colourless ; 2

(iii) far greater demand as reactant / can be used to make other useful substances ;
e.g. ethanol / polythene ;
not just 'polymers' or 'plastics' 2 max

(d) 1 heat / high pressure ;
2 catalyst (phosphoric acid on silica) ;
3 mixture of ethene and steam (allow water if heat specified) ;
4 $C_2H_4 + H_2O \longrightarrow C_2H_6O$; 3 max

Total [13]

10(a) silver ;
lowest voltage required ;
allow 'least resistance' if supported by calculation

(ii) resistance = voltage ÷ current ;
1.4 ÷ 0.8 = 1.75 Ω ; *unit essential*
2

(c)(i) steel ; 1

(ii) power = voltage x current ;
24 x 0.8 = 19.2 W ; *unit essential*
allow ecf if gave silver in (i) - answer is then 1.12 W 2

(d) 1 aluminium is, light / less dense ;
2 aluminium, has low resistance / is good conductor ;
3 but aluminium is weak ;

4 steel is strong ;
5 but steel has high resistance ;
6 but steel is too, heavy / dense ;

7 both aluminium and steel are cheap / copper is expensive ; 3 max

points 3, 5 and 6 must be written in such a way as to imply that these are disadvantages - i.e. reasons why this metal is not used alone

Total [10]

JUNE 2004

INTERNATIONAL GCSE

MARKING SCHEME

MAXIMUM MARK: 45

SYLLABUS/COMPONENT: 0654/05

CO-ORDINATED SCIENCES (DOUBLE AWARD)
Practical

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]

(ii) starch only found in areas where there is chlorophyll or where it is green [2]

(d) (i) to kill the leaf/soften the cuticle [1]

(ii) so that the colour change with iodine can be seen or green colour would mask test [1]

(iii) to make the leaf flexible so it can be spread out on tile [1]

(e) (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 = 15

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 sensible volume [2]

(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*

Axes correctly labelled

Sensible scales for the plotted points

Plotting correct for 4 values

Best straight line drawn [4]

Volume correctly read needs evidence of extrapolation

Within 10% of recorded volume [2]

(d) measure water level in cylinder

put in block and record new level

volume of water displaced calculated is equal to the volume of block [3]

Total = 15

Question 3

(a) gas/vapour burns

limewater milky

brown or charring/smoke/smell [3]

(b) goes out NOT 'nothing'

limewater milky [2]

(c) **(i)** decolourised [1]

(ii) UI goes red

pH about 1-4

acid present [3]

(d) blue/green

pH about 8-10

no mark for conclusion [2]

(e) effervescence or gets cold [1]

(f) brief description [1]

diagram [2]

Total = 15

JUNE 2004

INTERNATIONAL GCSE

MARKING SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 0653/06, 0654/06

COMBINED AND CO-ORDINATED SCIENCE
Alternative to Practical

Question 1

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

(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)

(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