**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**International General Certificate of Secondary Education**

# MARK SCHEME for the May/June 2008 question paper

# 0654 CO-ORDINATED SCIENCES

**0654/03** Paper 3 (Extended Theory), maximum raw mark 100

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.

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 discussions or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the May/June 2008 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

**1** **(a)** cell wall and cell membrane in correct positions and labelled ;
nucleus and chloroplasts in correct position (in the cytoplasm) and labelled ;
vacuole/cytoplasm, labelled ;

**(b)** brings, water/minerals (to leaf) ;
support ; [2]

**(c)** **(i)** temperature ;
water ;
carbon dioxide concentration ;
light intensity ;
light duration/day length ;
size/age/variety, of plants ;
planting distance between plants ; [max 2]

**(ii)** 680 nm ; [1]

**(iii)** carbon dioxide used in photosynthesis ;
which produces, glucose/carbohydrates ;
converted to other compounds used for building new, cells / tissue ; [max 2]

**(iv)** ref to chlorophyll ;
absorbs only some wavelengths ; [2]

**[Total: 12]**

**2** **(a)** **(i)** C H O ; (all three required) [1]

**(ii)** changing (the element) nitrogen in the air into nitrogen compounds ;
extra detail e.g. one way it occurs/reference to inert nitrogen being converted into useful compounds ; [2]

**(b)** **(i)** obvious use of formula moles = volume × concentration ;
(50.0 ÷ 1000) × 2.0 / **0.1** (moles) ; [2]

**(ii)** number of moles of acid used also = 0.1 ;
use of equation to show that acid will be in excess ;
so solution of ammonium sulphate will not be pure/owtte ; [3]

**(iii)** ammonium ion must be $NH_4^+$ ;
two positive charges required to balance the double negative of sulphate ; [2]

**[Total: 10]**

**3** **(a)** **(i)** $M_3$ = 1A ;
$M_4$ = 3A ;
$M_5$ = 4A ;

**(ii)** 3 Ω ; [1]

**(iii)** 1/R = 1/R1 + 1/R2 ;
= 1/3 + 1/1 = 4/3 ;
R = ¾ Ω ; [3]

**(b)** charge = current × time ;
= 4 × 60 = 240 C ; [2]

**(c)** friction ;
electron transfer ;
from man to floor ;
man left with a positive charge ; [max 3]

**[Total: 10]**

**4** **(a)** **(i)** automatic response ;
to a stimulus ; [2]

**(ii)** fast ;
avoid danger ; [2]

**(b)** **(i)** label to spinal cord ; [1]

**(ii)** arrow towards spinal cord on left hand neurone and away on right ; [1]

**(c)** **(i)** reduce friction ;
reduce damage to bone surface ;
shock absorber ; [max 2]

**(ii)** bone is stronger/harder than cartilage *or* cartilage more flexible than bone ;
cartilage effective as shock absorber/bone provides support ;

cartilage has a smoother surface than bone ;
so reduces friction at joints ; [2]

**[Total: 10]**

**5 (a) (i)** (normal bodywork) strongly attracted ;
(filled hole) not attracted ;

**(ii)** (plastic filler) is not magnetic ; [1]

**(iii)** no – aluminium is not magnetic ; [1]

**(iv)** aluminium does not corrode/corrodes less than steel ; [1]

**(b) (i)** 298 K ; [1]

**(ii)** P1/T1 = P2/T2 ;
2.5/318 = P2/298 ;
P2 = 2.3 $N/m^2$ ; [3]

**(iii)** kinetic energy of particles increases/move faster ;
more frequent collisions with tyre walls ; [max 2]

**(c) (i)** kinetic energy = ½ $mv^2$ ;
= ½ ×1000 × 12 × 12 = 72 000 J ; [2]

**(ii)** seat belt, reduces/removes, kinetic energy from passenger ;
stops collision with windscreen ; [2]

**[Total: 14]**

**6 (a) (i)** **A** ;

**(ii)** (biological)
roots ;
abrade rock surface ;
animals ;
abrade rock surface ;
(physical)
description of freeze/thaw ;
reference to ice expansion ;
description of thermal variation ;
expansion/contraction cause surface damage ;
particles carried by wind ;
abrade rock surface ;
(chemical)
acidic rain ;
reacts with rock ; [max. 2]

**(b)** for transparency light rays must pass through undeviated/owtte ;
light rays scattered when passing through colloid/shown on diagram ; [2]

**(c) (i)** chlorine more reactive than bromine/free halogen must be more reactive than halide in compound/iodine is less reactive than bromine ; [1]

**(ii)** 7 electrons on chlorine ;
8 electrons on bromide ; [2]

**(iii)** chlorine becomes 2,8,8/gains an electron/gains a full shell ;
bromide loses an electron/now has 7 electrons in outer shell ; [2]
(saying one electron transfers from bromide to chlorine gains both marks)

**(d)** saturated – only single bonds (between C atoms)/contains as much H as possible ;
unsaturated – contains double bond(s)/more H could be added ; [2]

**[Total: 12]**

**7 (a) (i)** 44 °C ;

**(ii)** particles have more kinetic energy ;
more frequent collisions ;
more energetic collisions ;
between substrate and, enzyme/active site ; [max 3]

**(iii)** enzyme needed to catalyse reaction ;
enzyme, (molecules) lose shape/denatured (at high temperatures) ;
substrate, cannot bind with/does not fit, active site ; [max 2]

**(b) (i)** produced in pancreas ;
acts in, small intestine/duodenum/ileum ; [2]

**(ii)** converts, fats/lipids, to fatty acids and glycerol ; [1]

**(c)**

| | |
|---|---|
| haemoglobin ; | carries oxygen ; |
| antibodies ; | destroy pathogens ; |
| keratin ; | forms hair/nails/outer layers of skin ; |
| insulin/glucagon ; | control blood sugar level ; |
| collagen ; | provides, strength/elasticity, in skin/bone/cartilage ; |

any *two* roles, max two marks from one role and one mark from another [max 3]

**[Total: 12]**

**8** **(a)** over millions of years ;
remains have been heated ;
subjected to pressure ;
decomposed by bacteria ;
in absence of oxygen ; [max. 2]

**(b)** **(i)** correct bonding electrons ;
lone pairs on sulphur ; [2]

**(ii)** 3 ;
must be the same number of each type of atom on both sides ; [2]

**(iii)** **advantage**
greater % of methane ;
so more efficient fuel/more heat from a unit mass ;

**disadvantage**
greater amount of hydrogen sulphide ;
so more atmospheric pollution/reference to consequences of $SO_2$ ; [3]

**(c)** attractive forces within molecules are very strong/chemical bonds holding atoms together are very strong ;
forces between nitrogen molecules are very weak/much less energy needed for molecules to separate than to break ; [2]

**[Total: 11]**

**9** **(a)** **(i)** velocity = frequency × wavelength ;
wavelength = 1500 / 40 000 = 0.0375 m ; [2]

**(ii)** sound travels through particle vibration ;
vibrations travel better when particles are closer together ; [2]

**(b)** area under graph/working ; 3.75 + 15 + 5 + 5 ;
= 23.75 m ; [2]

**(c)** straight lines with arrows ;
bending at surface ;
entering eye ; [3]

**[Total: 9]**