CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2012 series

0654 CO-ORDINATED SCIENCES

0654/33 Paper 3 (Extended Theory), maximum raw mark 120

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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

1 (a) (i) two (complete) sets of / 23 pairs / 46, chromosomes ;

(ii) fertilisation ;

(b) (i) **A** ;
D ; [2]

(ii) it has petals ;
stigma is, enclosed / inside petals / not feathery ;
anthers / stamens are, enclosed / inside petals ;
so wind cannot reach them / wind cannot blow away pollen ;
so insect must crawl past, anther / stigma (to reach nectar) ; [3]

(c) method of dispersal (wind, animals, water, self) ;
reference to feature of fruit that aids dispersal ;
description of how the feature aids dispersal ; [3]

[Total: 10]

2 (a) (i) 78 (%); [1]

(ii) different boiling points ;
gases boil off as their boiling point is reached / gases boil off separately ; [2]

(b) (i) transition ; [1]

(ii) improves (catalyst) efficiency / increases reaction rate ;
increases (catalyst) surface area ;
reactions occur on catalyst surface ; [max 2]

(iii) nitrogen **and** hydrogen ; [1]

(iv) idea that conversion of reactants through reactor is
incomplete / economic / environmental argument for recycling
reactants / reference. to equilibrium / reversible reaction ; [1]

(c) (i) force of attraction between, nuclei / protons, and electrons ;
because, opposite electrical / positive and negative, charges (attract) ;
energy / work, required to move particles apart against force of attraction ; [max 2]

(ii) idea that (relatively) large amount of energy required (to break bond) / difficult to break bond ;
because high force of attraction ;
because, many / 3 pairs / 6, shared electrons / electrons in the bond, / idea that bond is a large negative charge ; [max 2]

[Total: 12]

3 **(a)** **A** – constant / steady, speed / velocity ;
B – acceleration ;

(b) (distance = 20 × 90 =) 1800 (m) ;
(work done =) force × distance ;
= 1000 × 1800 = 1 800 000 J ; [3]

(c) **(i)** (acceleration =) change in speed ÷ time = 33/11 ;
= 3 m / s^2 ; [2]

(ii) (force =) mass × acceleration ;
= 950 × 3 = 2850 N ; [2]

(iii) the faster a car goes the greater the air resistance / frictional force ;
(eventually) air resistance balances (maximum) driving force ; [2]

[Total: 10]

4 **(a)** **(i)** any number above 20 000 Hz ; [1]

(ii) longitudinal ; [1]

(b) **(i)** more drinking attempts from smooth than rough ;
use of figures / almost no attempts from rough ; [2]

(ii) reference to water having a smooth surface ;
sound waves scattered in many directions from a rough surface / not scattered in many directions from a smooth surface ;
bats receive fewer echoes from a smooth surface / more echoes from a rough surface ;
other reasonable explanation ; [max 2]

(c) **(i)** moths with the, genes / behaviour, are more likely to survive ;
because they are less likely to be killed by bats ;
so moths with the, genes / behaviour, are more likely to reproduce ;
and pass their genes to their offspring ;
over time / over many generations, most moths will have the, genes / behaviour ; [max 4]

(ii) travel along sensory neurone ;
to the central nervous system / brain ;
travel along motor neurone ;
to muscles ; [max 3]

[Total: 13]

5 **(a)** **(i)** ions separated ;
randomly spread throughout the solution ;

(ii) metal atoms form ions by losing (outer shell) electrons ;
calcium ions have 2 more protons than there are electrons ;
sodium ions have 1 more proton than there are electrons ;
(accept numerical answers based on atomic numbers) [max 2]

(b) **(i)** calculates M_r of $BaSO_4$ as 137 + 32 + (16 × 4) = 233 ;
calculates moles as 4.66 ÷ 233 = 0.02 ; [2]

(ii) states / implies that 0.02 moles magnesium sulfate in original solution ;
calculates mass of 0.02 moles $MgSO_4$ as 120 × 0.02 = 2.4 g ;
[2]

[Total: 8]

6 **(a)** **(i)** alternating current / owtte ;
which changes 50 times per second ; [2]

(ii) power = voltage x current / (I =) P/V ;
current = 2000 ÷ 250 = 8 A ; [2]

(b) **(i)** particles separate / escape ;
more energetic particles escape (from surface) ;
able to overcome attractive forces of other particles ; [max 2]

(ii) conduction ;
particles nearest heater (element) gain energy and vibrate more ;
vibrations / heat / energy, passed from particle to particle along the metal ;
reference to energy passing via mobile electrons ; [max 2]

(c) solid has particles touching in regular arrangement ;
liquid has most particles touching in random arrangement ; [2]

(d) (energy =) mass × shc × <u>change in</u> temperature ;
= 3 × 4200 × 40 ;
= 504 000 J ; [3]

[Total: 13]

7 **(a)** **(i)** amylase ; [1]

(ii) mouth / salivary glands / pancreas ; [1]

(b) **(i)** absorb amino acids ;
absorb glucose ;
which dissolve in blood (plasma) ; [max 2]

(ii) absorb, fats / fatty acids / glycerol ;

(iii) increase surface area ;
increase rate of absorption ;

(c) taken up by liver cells ;
changed to glycogen ;
(glycogen) stored ; [max 2]

[Total: 9]

8 **(a)** diagram shows close packed regular pattern of spheres ;
including some with a different diameter disrupting structure ;
idea that different sized atoms make it more difficult for atoms to move with respect to one another ;
when a force is applied ; [max 3]

(b) $Cu_2S + O_2 \rightarrow 2Cu + SO_2$; [1]

(c) **(i)** copper sulfate ; [1]

(ii) (some copper from) the anode has dissolved ;
at anode $Cu \rightarrow Cu^{2+} (+ 2e^-)$;
copper has deposited on the cathode ;
at cathode $Cu^{2+} (+ 2e^-) \rightarrow Cu$; [max 2]

(iii) impure copper is made the anode ;
only copper, (atoms) deposit on / ions discharge at, the cathode / owtte ;
impurities, fall out / are not deposited / owtte ; [max 2]

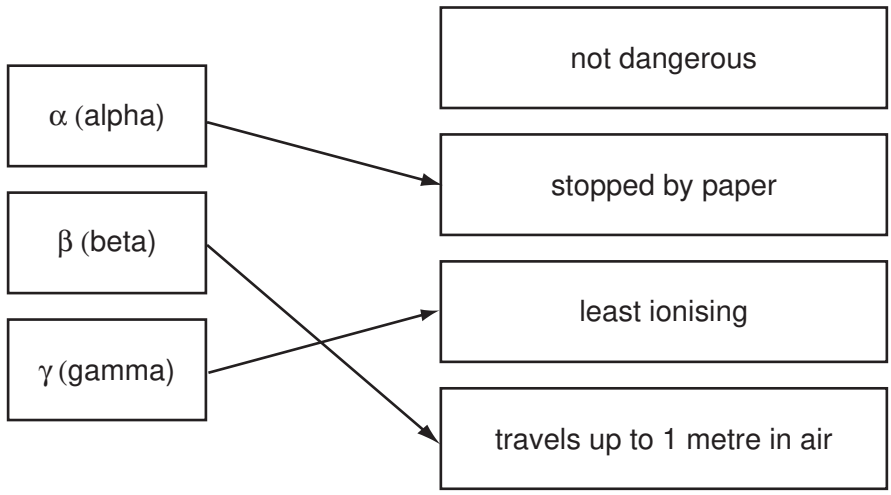
[Total: 9]

9 **(a)** turns atoms into ions / charged particles, / atoms become charged ;
removal of electrons ; [2]

(b) X-rays can damage cells ;
screen stops X-rays passing through ; [2]

(c) (3×10^8 m / s) because all electromagnetic waves travel at same speed ; [1]

(d)



all three correct two marks, two correct one mark ;; [2]

[Total: 7]

10 (a) through root hairs ;
across cortex of root ;
into xylem ;
additional detail about xylem in root / stem / leaf ;
to mesophyll cells in leaves ; [max 3]

(b) (i) to make amino acids / DNA ;
to make proteins ;
for growth / to build cells / to make enzymes ; [max 2]

(ii) no osmosis (into roots) ;
water potential outside lower than water potential inside / water concentration outside lower than water concentration, inside / ion concentration outside higher than ion concentration inside ;
because high concentration of (dissolved) ions reduces water potential ; [max 2]

(iii) fertiliser causes growth of, algae / plants ;
which, shade out other plants / die / decompose / decay ;
bacteria, feed on / decompose, dead plants / increase in bacterial growth ;
bacteria use oxygen (for respiration) ;
fish die <u>from lack of oxygen</u> ; [max 3]

[Total: 10]

11 (a) nucleus and 6 protons and 6 neutrons indicated ;
two electron shells with 2,4 configuration ; [2]

(b) diamond very hard <u>and</u> graphite softer / flaky ;

diamond has C atoms all interconnected in three dimensional array / all atoms bonded into the structure / one huge macromolecule / reasonable attempt at diagram ;
all bonds in diamond are very strong ;
graphite arranged in layers (of hexagonally bonded C atoms) / reasonable attempt at diagram ;
only weak forces between layers (allows layers to slide) ;
OR
diamond poor conductor and graphite good conductor ;
diamond has C atoms all interconnected in three dimensional array / all atoms bonded into the structure / one huge macromolecule / reasonable attempt at diagram ;
all (valence) electrons in bonds ;
graphite arranged in layers (of hexagonally bonded C atoms) / reasonable attempt at diagram ;
free electrons between layers ;
(reject reference to melting point) [max 4]

(c) (i) alkanes ;
only single bonds / saturated / fits general formula C_2H_{2n+2} ; [2]

(ii) gasoline burns to produce carbon dioxide which is linked to greenhouse effect / climate change ;
gasoline burns to produce pollutants such as carbon monoxide / other named pollutants (which have adverse effects on health) ;
hydrogen waste product is (non-polluting) water ; [3]

[Total: 11]

12 (a) heat energy turns water into steam / heats CO_2 ;
steam / kinetic energy, drives turbine (which drives generator) ; [2]

(b) slip rings ;
coil connections are not reversed / slips rings rotate with coil / direction of current reverses as coil turns ;
maintain connection / avoid wires twisting ; [max 2]

(c) (i) Vp / Vs = Np / Ns ;
Ns = 40 000 × 400 000 / 25 000 ;
= 640 000 (turns) ; [3]

(ii) to enable transformers to change voltage / transformers only work with a.c. ; [1]

[Total: 8]