UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 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.

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1 **(a)** take up oxygen / become oxygenated / oxygen goes into them ; not just 'carry oxyg
by diffusion ;
oxygen, combines with / taken up by/ received by, haemoglobin ;
haemoglobin changes to oxyhaemoglobin / oxyhaemoglobin formed ; [max

(b) destroy / engulf / produce antibodies against, bacteria / pathogens / foreign objects ;
or protect lungs / alveoli, against bacteria / pathogens / foreign objects ; [1 max]

(c) **(i)** ref. to diaphragm (muscles) ;
ref. to intercostal muscles / muscles between ribs ;
(either) contract ; (but do not give this if one is contracting and the other relaxing)
increases volume of, thorax / lungs / chest cavity ;
which decreases pressure (inside thorax / lungs / chest cavity) ;
air moves from high to low pressure ; [max 3]

(ii) to allow alveoli to, expand when breathing in / return to normal size when breathing out [1]

(d) capillary wall is, thin / one cell thick ; not 'thin cell wall'
wall of alveolus is, thin / one cell thick ; not 'thin cell wall'
small distance for gases to diffuse ;
so takes less time / diffusion is faster / diffusion is easier ;
large surface (area) ;
so diffusion can take place more rapidly ;
(ignore refs to diffusion gradient) max 3

(e) through stomata ;
by diffusion ; allow diffusion anywhere appropriate
(net movement) of carbon dioxide in during light and oxygen in during dark / allow converse ;
ref. to air spaces (inside leaf) ;
ref. to large surface area of (spongy mesophyll) cells inside leaf ; [max 3]

[Total: 13]

2 **(a)** place magnet in coil ;
magnet or coil need to be moving or implied ;
connect other end of coil to meter ; not just 'complete the circuit' [3]

(b) **(i)** wire moving across a magnetic field / idea that wire is experiencing a change in magnetic field ;
allow: there is a change in flux through the coil [1]

(ii) magnetic field is changing most / cuts most (magnetic) lines of force ;
rate of, cutting / changing, magnetic field is greatest when horizontal ;
is zero when vertical / cuts no (magnetic) lines of force ; [max 2]

[Total: 6]

3 **(a)** **(i)** hydrochloric ;

(ii) bubbles of gas / effervescence ;
hydrogen is a product ;

temperature increases / tube feels warm ;
reaction is exothermic / heat evolved ;

metal dissolves ;
metal reacts to form a soluble product ;

metal rises to surface ;
supported by bubbles of gas / made buoyant by gas ; [max 2]

(iii) it would react (like the first piece) / specific observation ;
because acid, remains / was in excess ; [2]

(b) *diagram shows*
lattice of, atoms / ions ;
delocalised electrons ;
ref to electrical conductivity explained in terms of ease of electron movement / energy transfer between electrons ; [3]

(c) **(i)** evidence of use of mass = molar mass x number of moles / Ar ;
Ar of Zr = 91 ; give this if 91 appears anywhere
mass = 0.011 x 91 = 1.00(1) ; [max 2]

(ii) mass of Mg = 100 – (3.575 + 1.001) = 95.424g ;
Ar Mg = 24 ; give this if 24 appears anywhere
moles of Mg = 95.424 ÷ 24 = 3.976 ; [3]

[Total: 13]

4 **(a)** no scales, feathers or fur on skin / smooth skin ; [1]

(b) Bufo ; [1]

(c) sugar cane ⟶ lacebugs ⟶ cane toads ;
producer consumer consumer ; [2]

(d) **(i)** 1550 m in 24 hours / so 1550 ÷ 24 ;
= 64.6 metres per hour / .018 m per s / other correct unit ; [2]

(ii) more food / less competition / no limiting factors ; [1]

(iii) idea that difference in leg length is due to genes ;
more likely to arrive in new area ;
so more likely to survive (because more food, less competition) ;
and more likely to reproduce ;
pass on, genes / alleles / mutation, for long legs to offspring ;
ref to long legged toads more easily escape predators ; [max 4]

[Total: 11]

5 **(a)** **(i)** nucleus (of atom) splits ; [1]

(ii) advantage – no global warming / CO_2 emissions / no reduction in fossil fuels reserves / *or* small amount of fuel produces large amount of, electricity / energy ;

disadvantage – radiation leaks / high decommissioning costs / waste disposal / expensive to build / expensive to maintain / expensive to keep safe ; [max 2]

(b) **(i)** alpha and beta deflected in opposite directions ;
because they have opposite charges ;
alpha to negative and beta to positive ; this also gets mp1
gamma <u>not charged</u> and not deflected ; [4]

(ii) largest / most massive / most charged, particle ; [1]

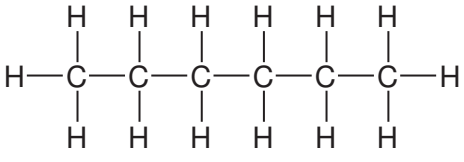
(iii) cancer / mutations / damage DNA / radiation burns / damages cells / ; [1]

(iv) lead only lets some gamma escape / lead is good at absorbing, gamma / all types of radiation ; [1]

[Total: 10]

6 **(a)** it is porous / permeable / description of porosity ; [1]

(b)



; 1

(alkane)
contains only single bonds (between carbon atoms) / is saturated /
contains maximum possible number of H atoms / fits formula C_nH_{2n+2} ; [1]

(c) **(i)** (catalytic) cracking ;

(ii) fractional distillation ;

(iii) bromine (solution) ;
orange to colourless / decolourised, with alkenes ;
take equal amounts of product mixture for both catalysts ;
the mixture which decolourises, the greater amount of bromine / faster / produces lightest colour, has the more alkenes ; [max 3]

[Total: 8]

7 **(a)** A oviduct / Fallopian tube
B ovary
C vagina / cervix
D uterus one mark for any two correct ; ; [2]

(b) **(i)** date between (June) 5th – 8th ; [1]

(ii) date between 20th – 28th ; [1]

(c) virus / HIV ;
in body fluids / description ; not 'in male gametes' or 'in sperm' [2]

(d) **(i)** fusion of, sperm and egg / male and female gamete / male and female nucleus ;
outside the (female's) body / after the eggs are laid / in the water ; [2]

(ii) sperm, could not survive in air / need liquid to swim in ; [1]

(iii) external fertilisation, less efficient than internal / many eggs not fertilised ;
eggs develop outside body with external fertilisation so not protected /
fewer embryos survive ; [2]

[Total: 11]

8 **(a)** (good thermal) <u>insulator</u> / poor <u>conductor</u> ; [1]

(b) **(i)** (work =) force x distance ;
= 900 x 6 = 5400 J ; [2]

(ii) 5400 J ; allow ecf [1]

(c) **(i)** zero ;
no velocity ; accept 'no speed' [2]

(ii) C (no mark)
mass is largest ; [1]

(iii) yes (no mark)
idea that as direction changes so does (velocity and therefore) momentum / mo
is a vector quantity ;

(d) **(i)** number of waves per unit time ; [1]

(ii) velocity = frequency x wavelength /wavelength = velocity/frequency ;
300 000 000/10 000 000 000 = 0.03 m ; [2]

(iii) digital series of pulses / on off *or* analogue has complete range of values ; [1]

(e) **(i)** moment = force x distance ; accept load instead of force
= 5000 x 10 = 50 000 Nm ;
if say moment = mass x distance but then do calculation correctly and give correct unit, can get second mp [2]

(ii) distance = 50 000/25 000 ;
= 2 m ;
allow ecf from **(i)** [2]

[Total: 16]

9 **(a)** any ionic (ignore solubility issues) ;
must contain ions / it is ionic / must be able to conduct ; [2]

(b) **(i)** X (most)
Y
zinc
(copper)
Z (least ;; (all correct for [2] two correct for [1]) [2]

(ii) X ;
it is the most reactive ; [2]

(c) evidence of balancing charge to find copper ion charge ;
deduces Cu^{+} in Cu_2O ;
deduces Cu^{2+} in CuO ;
statement to effect that Cu^{2+} has one less electron than Cu^{+} / or similar ; [max 3]
$2Cu^{+} + O^{2-}$ *arrow* Cu_2O gets mp 1 and 2 because it implies charge neutralised

(d) zinc ions / they, move to cathode / negative electrode ;
reference to Zn ions positive and attracted to negative electrode ;
zinc ions gain electrons ;
two electrons each / are discharged ;
$Zn^{2+} + 2e^{-}$ *arrow* Zn gets mp 3 and 4 [max 3]

[Total: 12]