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

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UNIVERSITY of CAMBRIDGE
International Examinations

1 (a) take up oxygen / become oxygenated / oxygen goes into them ;   not just 'carry oxygen'
by diffusion ;
oxygen, combines with / taken up by/ received by, haemoglobin ;
haemoglobin changes to oxyhaemoglobin / oxyhaemoglobin formed ;   [max 2]

(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 ;   [1]

(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 / A_r ;
A_r 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 ;
A_r 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 $\longrightarrow$ lacebugs $\longrightarrow$ 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]**

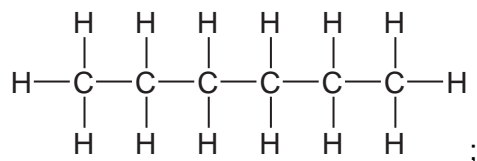   **(ii)** largest / most massive / most charged, particle ;   **[1]**

    (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 ; [1]

(ii) fractional distillation ; [1]

(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 / momentum
       is a vector quantity ;   [1]

  (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]