

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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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 oxygen'
by diffusion ;
oxygen, combines with / taken up by/ received by, haemoglobin ;
haemoglobin changes to oxyhaemoglobin / oxyhaemoglobin formed ; [max 3]
- (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]

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- 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]

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- (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 / CO₂ 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 not charged and not deflected ; [4]

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

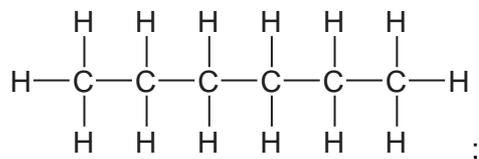
- (iii) cancer / mutations / damage DNA / radiation burns / damages cells / ; [1]

- (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]

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- (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) insulator / poor conductor ;

[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]

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

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

(ii) velocity = frequency x wavelength /wavelength = velocity/frequency ;
 $300\,000\,000/10\,000\,000\,000 = 0.03\text{ m}$; [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
 $= 5000 \times 10 = 50\,000\text{ Nm}$;
 if say moment = mass x distance but then do calculation correctly and give correct unit,
 can get second mp [2]

(ii) distance = $50\,000/25\,000$;
 $= 2\text{ m}$;
 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]
 $2\text{Cu}^+ + \text{O}^{2-} \rightarrow \text{Cu}_2\text{O}$ 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 ;
 $\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn}$ gets mp 3 and 4 [max 3]

[Total: 12]