**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**International General Certificate of Secondary Education**

# MARK SCHEME for the May/June 2010 question paper

# for the guidance of teachers

## 0654 CO-ORDINATED SCIENCES

**0654/31** Paper 31 (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, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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**1 (a) (i)** **C** and **D** ;

**(ii)** **A** and **D** ;

**(iii)** opens and closes ;
when atrium contracts valve is pushed open ;
when ventricle contracts valve is pushed shut ; [max 2]

**(b)** more oxygen (in right side of heart in fetus) ;
idea that it is a mix of oxygenated blood (from placenta) and deoxygenated (from body tissues) ; [2]

**(c) (i)** haemoglobin ; [1]

**(ii)** protein ; [1]

**(iii)** iron ; [1]

**(iv)** small particles / not made of large molecules ;
so can be absorbed as they are ; [2]

**(v)** for respiration / to combine with glucose ;
to release energy / to provide energy ; [2]

**[Total: 13]**

**2 (a) (i)** causes, skin cancer / eye damage / burns / mutation in skin / damage to DNA in skin ; [1]

**(ii)** protective clothing / sun block ; [1]

**(b)** (speed =) distance / time ;
= 300 m / s ; [2]

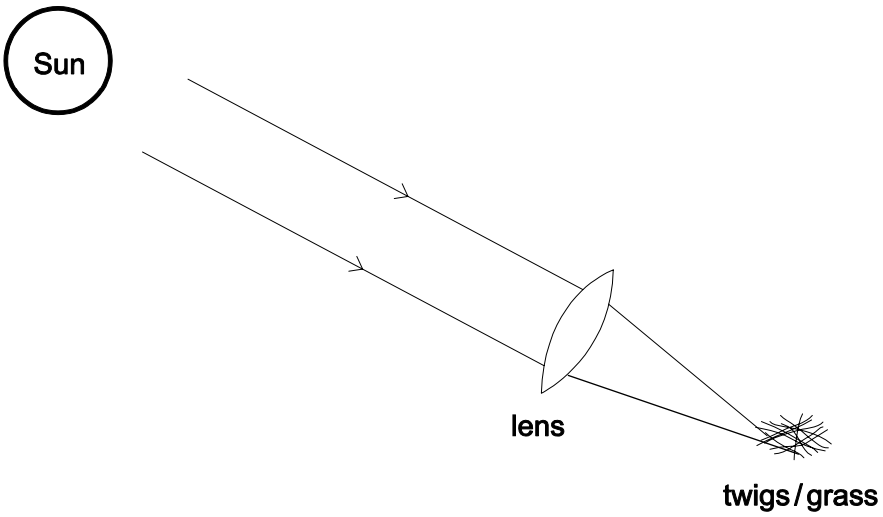
**(c)** (momentum =) mass × velocity ;
= 400 000 × 60 = 24 000 000 kg m / s ; [2]

**(d) (i)** all symbols correct ;
all symbols connected in series ; [2]

**(ii)** 6 V ; [1]

**(e)** electron transfer ;
fabric gains electrons / tent loses electrons / or vice versa ;
by friction between surfaces ; [3]

**(f)** two straight parallel rays drawn entering the lens ;
two straight rays brought to a focus at the twigs / grass ;
arrows correctly shown ;




**[Total: 15]**

**3** **(a)** ionising ;
removes electrons ;
damages DNA / mutation ;
effect (e.g. cancer / burns / radiation sickness) ; [max 3]

**(b)** **(i)** nuclei split / nuclear fission ; [1]

**(ii)** nuclear / radioactive / toxic waste ;
problems of disposal / storage ;
**or**
security of fissionable / radioactive material ;
use in terrorism ;
**or**
accident / malfunction ;
effect of radioactive materials on environment / humans ; [max 2]

**[Total: 6]**

**4** **(a)** **(i)** reaction is exothermic / heat was given off ; [1]

**(ii)** temperature falls (after 25 $cm^3$ of acid added) ;
so no further (exothermic) reaction / all alkali used up ; [2]

**(b)** **(i)** *moles of A*
((25.0 / 1000) × 0.2 =) 0.005 ;

*moles KOH*
((20.0 / 1000) × 0.5 =) 0.01 ; [2]
(allow 1 mark if the same error in converting to $dm^3$ is made in each calculation, e.g. if left in $cm^3$ answers are 5 and 10)

**(ii)** (0.5) (no mark)
[e.c.f. from **(i)** provided answer is half the KOH moles] because the number of moles of acid must be half the number of moles of KOH / owtte / or relevant working ; [1]

**(iii)** $H^+ + OH^- \rightarrow H_2O$ (all correct for 2 marks, two of the three for 1 mark) ;; [2]

**(c)** **(i)** electrolysis ; [1]

**(ii)** plate, has a negative charge / is negative, and potassium ions, are positively charged / are positive ;
opposite charges attract / potassium ions move towards the plate ;
potassium ions gain electrons from the plate ;
potassium ions, discharged / gain one electron / become atoms ; [max 3]

**[Total: 12]**

**5** **(a)** foam / air, is a poor conductor ;
foam, stops convection of air / traps air ;
radiation reflected by, shiny surfaces / foil / metal ; [3]

**(b)** **(i)** **B** (no mark)
turns ratio 2:1 ; [1]

**(ii)** water can conduct electricity ;
danger of electrocution ; [2]

**(c)** **(i)** current (flows in circuit) ;
produces (electro)magnet ;
(magnet) attracts iron bolt ; [3]

**(ii)** (no – no mark)
aluminium is not magnetic / not attracted to electromagnet ; [1]

**(iii)** (yes – no mark)
still an electromagnet (so still attracts bolt) ; [1]

**(iv)** more coils / bigger voltage / bigger core ; [1]

**[Total: 12]**

**6 (a) (i)** ammonium / $NH_4^+$ ;

**(ii)** shortage of something in the soil ;
nitrogen / nitrate, needed for making, protein / amino acids ;
proteins for growth ;
detail, e.g. more cells / more cytoplasm ;
correct ref. to function of P or K ; [max 3]

**(iii)** wheat – little / no, difference ;
potatoes – greater, with manure + bacteria / in plot **B** ;
10.50 tonnes (per hectare per year) (greater) ; [3]

**(iv)** manure contains plant and animal waste e.g. proteins / urea ;
which needs to be, broken down / decomposed (by bacteria) ;
to produce, ammonia / nitrates / something that can be used by plants ;
reference to nitrification / nitrifying bacteria ; [max 2]

**(b)** stimulates growth of, algae / plants ;
plants / algae, die ;
fed on by bacteria / decomposers ;
which respire (aerobically) ;
bacteria use oxygen ; [max 3]

**[Total: 12]**

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

**(ii)** protein;
only proteins contain, S / sulfur ;
only proteins contain, N / nitrogen ; [3]

**(b) (i)** molecules have only weak forces between them ;
molecules / particles, can move past one another easily ;
therefore (solid) nylon, melts / becomes a liquid, when heated / it enters the hot container ;
molten nylon can be pumped (through small holes) ;
molten threads solidify when cooled ;
strong forces between molecules when solid ; [max 3]

**(ii)** doesn't melt (on contact with hot containers) ;
molecules cannot move past one another ;
because strong bonds hold polymer chains / crosslinks ; [max 2]
[clear diagram could score crosslink mark]

**[Total: 9]**

**8 (a)** **A** to retina ;
**B** to optic nerve ;
**C** to iris ;

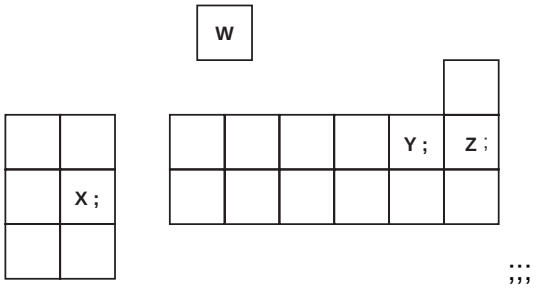
**(b)** ciliary muscles, contract / get shorter ;
loosen (tension on) (suspensory) ligaments ;
lens more rounded / fatter ;
more refraction / shorter focal length ;
light (rays) brought to a focus <u>on the retina</u> ; [max 3]

**(c)** cystic fibrosis / sickle cell anaemia / thalassaemia / other ;
statement as to whether allele is dominant or recessive ;
(above examples are all recessive. Huntington's is dominant)

*if recessive*
both parents must have allele for offspring to inherit disease / are heterozygous ;
parental genotypes and offspring genotypes shown / 1 in 4 chance of offspring having disease ;
**or**
*if dominant*
only one parent needs to have allele for offspring to inherit disease ;
parental genotypes and offspring genotypes shown / 1 in 2 chance of offspring having disease ; [max 3]

**[Total: 9]**

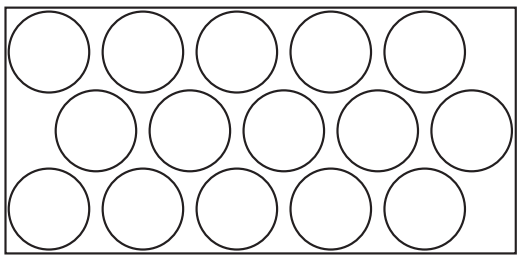
**9 (a)**




;;;

[3]

**(b)** **(i)** atoms all same size arranged in regular lattice ; [1]
e.g.



**(ii)** reference to delocalised electrons ;
movement of charge / electrons ; [2]

**(c)** **(i)** oxidation / reaction with oxygen (from air) / formation of metal oxide ;
reference to the, hot / molten, metal ;

**(ii)** three shells with 18 electrons ;
arranged 2,8,8 ; [2]

**(iii)** outer shell is complete ;
does not need to, lose / gain electrons, (by reaction) / owtte ; [2]

**[Total: 12]**