CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0442 CO-ORDINATED SCIENCES (US)

0442/33 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.

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1 **(a)** **A** to cell membrane / membrane round vacuole ;
B to nucleus ;
C to cell wall / large vacuole ;

(b) functions are uptake of water / mineral ions ;
partially permeable membrane allows (water to enter by) osmosis ;
has large surface area ;
increases (rate of) uptake (of water / mineral ions) ; [max 3]

(c) phloem has been removed / prevents phloem transport ;
phloem transfers substances from <u>leaves</u> (to roots) ;
reference to sucrose ;
roots have no sucrose / short of nutrients ; [max 3]

[Total: 9]

2 **(a)** **any** two from oxygen, sulfur, fluorine ;
both non-metals ; [2]

(b) <u>PH_3</u> ;
hydrogen atoms have electron configuration of 1 / need to gain 1 electron for filled outer shell ;
atoms share (pairs) of electrons ;
so that each has filled shells ; [max 3]

(c) **(i)** any three from barium, magnesium, chlor<u>ide</u>, hydrogen ; [1]

(ii) 0.75×50.0 ;
$(0.75 \times 50.0) \div 1000 = 0.0375$ or 0.038 ; [2]

(iii) 0.0375 or 0.038 ; [1]

(iv) M_r barium sulfate = 233 ;
$0.0375 \times 233 = 8.74$ (g) ; [2]

[Total: 11]

3 **(a)** decreases <u>and</u> decreases ;

(b) length ;
diameter / cross-sectional area / thickness / width ; [2]

(c) **(i)** (power =) voltage × current ;
= 3 × 0.6 = 1.8 W ; [2]

(ii) work = force × distance *and* (power =) work/time or (P=)Fx/t ;
= 40 × 1.2/36 ;
1.3(3) W ; [3]

(iii) energy lost / wasted (as heat / sound) ; [1]

(iv) efficiency = 1.33/1.8 × 100 ;
73.88% *(allow 0.74 or 0.72)* ; [2]

(d) **(i)** negative ; [1]

(ii) alpha is positive / opposite charge to beta ;
gamma has no charge ; [2]

[Total: 14]

4 **(a)** **(i)** bacteria / *Lactobacillus* / *Streptococcus* ; [1]

(ii) to speed up the production of yoghurt ;
microorganisms work faster (at higher temperature) ;
reproduction rate of microorganisms is faster ; [max 2]

(b) **(i)** increased ;
use of data e.g. from 0.15% to 0.31% ;
description of variation in rate e.g. rate of increase slowed after six hours ; [max 2]

(ii) added sugar increases the amount of lactic acid / use of data to illustrate this ;
microorganisms convert sugar to lactic acid ;
more sugar increases rate of production of lactic acid ; [2]

(c) area too small to support populations / reduction in biodiversity / extinction / species become endangered / lack of opportunity to find new medicines ;
due to reduction of habitat ;

flooding / leaching of minerals ;
due to rain falling directly on soil / lack of protection of tree canopy / increased runoff ;

soil erosion ;
due to lack of tree roots ;

drought ;
due to lack of transpiration by trees to form rain (leading to desertification) ;

CO_2 levels in the atmosphere increase ;
due to fewer trees to photosynthesise / less photosynthesis to remove carbon dioxide ;
also due to burning trees produce CO_2 / rotting trees produce CO_2 by respiration of microbes ;

carbon dioxide reduces rate of loss of heat from the Earth's surface / increases global warming ;
due to trapping long-wave radiation / infra-red / heat / thermal energy / being a greenhouse gas ; [max 4]

[Total: 11]

5 (a) oxidation is loss of electrons / reduction is gain in electrons ;
iron <u>atoms</u> have lost electrons / copper <u>ions</u> have gained electrons ; [max 2]

(b) (i) oxygen ; [1]

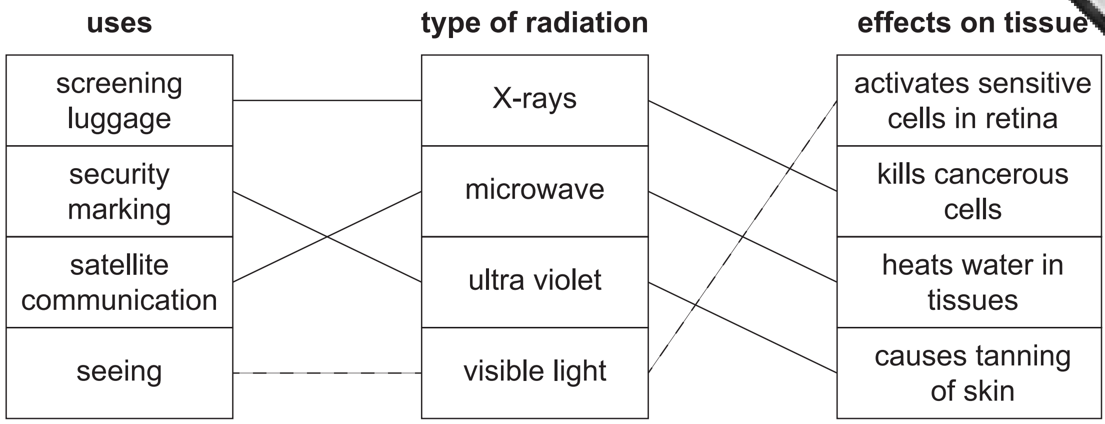
(ii) hydrogen ; [1]

(iii) **Q**
G
P ;
Q more reactive than **G** because able to remove oxygen from it / owtte ;
P less reactive than **G** since unable to separate oxygen from it / owtte ; [3]

(c) air / oxygen and water react with iron / steel to form rust ;
zinc provides barrier between iron and environment ;
(if zinc layer damaged) zinc corrodes / oxidises rather than iron / owtte ;
because zinc more reactive than iron ; [4]

[Total: 11]

6 **(a)** **(i)**



links in the left column: 3 correct = 2 marks and 1 correct = 1 mark ;;
links in the right column: 3 correct = 2 marks and 1 correct = 1 mark ;; [4]

(ii) (wave) speed ;
transverse waves ;
do not require a medium ; [max1]

(b) **(i)** flask **B** because temperature drops most (over a period of time) ; [1]

(ii) black surfaces are good emitters of radiation; [1]

(iii) need two answers
volume of water
shape / size of flask
starting temperature of water / ambient temperature ; [1]

[Total: 8]

7 **(a)** neither allele is, dominant / recessive ; [1]

(b) <u>phenotype</u> ; [1]

(c) (parents' genotypes) A^NA^N and A^NA^B ;
gametes A^N from one parent, A^N and A^B from the other ;
offspring genotypes A^NA^N and A^NA^B ;
relates genotypes to phenotypes / equal numbers of normal and cinnamon ; [4]

(d) breed black snake with a normal snake (to give cinnamon offspring) ;
then breed cinnamon offspring, with each other / with the black snake ; [2]

[Total: 8]

8 **(a)** calcium ions are Ca^{2+} ;
reference to need for charge balance (so two nitrate ions required) ;
formula is $Ca(NO_3)_2$; [

(b) **(i)** the greater the acid concentration the higher the rate ;
reference to direct proportionality ; [2]

(ii) reference to reaction occurring as the result of particle collisions ;
higher concentration means higher frequency/*probability* of collision ; [2]

(iii) temperature affects rate of reaction ;
so control needed so rate investigation data is valid/reference to fair test ;
additional collision theory detail related to rate ; [max 2]

[Total: 9]

9 **(a)** **(i)** $\frac{50}{20-10}$ (= 5 m/s) ;
(working could be on graph) [1]

(ii) (KE =) ½ mv^2;
= ½ × 400 × 5 × 5 = 5000 J ; [2]

(iii) not moving ; [1]

(iv) (acceleration =) change in speed/time ;
= 2/5 = 0.4 m/s^2 ; [2]

(b) **(i)** particles move faster/have more energy, so more frequent collisions with tyre (wall) ;
particles move faster/have more energy, so more forceful collisions with tyre (wall) ;
[max 1]

(ii) heat transferred from body to sweat/heat absorbed by sweat from athlete's body/heat energy in body reduced by sweating ;
kinetic energy of water molecules increases/water molecules move faster ;
faster moving/more energetic (water) molecules escape/leave the surface/water (sweat) molecules turn to gas/vapour ;
reference to break bonds/break forces of attraction <u>between</u> molecules ;
(KE)/energy of (remaining) water molecules (in sweat) decreases ; [max 2]

(iii) liquid – most particles touching, irregular arrangement, particles of similar size ;
gas – particles far apart, irregular arrangement, particles of similar size ; [2]

[Total: 11]

10 **(a)** more/further ;
ciliary ;
contract/shorten ;
decreases ;
decreases ; [5]

(b) **F** on retina ; [1]

(c) **(i)** fast/automatic, response to a stimulus ; [1]

(ii) (either) transmits nerve impulse ;
(sensory neurone) from retina, to brain ;
(motor neurone) from brain to muscle (in iris)/effector ; [3]

(d) **(i)** so that light can pass through them / blood would absorb light ; [1]

(ii) for respiration ;
for release of energy ;
ref. to use of energy, e.g. protein synthesis, cell division,
cell contraction, passage of nerve impulses ; [max 2]

[Total: 13]

11 **(a)** **(i)** C_8H_{18} ; [1]

(ii) it is a hydrocarbon containing only single bonds/a saturated hydrocarbon ; [1]

(b) **(i)** molecules in gasoline (on average) are smaller/lighter ;
so (attractive) forces between molecules in gasoline are lower ;
so less energy needed to separate molecules (in gasoline) ;
so are less entangled (than in diesel) ; [max 2]

(ii) gasoline is a mixture/not a single compound/different compounds in gasoline all have different boiling points ; [1]

(c) **(i)** bromine/bromine water/potassium permanganate ;
changes from orange to colourless/purple to colourless ; [2]

(ii) $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$;; [2]
[all formulae then look for balanced]

[Total: 9]

12 **(a)** waves are reflected along fibre / by reflection ;
total internal (reflection) ;
angle (of incidence) is greater than critical angle ;
(a well-drawn diagram of an internally reflecting ray with accurate angles of incidence and reflection can be awarded the first two marking points) [3]

(b) **(i)** two rays reflected at the mirror entering the eye and angles approx. correct ; [1]

(ii) two lines drawn back from the mirror locating **X** ;
X labelled in correct position ; [2]

[Total: 6]