CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the May/June 2015 series

0654 CO-ORDINATED SCIENCES

0654/22 Paper 2 (Core Theory), maximum raw mark 120

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CAMBRIDGE
International Examinations

1 **(a)** mass is a measure of amount of matter in an object ;
weight is the gravitational force pulling on the object ;
mass will be the same throughout the universe but weight will depend on the gravitational field strength ;
mass is measured in kg weight is measured in N ; [max 2]

(b) **(i)** kinetic (energy) ; [1]

(ii) (gravitational) potential energy ; [1]

(c) **(i)** **B** and **D**, and **A** and **C** (either order) ;
B and **D** ; [2]

(ii) equal ;
opposite ; [2]

(d) **(i)** **B–C** – horizontal line means constant speed ; [1]

(ii) **A–B or C–D** – (diagonal line means) speed is changing ; [1]

[Total: 10]

2 **(a)** red
blue ;
colourless / white / is bleached ;
(allow red then white but not blue then white)
(red and blue correct = 1 chlorine result correct = 1) [2]

(b) **(i)** increases ; [1]

(ii) 7 ;
mixture is neutral / the acid has been neutralised ; [2]

(c) **(i)** limewater / calcium hydroxide / slaked lime ; [1]

(ii) goes cloudy / milky / white precipitate ; [1]

(iii) calcium chloride ;
water ;
in either order [2]

(iv) increase acid concentration ;
increase (acid) temperature ;
increase surface area (of calcium carbonate) / smaller particle size ; [max 2]

[Total: 11]

3 **(a)** (labels, from top left)
photosynthesis ;
respiration ;
combustion ; [3]

(b) arrow from plants to animals ;
ignore arrow from died and decaying matter to animals [1]

(c) more photosynthesis (than respiration and decay) in spring / summer ;
more decay / respiration (than photosynthesis) in autumn ; [2]

(d) (increase – no mark)
plants remove less CO_2 from atmosphere ;
by photosynthesis ;
removed trees form dead matter ;
and decay to produce more CO_2 ;
burning wood / combustion release CO_2 ; [max 2]

[Total: 8]

4 **(a)**

description	element symbol(s)
it is an unreactive gas	Ne
it oxidises to form rust	Fe
its atoms have the lowest proton number	H
they are good electrical conductors	Na K Fe Cu
they are transition metals	Fe Cu
they combine to form sodium chloride	Na Cl

1 mark for each completely filled box ; ; ; ; ; [6]

(b) **(i)** 13 ; [1]

(ii) Group 4 – silicon ;
4th period – calcium ; [2]

(c) **(i)** (KF)
reference to metal combining with non-metal ; [1]

(ii) reference to gain of electrons / outer shell is completed /
outer shell electron number goes from 7 to 8 /
the ion now has a single negative charge ; [1]

[Total: 11]

5 **(a)** **(i)** 1955 ; [1]

(ii) 330 (g / m^2) ; [1]

(b) **(i)** identify / choose highest yielding plants ;
use these for breeding / repeat over many generations / check for appearance of undesirable characteristics ; [2]

(ii) more / better / use of fertiliser ;
better pest control ;
irrigation ;
new varieties of wheat from outside ;
better soil quality ;
better weather ; [max 2]

(c) disease / drought / flood / frost / AVP ; [1]

(d) disease resistance / pest resistance / hardiness / taste / nutrient content / high germination rate ; [1]

[Total: 8]

6 **(a)** friction ;
transfer of electrons / charged particles ; [2]

(b) **(i)** symbols for lamp and switch correct in a working circuit ;
lamps connected in parallel ;
switch in correct position to control both lamps ; [3]

(ii) still a complete circuit for the other lamp ; [1]

(iii) current = voltage / resistance ;
= 12 / 2 = 6 A ; [2]

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

(ii) transverse waves oscillate at right angles to direction of wave / energy transfer ;
longitudinal waves oscillate parallel to direction of wave / energy transfer ; [2]

[Total: 11]

7 **(a)** ovary ; [1]

(b) **(i)** oviduct / fallopian tube ; [1]

(ii) prevents egg reaching uterus / sperm cannot reach egg / prevents fertilisation / sperm cannot enter fallopian tube ; [1]

(c) **(i)** chemical substance produced by gland ;
carried in the blood ;
affects / alters activity of target organs ;
destroyed in liver ; [max 3]

(ii) ovary labelled on Fig. 7.1 ; [1]

[Total: 7]

8 **(a)** **(i)** 46.6% ; [1]

(ii) nitrogen 78% ;
oxygen 21% ; [2]

(b) **(i)** reduction ; [1]

(ii) compounds are broken down by electrical energy / by passing an electric current through them ;
contains (mobile) ions / a compound that conducts ;
the negative electrode ; [max 3]

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

(ii) unreactive / will not react with food / catch fire in oven
high melting point / will not melt during cooking ;
other science based ideas, e.g. reflects heat back into food ; [max 2]

[Total: 10]

9 (a) (i) (time) = distance / speed ;
= 50 / 1500 = 0.03(3) (s) ; [2]

(ii) cannot hear (no mark)
max human audible frequency is 20 000 Hz ; [1]

(b) ray from head bends at surface ;
enters eye ; [2]

(c) (i) temperature at which a liquid boils and turns into a vapour ; [1]

(ii) thermal energy transferred to (water) particles (from surroundings) / particles gain KE / move faster when heated ;
water changes from liquid to vapour / gas ;
ref. to attraction between particles in the liquid ;
fastest moving particles escape ;
(escape) at surface / ref to process happening at temperature below boiling point ;
average energy of the rest of the particles reduced / thermal energy removed from liquid ; [max 3]

(d) (i) **B** because most particles are touching and randomly arranged ; [1]

(ii) **C** because particles are widely spaced and randomly arranged ; [1]

[Total: 11]

10 (a) (i) root hair (cell) ; [1]

(ii) cell wall ;
nucleus ; [2]

(b) absorbs mineral ions / nitrate / magnesium (ions) / other named mineral ion ; [1]

(c) (i) transpiration ; [1]

(ii) leaves / stomata / mesophyll ; [1]

(d) for photosynthesis ;
as part of cytoplasm / for growth ;
support / turgor ;
for transport (of ions / sugars) ; [max 1]

[Total: 7]

11 (a) (i) cracking ; [1]

(ii) (alkene)
ref. to double bond / conforms to general formula C_nH_{2n} ; [1]

(iii) orange ;
to colourless ; [2]

(b) (i) (addition) polymerisation ; [1]

(ii) several G symbols linked into a chain (minimum 4) ; [1]

(iii) (white solid is hydrocarbon)
made of the elements hydrogen and carbon ;
only ;

OR

G is a hydrocarbon and so **G**s linked must be hydrocarbon ;
because no other elements are included ; [2]

[Total: 8]

12 (a) incisor ; [1]

(b) (structure) larger ;
two roots ;
flatter ;
[max 2 for structure]
(function) grinding / crushing ;
T1 for biting ; [max 3]

(c) breaks into small pieces ;
(so) easier to swallow ;
more surface area for enzyme action ; [max 2]

(d) removes plaque / bacteria ;
removes sugar / food remnants ;
which encourage bacteria ;
removes / neutralises acid ; [max 2]

(e) flossing ;
avoiding sugary / sticky foods ;
avoiding snacks between meals ;
mouthwash ;
fluoride ;
regular dental checks / professional cleaning / sealing ; [max 2]

[Total: 10]

13 (a) (i) removes electrons from atoms / turns atoms to ions ; [1]

(ii) repeated exposure to X-rays is harmful ;
X-rays are harmful to humans / cause cancer, etc. ;
metal screen stops X-rays penetrating ; [max 2]

(iii) X-rays in 6th box ;
γ rays in 7th box ; [2]

(b) (i) reflection continues through fibre with angle approx. correct ; [1]

(ii) total internal reflection ;
angle of incidence always exceeds critical angle ; [max 1]

(c) it can pass through the human body **and** it is safer than α or β radiation ;
(both required for 1 mark) [1]

[Total: 8]