CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0654 CO-ORDINATED SCIENCES

0654/32 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.

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1 (a) (i) (named) decomposer ; [1]

(ii) nitrate ;
phosphate ;
potassium ;
magnesium ;
other named essential mineral ion ; [max 2]

(b) (i) carbon dioxide ;
ethanol ; [max 2]

(ii) keep the compost bin warm ;
mix / aerate the compost ;
break up compost into smaller pieces ; [max 2]

(c) dead matter recycled / (nutrients in) crop not being removed ; [1]

[Total: 8]

2 (a) (i) magnesium
zinc
J
hydrogen
copper ;; [2]

(ii) copper ions ;
brown deposit made of copper atoms ;
copper ions gain electrons ;
gain of electrons is reduction ; [max 3]

(b) (i) regular arrangement of gold atoms ;
interspersed with fewer of the different atom ; [2]

(ii) mass of diamond in grams = $186 \times 0.2 = 37.2\,g$;
moles C = $\frac{37.2}{12}$ = 3.1 (moles) ; [2]

[Total: 9]

3 (a) (i) distance = area under graph (**or** working on graph) ;
$= 25 \times 100 + ½ \times 150 \times 25 = 4375$;
m ; [3]

(ii) (KE =) $½\ mv^2$;
$= ½ \times 500\,000 \times 20 \times 20 = 100\,000\,000\,(J) = 100\,000\,(kJ)$; [2]

(b) (i) density decreases ;
mass does not change ;
kinetic energy of particles increases / speed of particles increases ;
particles move further apart ; [max 3]

(ii) volume = 125 000 cm^3 ;
mass = 7.8 × 125 000 = 975 000 g ;
= 975 (kg) ; [3]

[Total: 11]

4 (a) petroleum / crude oil ; [1]

(b) reference to fractions having different boiling ranges / points ;
reference to smaller molecules in materials with lower boiling points ;
reference to the temperature gradient in the tower ;
reference to collection of fraction at heights corresponding to boiling point ; [max 3]

(c) (i) cracking ; [1]

(ii) (react with) bromine (solution / liquid) ;
decolourised if hydrocarbon is unsaturated ; [2]

(iii) the idea of applying the test before and after the cracking ;
the result that decolourisation only occurs following the cracking process ; [2]

[Total: 9]

5 (a) taking in nutrients / organic substances / mineral ions ;
containing raw materials / energy ;
absorbing / assimilating them ; [max 2]

(b) (i) unbalanced diet / wrong amount of some part of the diet ; [1]

(ii) too much energy / too much fatty food / too much carbohydrate / sugar so
(human) body (makes /) stores as fat ; [1]

(c) (i) increases ;
after 1970 / no increase before 1970 ;
from 5% to 21–22% / by 16–17% ; [max 2]

(ii) more available / fast food ;
people take less exercise ; [max 1]

(iii) diabetes ;
arthritis ;
(coronary) heart disease ;
high blood pressure / cholesterol ;
reduced fertility ;
cancer ; [max 2]

(d) (i) making / maintaining bones ;
absorbing / using calcium ; [max 1]

(ii) egg / liver / (oily) fish / milk / other milk products ; [1]

(iii) rickets ;
soft / brittle bones / 'bending' of legs ; [2]

[Total: 13]

6 (a) mirror drawn at suitable angle ; [1]

(b) total internal reflection / angle of incidence greater than critical angle; [1]

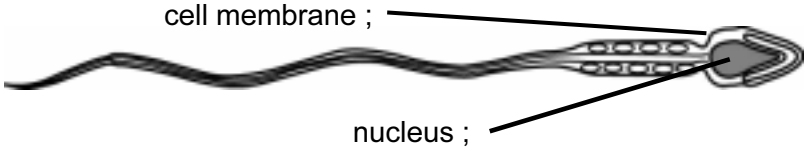
(c) steel will be attracted to magnet / aluminium alloy will not be attracted; [1]

(d) (i) $P_1V_1 = P_2V_2$;
$V_1 = \frac{P_2V_2}{P_1} = 2 \times 10^5 \times \frac{1600}{1} \times 10^5$ (= 3200 cm^3) ; [2]

(ii) number of strokes = $\frac{3200}{90}$ = 35.55 so 36 ; [1]

[Total: 6]

7 (a)



[2]

(b) male gametes smaller / ORA ;
male gametes produced in larger numbers / ORA ;
male gametes elongated shape / ORA ; [max 3]

(c) (i) 20 °C ; [1]

(ii) lower rate of respiration / enzymes less active / less kinetic energy for enzymes ; [1]

(iii) any suggestion below 62.5% ; [1]

(d) (i) less mobile, because too warm ; [1]

(ii) sperms are more mobile as they are outside the body cavity and therefore cooler / owtte ; [1]

(iii) reduced, because sperm mobility reduced ; [1]

[Total: 10]

8 (a) (i) radiation ; [1]

(ii) car **A** / black car – black surfaces absorb heat more ; [1]

(b) (i) $(R) = \frac{V}{I}$;

$= \frac{12}{4.8} = (2.5\,(\Omega))$; [2]

(ii) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$;

resistance $(R_T) = 1.25\ (\Omega)$; [2]

(c) (i) 20 (Hz) to 20 000 (Hz) ; [1]
(both needed for mark)

(ii) (distance =) speed × time ;

$= 34\,000 \times \frac{0.002}{2} = 34\,(\text{cm})$; [2]

(iii) $v = f \times \lambda$;

wavelength $= \frac{340}{40\,000} = 0.0085\,(\text{m})$; [2]

(iv) compressions further apart ;
larger wavelength ; [2]

[Total: 13]

9 (a) (i) 2,5 ; [1]

(ii) reference to completion of outer shell ;
so now 3 more electrons than protons / ion has 3 more negative electrons compared to the neutral atom ; [2]

(iii) Mg_3N_2 ;
reference to charge balance ; [2]

(b) (i) $N_2 + 3H_2 \longrightarrow 2NH_3$; [1]

(ii) use of damp, red litmus paper / universal indicator paper ;
colour change to blue / purple ;
OR
use of hydrogen chloride gas ;
white smoke / ammonium chloride ; [max 2]

(iii) increases the surface area (of the catalyst) ;
increases the frequency that gas molecules collide with the catalyst ; [2]

[Total: 10]

10 (a) (i) (efficiency =) $\frac{\text{useful energy (power) out}}{\text{useful energy (power) in}}$;

$= \frac{800}{2400} = 0.33 \times 100 = 33(\%)$; [2]

(ii) nuclear fusion / nuclei join together (to release energy) ; [1]

(b) (i) γ-radiation ; [1]

(ii) (γ-radiation / gamma – *no mark if* ***no*** *explanation given*)
not charged particles so not affected by electric field ; [1]

(c) (i) to reduce energy / power losses ;
high voltage means low current ; [2]

(ii) number of primary coils less than number of secondary ;
reference to a.c. / alternating current ;
changing magnetic field induces secondary voltage;
reference to changing current leading to change in magnetic field ; [max 3]

[Total: 10]

11 (a) (i) folded / large surface area ;
thin / permeable ;
moist ; [max 2]

(ii) has blood vessels / (blood) capillaries ; [1]

(b) (i) carbon dioxide ; [1]

(ii) <u>diffusion</u> ; [1]

(c) (i) slower gas exchange / oxygen uptake ;
(because) less surface area ; [2]

(ii) cancer ;
bronchitis ;
asthma ;
coughing / excess mucus ;
increased risk of colds / sore throat / etc. ;
AVP ; *(**do not accept** references to CHD etc.)* [max 2]

[Total: 9]

12 (a) (i) *(element: K or H)*
cannot be simplified / contains atoms with same proton number / contains only one type of atom ;
(compound potassium hydroxide or water)
made of different types of atom bonded together / can be simplified / broken into elements ; [2]

(ii) same numbers of each type of atom on both sides ; [1]

(iii) *state symbol:* (l) refers to a (single) liquid substance / (liquid containing only one type of molecule) ;
state symbol: (aq) refers to a solution of a substance in water ; [2]

(iv) green to purple / blue ;
potassium hydroxide is an alkali / solution becomes alkaline / pH increases ; [2]

(v) reaction is exothermic / heat given off ;
hydrogen gas ignites ; [2]

(b) (i) line clearly drawn to any shared pair and labelled with an **S** ; [1]

(ii) each atom becomes stable if it can gain complete valence shell / owtte ;
complete shells achieved by sharing electrons in pairs ;
other detail e.g. H full shell has two electrons the other elements have eight ; [max 2]

[Total: 12]