CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2015 series

0654 CO-ORDINATED SCIENCES

0654/22 Paper 2 (Core 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)** decomposition / decay / respiration ; [1]

(b) **(i)** carbon dioxide ;
water ; [2]

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

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

(c) **(i)** CO_2 / methane ; [1]

(ii) traps solar energy / causes global warming ; [1]

[Total: 9]

2 **(a)** **(i)** hydrogen ; [1]

(ii) lighted splint ;
'pops' ; [2]

(iii) calcium
magnesium
zinc
copper ;;
(four correct = 2 marks, one or two correct = 1 mark) [2]

(iv) potassium and or sodium very / too reactive;
reference to safety of student ; [2]

(b) alloy is stronger than pure gold ; [1]

[Total: 8]

3 **(a)** **(i)** constant speed (of 25 m / s) ; [1]

(ii) **X** at time 250 s ; [1]

(b) **(i)** air resistance ; [1]

(ii) 30 000 (N) ; [1]

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

(ii) thermal / sound ; [1]

(d) rails expand during hot weather ;
will buckle if no gap left ; [2]

(e) **(i)** volume = $0.5^3 = 0.125\,(m^3)$; [1]

(ii) (mass =) density × volume ;
= 7800 × 0.125 = 975 (kg) ; [2]

[Total: 11]

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

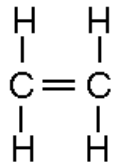
(b) **(i)** fractional distillation ; [1]

(ii) heating / cooking / other correct ; [1]

(iii) gasoline / petrol ; [1]

(c) **(i)** C_2H_6 ;
ethane; [2]

(ii)



C =C double bond ;
all else correct ; [2]

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

(ii) (react / mix / shake with) bromine (solution) ;
bromine not decolourised by alkane ;
bromine decolourised by alkene ; [3]

[Total: 12]

5 **(a)** **(i)** 8.5(%) *(accept 8–9)* ;
5(%) *(accept 4.5–5.5)* ; [2]

(ii) glycogen converted to sugar / glucose ;
for (increased) respiration ;
provides energy (for training / muscle contraction) ; [max 2]

(iii) *(description):*
increases ;
(from 5) to 8.5 / back to original level ;

(explanation):
glucose converted to glycogen ;
energy storage ; [max 3]

(iv) less food eaten / more activity on day **2** (after training) ; [1]

(b) **(i)** carbon ;
hydrogen ;
oxygen ; [3]

(ii) glucose ; [1]

(c) **(i)** decrease – (no mark)
adrenaline causes glycogen breakdown / increased blood glucose ; [1]

(ii) increased heart rate ;
AVP ; [max 1]

[Total: 14]

6 **(a)** upright ;
laterally inverted (or description) ;
same size as object ; [max2]

(b) **(i)** no refraction / total internal reflection / angle (of incidence) greater than critical angle ; [1]

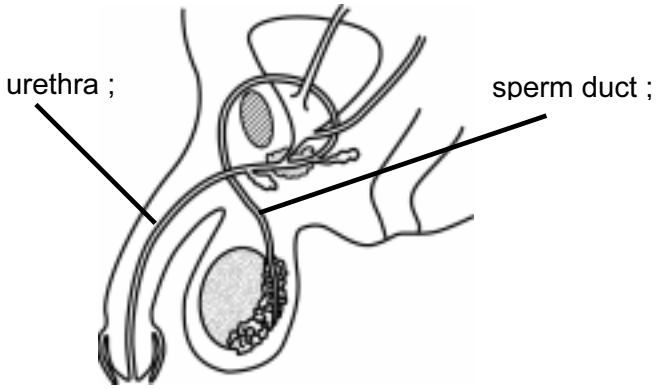
(ii) ray reflects at **P** and on opposite side of prism ;
emergent ray parallel to incident ray ; [2]

(c) particles <u>constantly</u> in motion ;
collide with walls of tyre ;
force of collisions exerts a pressure ; [max 2]

(d) heat transferred from body to sweat / absorbed by sweat from 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 molecules turn to gas / vapour ;
break bonds / break forces of attraction between molecules ;
(KE) / energy of (remaining) water molecules (in sweat) decreases ; [max 2]

[Total: 9]

7 (a) (i)



[2]

(ii) **X** = prostate gland ;
Y = testis ; [2]

(b) sperm production ;
production / secretion, of hormones / testosterone ; [2]

(c) (i) 0 °C; [1]

(ii) sperm less likely to be able to reach the egg / less chance of fertilisation / owtte ; [1]

(iii) scrotum is outside the main body cavity ;
so lower temperature;
helps maintain sperm mobility ; [max 2]

[Total: 10]

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

(b) **(i)** labels to head (front) lights and rear lights ;
four lamps connected in parallel with battery ;
switch controlling headlights ;
switch controlling rear lights ; [4]

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

(iii) 28 (Ω) ; [1]

(c) **(i)** 20 (Hz) ;
20 000 (Hz) ; [2]

(ii) number of waves generated per second (unit time) / number of waves passing a fixed point per second ; [1]

(iii) distance = speed × time ;
$= 34\,000 \times \frac{0.002}{2} = 34$ cm ; [2]

[Total: 13]

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

(ii) contains protons and neutrons ;
7 protons and 7 neutrons ; [2]

(iii) nitride has (3) more electrons than protons ; [1]

(b) **(i)** nitrogen + hydrogen → ammonia ; [1]

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

(iii) increases reaction rate ;
without being consumed / permanently changed ; [2]

(c) sulfuric (acid) ; [1]

[Total: 10]

10 **(a)** **(i)** relationship between energy input and useful energy output ; [1]

(ii) nuclei split ; [1]

(b) **(i)** γ-radiation ; [1]

(ii) γ-radiation ; [1]

(iii) radiation burns ;
radiation sickness ;
cancer ;
mutation ;
damages cells ; [max 2]

(iv) work behind shields / wear protective clothing / gloves / tongs ; [max 1]

[Total: 7]

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

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

(ii) diffusion ; [1]

(c) epidermal cell ;
guard cell ;
palisade cell ;
phloem ; [max 3]

[Total: 7]

12 (a) (i) *(element:)*
cannot be simplified / contains atoms with same proton number / contains only one type of atom / in Periodic Table ;

(compound:)
made of different types of atom bonded together / can be simplified / broken down into elements ; [2]

(ii) *(green to)* blue / purple ;
solution becomes alkaline / potassium hydroxide produced ; [2]

(iii) reaction is exothermic / thermal energy / heat given off ; [1]

(iv) less bubble / slower moving / no flame / less heat given off ; [max 1]

(b) (i) covalent ;
reference to bonding of non-metallic elements ; [2]

(ii) kills (harmful) microorganisms / sterilises ; [1]

(iii) filtration / chlorination ; *(accept distillation)* [1]

[Total: 10]