CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 series

0654 CO-ORDINATED SCIENCES

0654/33 Paper 3 (Extended Theory), maximum raw mark 120

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CAMBRIDGE
International Examinations

1 **(a)** variation ;
adaptation ;
survive ;
selection ; [4]

(b) **(i)** (in 1980) no (significant) difference ;
(in 2010) higher in country **A** / ORA ; [2]

(ii) mutation produces resistant variety ;

some bacteria more resistant than others / some bacteria are resistant ;
antibiotics in (frequent) use ;
resistant bacteria more likely to survive / natural selection / ORA ;
and reproduce to pass on this resistance ; [max 3]

(iii) more / incorrect antibiotic use in country **A** / ORA ; [1]

[Total: 10]

2 **(a)** **(i)** 3000 (W) shown ;
$= \frac{3000}{250}$ (= 12 A) ; [2]

(ii) (resistance =) $\frac{\text{voltage}}{\text{current}}$;
$\frac{250}{12}$ = 20.8 or 21 ;
Ω ; [3]

(b) **(i)** (larger current so) wire moves (upwards) higher / quicker / with more force ; [1]

(ii) (current reversed so) wire moves downwards / direction reverses / force acts downwards ; [1]

[Total: 7]

3 **(a)** **(i)** 1(%) ; [1]

(ii) any noble gas ; [1]

(b) **(i)** 24 dm^3 ; [1]

(ii) reference to the idea that 1 mole of any gas at room temperature and pressure has a volume of 24 dm^3 / 1 mole of any gas under same conditions occupies the same volume ; [1]

(iii) nitrogen has lower / different mass / lower density ; [1]

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

(ii) hydrocarbon / named alkane / petroleum / water ; [1]

(iii) 1000 ÷ 17 = 58.8(24) or 59 ;
58.8 ÷ 2 = 29.4(12) ;
M_r N_2 = 28 ;
29.4 × 28 = 823.2 g (unit required) ; [4]

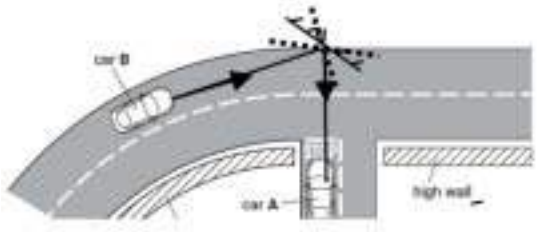
[Total: 11]

4 **(a)** **(i)** *(positive acceleration: driving force is greater than air resistance **OR** negative acceleration: driving force is less than air resistance)*
there is a resultant / net force / sum of forces is not zero ; [1]

(ii) (force =) mass × acceleration ;
acceleration = 3.5 (m / s^2) ;
= 1200 × (3.5) = 4200 (N) ; [3]

(iii) (KE =) ½ mv^2 ;
initial KE = 153 600 and final KE = 540 000 (J) ;
difference = 540 000 – 153 600 = 386 400 (J) ; [max 3]

(b) mirror drawn at suitable angle ;



ray of light drawn from car **B** reflects off mirror to car **A** indicated by arrow ;
angles between rays and mirror approximately correct ; [3]

(c) engine vibration causes air particles to vibrate ;
energy / vibrations passed from particle to particle ;
compressions and rarefactions ; [max 2]

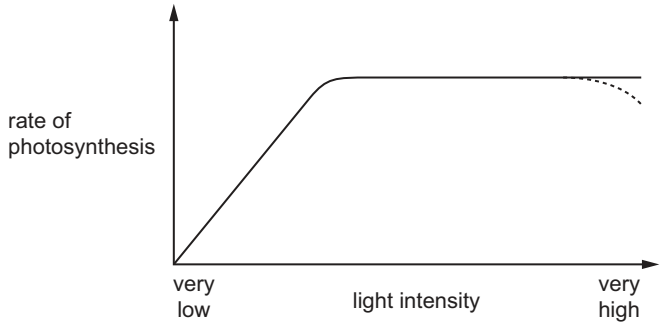
[Total: 12]

5 **(a)** as an energy source ; [1]

(b) oxygen ; [1]

(c) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
formulae ; balancing ; [2]

(d) **(i)**



straight line for first part of graph ;
levelling off at higher intensity ; [2]

(ii) (at low) more light means more <u>energy</u> available / more light <u>energy</u> speeds up rate ;
(at very high) not enough CO_2 / plant photosynthesising as fast as it can / another limiting factor / <u>limiting factor</u> ; [2]

(e) temperature ;
CO_2 concentration ;
wavelength / frequency / colour of light ;
rainfall / water / humidity ;
lack of magnesium ; [max 2]

(f) **(i)** chlorophyll ; [1]

(ii) to absorb the light / energy ; [1]

[Total: 12]

6 (a)

element	physical state at 20 °C	colour	formula of molecules
chlorine	**gas**	(pale green)	**Cl_2**
bromine	(liquid)	**orange / brown**	**Br_2**
iodine	**solid / crystals**	**dark grey / black**	(I_2)

;;;

(1 mark for each correct column) [3]

(b) chlorine + sodium iodide → iodine + sodium chloride ; [1]

(c) become ill / be poisoned / might die ;
because harmful microorganisms would not be killed ; [2]

(d) $2F_2 + 2H_2O \rightarrow O_2 + 4HF$
formulae ; balanced ; [2]

[Total: 8]

7 (a) **V** = testis ;
W = ovum / egg ; [2]

(b) fertilisation ; [1]

(c) at **Y** = mitosis ;
at **Z** = meiosis ; [2]

(d) **W** = 23 ;
embryo = 46 ; [2]

[Total: 7]

8 (a) (i) 68 (W) ; [1]

(ii) working for **A OR B** ;
A = 25% and **B** = 3.75% ; [2]

(iii) **A** is more efficient than **B** / less energy consumed ;
valid environmental statement e.g. less fossil fuels burned / non-renewable resources used / less CO_2 released ; [2]

(b) nuclear ;
kinetic ; [2]

(c) (i) time taken for half the atoms / nuclei to decay / time for radioactivity to fall to half ; [1]

(ii) β particles and γ wave ;
β more ionising ;
β less penetrating ;
β has charge and γ has no charge ;
β has mass and γ has no mass ; [max 2]

[Total: 10]

9 (a) (i) with ethane no colour change / stays orange ;
with ethene orange solution becomes colourless ; [2]

(ii) x is 4 ;
y is 8 ;
alkenes ; [3]

(b) (i) polymerisation ;
addition (polymerisation) ; [2]

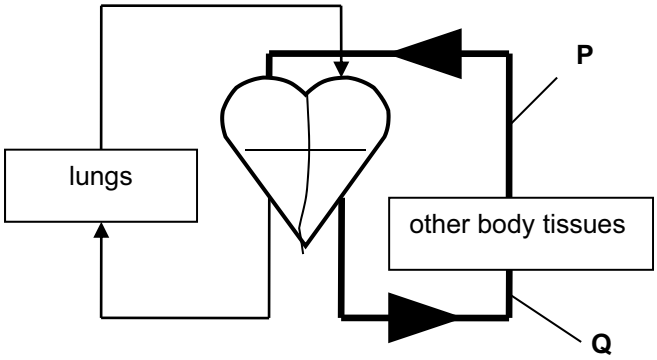
(ii) poly(ethene) ; [1]

(iii) carbon dioxide ;
water ; [2]

[Total: 10]

10 (a) (i) **X** = pulmonary vein ;
Y = right atrium ; [2]

(ii)



correct arrow on **P** ;
correct arrow on **Q** ; [2]

(iii) blood flows twice through the heart (for each complete circuit) ;
through lungs, then through body tissues / v.v. ;
idea of separate oxygenated and deoxygenated blood ; [max 2]

(iv) blood has less far to travel / flows through fewer capillaries / organs ;
right (ventricle of) heart has less muscle ; [max 1]

(b) (i) artery ; [1]

(ii) surge of blood / pressure into the vessel ;
vessel wall stretches (and recoils) with each beat ; [max 1]

(iii) more blood to muscles ;
so more oxygen / glucose ;
removes more CO_2 ;
increased respiration ;
increased energy released ; [max 2]

[Total: 11]

11 (a) (i) poor (heat) conductor / idea of heat not passing through handle ; [1]

(ii) shiny / silver surface poor heat emitter ; [1]

(b) *(in base of saucepan)*
increased particle movement / vibration / kinetic energy ;
energy transferred by collision, vibration / energy, passed from particle to particle ;

(in water)
water particles move further apart ;
less dense water rises ; [4]

(c) (pressure =) $\frac{\text{force}}{\text{area}}$;
$= \frac{15}{300} = 0.05\ (\text{N/cm}^2)$; [2]

(d) $(c =) \frac{H}{m\theta}$ or $\frac{H}{m\Delta T}$;
$\frac{63\,000}{(0.5 \times 30)}$;
$= 4200\ (\text{J/kg °C})$; [3]

[Total: 11]

12 (a) transition metals have high density ;
transition metals (and compounds) can act as catalysts ;
transition metals (often) form coloured compounds ;
transition metals have high melting / boiling points ;
reference to variable oxidation states / valency ; [max 3]

(b) (i) (26)
same as proton number ; [1]

(ii) 3 ;
same as Group number ;
electrons arranged in 2,8,3 ; [max 2]

(c) (i) aluminium atom / A*l* ;
becomes a positive ion ;
(aluminium atoms) lose electrons (when they ionise) / electron loss is oxidation / electrons transferred to iron (ions) / oilrig explained ; [max 3]

(ii) less ;
reaction is exothermic ;
chemical energy in reactants has been transferred to surroundings / changed to thermal energy (and so less in products) ; [max 2]

[Total: 11]