CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 series

0654 CO-ORDINATED SCIENCES

0654/32 Paper 3 (Extended Theory), maximum raw mark 120

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International Examinations

1 (a) (i) mass 100 (kg) weight less than 1000 (N) ; [1]

(ii) mass does not change / does not depend on gravitational field ;
weight different because weight is effect of gravitational field on mass / owtte ; [2]

(b) need resultant upwards force to accelerate the rocket ; [1]

(c) (KE) = ½ mv^2 ;
= ½ × 1 500 000 × 10 000 × 10 000 ;
= 7.5×10^{13} (J) ;
= 7.5×10^{10} (kJ) ; [4]

(d) sound cannot travel through space / a vacuum / without a medium ; [1]

(e) turns atoms into ions ;
by removal of electrons ; [2]

[Total: 11]

2 (a) **X** = umbilical cord ;
Y = amnion / amniotic sac ; [2]

(b) protection ;
from mechanical damage / 'knocks and bumps' / owtte ; [2]

(c) increased oxygen ;
decreased carbon dioxide ;
increased glucose / nutrients / named nutrient ;
decreased urea / wastes ; [max 3]

(d) carbon monoxide ;
combines with haemoglobin / takes place of oxygen in the blood (cells) ;
reduces oxygen transport in <u>mother's</u> blood ; [3]

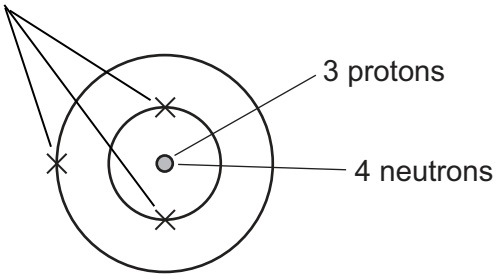
[Total: 10]

3 (a) (i) H and He ; [1]

(ii) neon ; [1]

(iii) period 4 ; *(allow 5 / 6 / 7)* [1]

(b) (i) 3 electrons



3 protons indicated ;
4 neutrons indicated ;
3 electrons arranged in electron configuration of: 2,1 ; [3]

(ii) reference to increased number of electrons shells / orbits down the group ; [1]

(iii) fewer electron shells / orbits / reference to loss of electron shell / orbit ; [1]

(iv) (outer) electrons further from nucleus ;
if electrons further from nucleus then more easily lost / less strongly attracted to nucleus ; [2]

[Total: 10]

4 (a) (i) at the start / in first minute / in first few seconds ; [1]

(ii) high starch concentration / more starch / greater rate of molecular collision ; [1]

(iii) line sketched so that it is of same general shape ; *(but <u>not</u> levelling off above zero or at less than 4 mins)*
and above the 35 °C line ; [2]

(iv) higher temperature means molecules have more energy / greater speed / ORA ;
more frequent collisions (ORA) / more collisions that are successful / result in reaction ; [2]

(b) (i) **X** = capillary ;
Y = lacteal ; [2]

(ii) increased surface area (for absorption) ; [1]

(iii) molecules smaller / soluble ; [1]

[Total: 10]

5 **(a)** Al_2O_3
Fe_2O_3
NaCl
$CuFeS_2$;;
(1 mark for two or three correct, 2 marks for four correct) [2]

(b) **(i)** $2PbO + C \rightarrow 2Pb + CO_2$
reactant formulae ; product formulae ; correctly balanced ; [3]

(ii) lead ions gain electrons;
electron gain is reduction ; *(allow $Pb^{2+} + 2e^- \rightarrow Pb$)* [max 1]

(c) becomes zero / no current registered / owtte ;
electrolyte freezes ;
ions no longer mobile ; [3]

[Total: 9]

6 **(a)** $(v =) f \times \lambda$;
frequency = 0.3 Hz ;
$0.3 \times 0.8 = 0.24$ (m / s) ; [3]

(b) **(i)** machinery noise causes water particles to vibrate ;
vibration is passed from particle to particle ; [2]

(ii) any value greater than 340 m / s ;
sound travels more quickly through liquids than gases ; [2]

(c) **(i)** molecules have range of energies / some molecules move faster / have more energy than others / molecules gain energy from the Sun ;
faster / more energetic molecules escape ;
overcome forces between molecules / pull of other molecules ;
leave as water vapour ; [max 3]

(ii) (thermal energy =) $mc\theta$ **OR** $mc\Delta T$;
$= 200\,000 \times 4200 \times 5$ (J) ;
= 4200 (MJ) ; [3]

[Total: 13]

7 (a) **M**
E
C
E ;;
(1 mark for two or three correct, 2 marks for four correct) [2]

(b) (i) (assume answers refer to **P** if the word *it* is used)
P is more flammable/burns more easily / ORA ;
P burns with cleaner flame / owtte ;
P is less viscous / flows easily / easily moved around through pipes / owtte ; [max 2]

(ii) carbon dioxide / CO_2 ;
water (vapour) / H_2O ;
carbon monoxide / CO ; [max 2]

(iii) ice ;
low temperature of the air causes the water formed to freeze ; [2]

(c) (i) family of compounds / hydrocarbons with similar properties / that have a general formula / that differ only by a CH_2 increment ; [1]

(ii) 174 ± 10 °C ; [1]

(iii) the larger / heavier / more C atoms in the molecules the higher the boiling point of the alkanes ;
because the larger the molecules the greater attractive forces between <u>molecules</u> ;
because the larger the molecules the more (heat) energy needed to separate them ;
[max 2]

[Total: 12]

8 (a) less ;
sulfur dioxide ;
coal fired ;
fossil ; [4]

(b) (i) mosquito larva ;
mosquito larva ;
crayfish ; [3]

(ii) below their ideal pH range / close to lowest tolerable pH ; [1]

(iii) kills the trout / less trout to compete ; [1]

(c) enzymes less effective / denatured ;
AVP e.g. increased aluminium levels / reduced levels of calcium or nutrients ; [max 1]

[Total: 10]

9 **(a)** **(i)** (current =) $\frac{\text{power}}{\text{voltage}}$;

$= \frac{11000}{220} = 50\,(\text{A})$; [2]

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

$\frac{220}{50} = 4.4\,(\Omega)$; (allow ecf) [2]

(b) **(i)** voltmeter or symbol connected across rings ; [1]

(ii) sine wave ;
constant amplitude ; [2]

(iii) spin coil <u>faster</u> ;
stronger / larger magnetic field ;
<u>more</u> turns on coil ; [max 2]

[Total: 9]

10 **(a)** ability to detect / sense changes in the environment / stimuli ;
and to respond ; [2]

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

(ii) (roots grow downwards so) can absorb water ;
can absorb mineral ions ;
better anchorage in soil ; [max 2]

(stems grow upwards so) can reach light ;
for photosynthesis ; [2]

(iii) accumulates on lower side ;
stimulates growth / elongation in stem ;
inhibits growth / elongation in root ; [3]

[Total: 10]

11 **(a)** hydrogen ;
copper chloride ;
potassium chloride <u>and</u> water ; [3]

(b) **(i)** $66\,(\text{cm}^3)$; [1]

(ii) graph levels off / becomes horizontal ;
reaction slows down / stops no more CO_2 produced ;
(reaction stops) because calcium carbonate used up / (reaction slows) because acid becomes less concentrated / calcium carbonate has less surface area (as used up) ; [2]

(iii) maximum volume of CO_2 collected = 95 cm^3 ;
convert molar volume to 24 000 cm^3 / volume to 0.095 dm^3 ;
number of moles of CO_2 therefore = 95 ÷ 24000 = 0.0040 or 0.095 ÷ 24 = 0.0040 ; *(allow 0.00396/0.00395/0.0039/0.004)* [3]

[Total: 9]

12 (a) **QR** / 40 – 68 s ; [1]

(b) **P** or **S** / 0 s or 120 s ; [1]

(c) (acceleration =) change of speed / time or working / $\frac{28}{40}$;
= 0.70 (m / s^2) ; [2]

(d) area under graph ;
(½ × 40 × 28) + (28 × 28) + (½ × 52 × 28) **OR** working ;
= 2072 (m) ; [3]

[Total: 7]