UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

0652 PHYSICAL SCIENCE

0652/31 Paper 3 (Extended Theory), maximum raw mark 80

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1 **(a)** 50 m/s ; [1]

(b) acceleration/deceleration/slowing down ;
constant/steady referring to acceleration/deceleration (**not** at constant speed)/calculated value of acceleration/comes to rest ; [2]

(c) **(i)** use of gradient, (a = (30 – 0)/(10 – 0)) ;
3.0 m/s^2 ; [2]

(ii) use of F = ma = 1500 × 3.0 (e.c.f.) ;
= 4500 N ; [2]

(iii) mention of frictional force/air resistance ;
force from engine = accelerating force + frictional force/work done against friction ; [2]

(d) (car **B**) ;
larger gradient/same mass (**not** accept shorter period of time) ;
greater acceleration/deceleration ; [2]
(both marks can be scored for a correct calculation of both accelerations and comment)

[Total: 11]

2 **(a)** **(i)** $2NO + 2CO \rightarrow N2 + 2CO_2$
all formulae correct ;
balanced ; [2]
($NO + CO \rightarrow N + CO_2$ max 1)

(ii) nitrogen (monoxide) is reduced because it has lost oxygen ;
carbon (monoxide) is oxidised because it has gained oxygen ; [2]
(marks can be gained for correct reference to electron loss and gain/oxidation states)
(1 max if general explanation without reference to NO and CO is given)

(iii) any two:
(percentage) of nitrogen monoxide has decreased ;
(percentage) of nitrogen has increased ;
(percentage) of carbon monoxide has decreased ;
(percentage) of carbon dioxide has increased ; [max 2]

(iv) carbon monoxide reacts with oxygen to form carbon dioxide/hydrogen reacts with oxygen to form water ; [1]
(**if** the carbon monoxide to carbon dioxide process is not scored in **(iii)** it can score here)

(b) **(i)** galvanising means coating with zinc ;
zinc more reactive than steel/iron ;
zinc reacts not iron/sacrificial reaction ; [3]

(ii) painted steel will rust if scratched or chipped but galvanised will not (rust) ; [1]
(both required, but allow the comment re zinc not reacting if included in **(i)**)

[Total: 11]

3 **(a)** the band vibrates ;
causing air (molecules) to vibrate / forming a longitudinal / compression wave in the air ; [2]

(b) 4.5 or 5 waves number of waves or specified number of divisions ;
4.5 in 4 divs (accept 5 waves in 5 divs) ;
f = 450 (Hz) ; [3]
(allow rounding errors for answer) (use of only one wave – 2 max, raw answer 400 Hz – 2 max)

[Total: 5]

4 **(a)** **(i)** light provides energy ; [1]

(ii) reduction is gain of an electron / oxidation state goes down ; [1]

(iii) $Ag^+ + e^- \rightarrow Ag$; [1]

(b) **(i)** add potassium bromide solution to silver nitrate solution until no further reaction ;
filter (to obtain ppt) ;
wash ppt with distilled water ;
leave ppt to dry ;
keep in dark ; [max 4]

(ii) $AgNO_3 = 170$ and $AgBr = 188$;
number of moles = $\frac{5}{170}$ (accept $\frac{5}{188}$) ;
= 5.5 g ; [3]

[Total: 10]

5 **(a)** **(i)** use of $I = V/R$ (= 6 / 48) ;
= 0.125 A (0.13 A) ; [2]

(ii) (e.c.f.) use of $R = V/I$ (= 4.5 / 0.125) ;
= 36 Ω ; [2]

(b) $R = V/I$ = 3.0 / 0.125 = 24 Ω / discussion re ½ potential difference leads to ½ R ; [1]

(c) **(i)** use of $1/R = 1/R_1 + 1/R_2 = 1/24 + 1/8 = 4/24$ (accept sum / product) ;
$R = 24/4 = 6$ Ω ; [2]
(must show R = 6 Ω)

(ii) (6 + 24 =) 30 Ω ; [1]

(iii) (e.c.f.) current = 6 / 30 = 0.2 A ;
potential difference = 0.2 × 6 = 1.2 V ; [2]

(iv) dim / not properly lit if potential difference < 3, bright if potential difference > 3, normal if potential difference = 3 ; [1]

[Total: 11]

6 **(a)** $CaCO_3$ = 100 ;
number of moles = $\frac{2.5}{100}$ or 0.025 ;
= 0.6 dm^3 ; [3]

(b) **(i)** calcium oxide is a base because it gains a proton / the oxide ion gains a proton ;
hydrochloric acid is an acid because it donates a proton ; [2]
(max 1 if neither refers to specific reaction)

(ii) amphoteric ;
acidic ;
neutral ; [3]

[Total: 8]

7 **(a)** **(i)** the needle of the voltmeter moves ;
then goes back to zero ;
(do **not** allow if there is a residual current. e.g. needle falls to zero) [2]

(ii) when the magnet moves the coil cuts / there is a change in magnetic flux ;
which induces an e.m.f./current ; [2]

(b) the needle of the voltmeter moves in the opposite direction ; [1]

(c) wave trace seen on the cathode ray oscilloscope ;
changing current produces changing field ; [2]

[Total: 7]

8 **(a)** **(i)** noble gases (do not accept inert, rare) ; [1]

(ii) boiling point increases / density increases / mass increases ;
with increasing atomic number / down group ; [2]

(iii) unreactive (accept inert) ; [1]

(iv) any value between 4.5 and 9.9 kg / m^3 ; [1]

(b) (i) diagram showing 8 electrons in outer shell ;
3 shells with 2 electrons in first shell and 8 in second shell ; [2]

(ii) potassium, 1+ **OR** chloride, 1− ;; [2]

(iii) loses electrons ;
two electrons are lost ; [2]

[Total: 11]

9 (a) (i) liquid turns to vapour / gas (not molecules) ; [1]

(ii) boiling: bubbles of vapour form in the liquid ;
evaporation: molecules leave the surface of the liquid ;
OR
boiling occurs at fixed temperature ;
evaporation at a range of temperatures 1 ; [max 2]
OR
boiling is a violent process (1 max) ;

(b) 15 – 25 °C ; [1]

(c) molecules lose energy / slow down etc. ; (not accept **molecules** lose **thermal** energy)
clear energy loss is loss in kinetic energy / energy is transferred to the surroundings / hence temperature falls ; [2]

[Total: 6]