

## 0620 MCQ Answers

1-A	11-C	21-C	31-B
2-D	12-B	22-D	32-B
3-D	13-D	23-B	33-C
4-B	14-C	24-B	34-B
5-C	15-C	25-B	35-B
6-B	16-D	26-D	
7-	17-C	27-D	
8-	18-C	28-D	
9-C	19-D	29-D	
10-D	20-B	30-D	

## 0620 Theory Answers

### Question 1

(c)  $0.104/0.026$  [1]  
 $n = 4$

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### Question 2

(c) mass of hydrated magnesium sulfate = 1.476 g  
mass of barium sulfate formed = 1.398 g  
the mass of one mole of  $\text{BaSO}_4$  = 233 g  
the number of moles of  $\text{BaSO}_4$  formed = 0.006 [1]  
the number of moles of  $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$  used in experiment = 0.006 [1]  
the mass of one mole of  $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$  =  $1.476/0.006 = 246$  g [1]  
the mass of  $x\text{H}_2\text{O}$  in one mole of  $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$  =  $246 - 120 = 126$  g [1]  
 $x = 126/18 = 7$  [1]  
if  $x$  given without method = max 1  
note: apply ecf but  $x$  must be an integer and less than 10

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### Question 3

(c) calculation:  
Mr for  $\text{NaHCO}_3$  = 84 g; Mr for  $\text{Na}_2\text{O}$  = 62 g; Mr for  $\text{NaOH}$  = 40 g  
Mr for  $\text{Na}_2\text{CO}_3$  = 106 g  
(i) number of moles of  $\text{NaHCO}_3$  used =  $3.36/84 = 0.04$  [1]  
(ii) if residue is  $\text{Na}_2\text{O}$ , number of moles of  $\text{Na}_2\text{O}$  =  $2.12/62 = 0.034$  / 0.03  
if residue is  $\text{NaOH}$ , number of moles of  $\text{NaOH}$  =  $2.12/40 = 0.053$  / 0.05  
if residue is  $\text{Na}_2\text{CO}_3$ , number of moles of  $\text{Na}_2\text{CO}_3$  =  $2.12/106 = 0.02$  all three correct [2]  
note: two correct = 1  
(iii) equation 3 [1]  
mole ratio 2:1 agrees with equation [1]

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### Question 4

(b) number of moles of  $\text{HCl}$  used =  $0.04 \times 2 = 0.08$   
number of moles  $\text{CoCl}_2$  formed = 0.04

number of moles  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$  formed = 0.04  
mass of one mole of  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$  = 238 g  
maximum yield of  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$  = 9.52g [4]  
accept 9.5 g  
mark ecf to moles of  $\text{HCl}$   
do not mark ecf to integers  
to show that cobalt(II) carbonate is in excess  
number of moles of  $\text{HCl}$  used = 0.08 must use value above ecf  
mass of one mole of  $\text{CoCO}_3$  = 119g  
number of moles of  $\text{CoCO}_3$  in 6.0g of cobalt(II) carbonate =  $6.0/119 = 0.050$  [1]  
reason why cobalt(II) carbonate is in excess  $0.05 > 0.08/2$  [1]

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### Question 5

(d) (i) how many moles of  $\text{H}_2\text{SO}_4$  were added =  $0.02 \times 0.3 = 0.006$  [1]  
(ii) how many moles of  $\text{NaOH}$  were used =  $0.04 \times 0.2 = 0.008$  [1]  
(iii) sulfuric acid [1]  
only mark ecf if in accord with 1:2 ratio and with values from (i) and (ii).  
reason  $0.006 > 0.008/2$  [1]  
for ecf mark candidate must use 1:2 ratio in answer  
(iv) less than 7 [1]

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### Question 6

(b) (i) 80 cm<sup>3</sup> of oxygen therefore 40 cm<sup>3</sup> of methane [1]  
 $40/60 \times 100 = 66.7\%$  [1]  
accept 66% and 67%  
no ecf  
(ii) add sodium hydroxide(aq) / alkali [1]  
carbon dioxide dissolves, leaving methane [1]

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### Question 7

(b) (i) add up to 5.8 g [1]  
(ii) moles of C atoms =  $2.4/12 = 0.2$   
moles of H atoms =  $0.2/1 = 0.2$   
moles of O atoms =  $3.2/16 = 0.2$   
all three correct = 2 [2]  
two correct = 1  
empirical formula  $\text{CHO}$  [1]  
(iii)  $116/29 = 4$  [1]  
 $\text{C}_4\text{H}_4\text{O}_4$  [1]  
correct formula with no working scores both marks.  
(iv)  $\text{HOOCCH}=\text{CHCOOH}$  /  $\text{CH}_2=\text{C}(\text{COOH})_2$  [2]

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### Question 8

(c) number of moles of  $\text{FeSO}_4$  used =  $9.12/152 = 0.06$  [1]  
number of moles of  $\text{Fe}_2\text{O}_3$  formed =  $0.03^*$  [1]  
mass of one mole of  $\text{Fe}_2\text{O}_3$  = 160 g [1]  
mass of iron(III) oxide formed =  $0.03 \times 160 = 4.8$  g [1]  
number of moles of  $\text{SO}_3$  formed = 0.03 [1]  
volume of sulfur trioxide formed =  $0.03 \times 24 = 0.72$  dm<sup>3</sup> [1]  
If mass of iron(III) oxide greater than 9.12 g, then only marks 1 and 2 available  
Apply ecf to number of moles of  $\text{Fe}_2\text{O}_3^*$  when calculating volume of sulfur trioxide.

Do not apply ecf to integers

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**Question 9**

7 (a) (i) 35 cm<sup>3</sup> [1]  
40 cm<sup>3</sup> [1]

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**Question 10**

(b) (i) 7.7% [1]  
(ii) for any number: equal number ratio [2]  
for example 1:1 or 6:6  
(iii) empirical formula is CH [1]  
molecular formula is C<sub>6</sub>H<sub>6</sub> [1]  
no e.c.f., award of marks not dependent on (ii)

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**Question 11**

(c) (i) 196 [1]  
(ii)  $112/196 \times 100$  [1]  
= 57(.1)% ACCEPT 57 to nearest whole number [1]  
mark e.c.f. to (c)(i) provided percentage not greater than 100%  
ONLY ACCEPT 112/answer (c)(i)  $\times 100$   
otherwise [0]

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**Question 12**

(ii) mass of one mole of CaCO<sub>3</sub> = 100  
number of moles of CaCO<sub>3</sub> =  $0.3/100 = 0.003$  [1]  
moles of HCl =  $5/1000 \times 1 = 0.005$  [1]  
reagent in excess is CaCO<sub>3</sub> [1]  
ecf from above  
would need 0.006 moles of HCl  
or hydrochloric acid only reacts with 0.0025 moles of CaCO<sub>3</sub> [1]  
NOTE this mark needs to show recognition of the 1:2 ratio  
(iii) mark ecf to (ii), that is from moles of limiting reagent in (ii)  
moles of CO<sub>2</sub> =  $0.005 \times 0.5 \times 24 = 0.06 \text{ dm}^3$  [1]  
NOT cm<sup>3</sup> unless numerically correct. 60 cm<sup>3</sup>  
Ignore other units  
NOTE If both number of moles integers then no ecf for (ii) and (iii)

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**Question 13**

(a)  
copper iron sulphur  
composition by  
mass/g  
(4.80) (4.20) 4.8 [1]  
number of moles  
of atoms  
0.075 0.075 0.15 [1]  
simplest mole ratio  
of atoms  
1 1 2 [1]  
[3]  
The empirical formula is CuFeS<sub>2</sub> [1]

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**Question 14**

(b) (i) 100 [1]  
56 ignore units in both cases [1]  
(ii) 7.00kg is 1/8 of 56 [1]  
1/8 of 100kg is 12.5kg [1]  
Give both marks for correct answer without explanation.  
Ignore missing units  
but penalise wrong units

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**Question 15**

Question 6  
(a)(i) moles of NiCO<sub>3</sub> reacted = 0.08 [1]  
mass of nickel carbonate reacted = 9.52 g [1]  
mass of nickel carbonate unreacted = 2.48 g [1]  
(ii) maximum number of moles of hydrated salt = 0.08 [1]  
maximum mass of salt =  $0.08 \times 281 = 22.48 \text{ g}$  [1]  
percentage yield  $10.4/22.48 \times 100 = 46.3\%$  [1]

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**Question 16**

Mark consequentially to any error but not involving simple integers  
There has to be some evidence that the candidate has attempted to work through the calculation and not merely inserted whole numbers.  
For example 2, 1, 160 or 1, 0.5, 80  
number of moles of Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> = 1/40 or 0.025  
number of moles of Fe<sub>2</sub>O<sub>3</sub> formed = 1/40 or 0.025  
mass of iron(III) oxide formed =  $0.025 \times 160 = 4\text{g}$   
number of moles of SO<sub>3</sub> produced = 3/40 or 0.075  
volume of sulphur trioxide at r.t.p. =  $0.075 \times 25 = 1.8\text{dm}^3$  [5]

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**Question 17**

(d) the number of moles of SO<sub>2</sub> in the mixture = 0.125  
the number of moles of Cb in the mixture = 0.2  
cond reagent was not in excess? SO<sub>2</sub>  
cond moles of SO<sub>2</sub>Cb formed = 0.125  
cond the mass of sulphuryl chloride formed = 16.9g [5]

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**Question 18**

(f) (i)  $11.5/23 = 0.5$  [1]  
(ii) 0.25 [1]  
conseq to (i)  
...  
(iii)  $0.25 \times 32 = 8 \text{ g}$  [1]  
conseq  
(iv) 2.0 g [1]  
only conseq to (iii) if answer to (iii) is less than 10  
NB If (ii) is 0.3(125), no excess is possible, (iv) ZERO

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**Question 19**

(c) (i) copper sulphate or anhydrous copper sulphate [1]  
accept "unhydrated"  
NOT formula  
(ii) goes blue or becomes hot or steam [1]

(iii) copper oxide [1]  
(iv)  $5/250 = 0.02$  moles  
Mr=80  
 $80 \times 0.02 = 1.6$  g  
NB (iv) to be marked conseq to (iii)  
Correct answer no working ONLY [1]

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#### Question 20

(e) (i) percentage of oxygen = 31.6 % [1]  
(ii) calculate the number of moles of atoms for each element  
number of moles of Ti =  $31.6/48 = 0.66$   
number of moles of O =  $31.6/16 = 1.98$  accept 2 [1]  
both correct for one mark  
(iii) the simplest whole number ratio for moles of atoms:  
Fe : Ti : O  
1 1 3 [1]  
(iv) formula is FeTiO<sub>3</sub> accept TiFeO<sub>3</sub> [1]  
must be whole numbers from (iii) or cancelled numbers from  
(iii)  
mark ecf throughout

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#### Question 21

(ii) Volume ratio  
C<sub>x</sub>  
Hy(g) + O<sub>2</sub>(g) → CO<sub>2</sub>(g) + H<sub>2</sub>O(l)  
20 160 100 all in cm<sup>3</sup>  
1 8 5 mole ratio  
C<sub>5</sub>  
H<sub>12</sub> + 8O<sub>2</sub> → 5CO<sub>2</sub> + 6H<sub>2</sub>O  
For evidence of method (1)  
for equation as above (2) [3]

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#### Question 22

(c) (i) (to prove) all water driven off or evaporated or boiled /  
no water remains / to  
make salt anhydrous (1)  
(ii)  $m_1 - m_2 = \text{mass of water}$  (1)  
(calculate) moles of water AND moles of hydrated or  
anhydrous salt (1)  
1:1 ratio / should be equal (1) [3]

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#### Question 23

(d) number of moles of O<sub>2</sub> formed =  $0.096 / 24 = 0.004$  (1)  
number of moles of H<sub>2</sub>O<sub>2</sub> in 40 cm<sup>3</sup> of solution =  $0.004 \times 2 =$   
0.008 (1)  
concentration of the hydrogen peroxide in mol / dm<sup>3</sup> =  $0.008$   
/  $0.04 = 0.2$  (1) [3]

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#### Question 24

8 (a) (i) (the number of particles which is equal to the number  
of atoms in) 12 g of carbon 12  
or  
the mass in grams which contains the Avogadro's constant  
number of particles  
or  
Avogadro's constant or 6 to  $6.023 \times 10^{23}$  of atoms / ions /  
molecules / electrons /

particles  
or  
(the amount of substance which has a mass equal to) its  
relative formula mass / relative  
atomic mass / relative molecular mass in grams  
or  
(the amount of substance which has a volume equal to) 24  
dm<sup>3</sup> of a gas at RTP  
[1]  
(ii) (Avogadro's constant is the) number of particles / atoms /  
ions / molecules in one mole of  
a substance  
or  
the number of carbon atoms in 12 g of C(12).  
or  
the number of particles / molecules in 24 dm<sup>3</sup> of a gas at RTP  
or  
6 to  $6.023 \times 10^{23}$  (particles / atoms / ions / molecules /  
electrons) [1]  
(b) CH<sub>4</sub> and SO<sub>2</sub> [1]  
 $2/16 = 1/8$  or 0.125 moles of CH<sub>4</sub> AND  $8/64 = 1/8$  or 0.125  
moles of SO<sub>2</sub>  
(c) (i)  $4.8/40 = 0.12$  moles of Ca  
 $3.6/18 = 0.2$  moles of H<sub>2</sub>O both correct [1]  
(ii) Ca is in excess (no mark) (because 0.12 moles of Ca need)  
0.24 moles / 4.32 g of H<sub>2</sub>O  
to react [1]  
there is not enough / there are 0.2 moles / 3.6 g of H<sub>2</sub>O [1]  
or  
Ca is in excess (no mark) (because 0.2 moles / 3.6 g of water  
will react with)  
0.1 moles / 4.0 g of Ca [1]  
there is more than that / there are 0.12 moles / 4.8 g of Ca [1]  
or  
Ca is in excess (no mark) because the mole ratio Ca:H<sub>2</sub>O is 3:5  
/ mass ratio 4:3 [1]  
which is bigger than the required mole ratio of 1:2 / mass ratio  
10:9 [1]  
or  
Ca is in excess (no mark) because the mole ratio H<sub>2</sub>O:Ca is 5:3  
/ mass ratio 3:4 [1]  
which is smaller than the required mole ratio of 2:1 / mass  
ratio 9:10 [1]  
(iii)  $0.02 \times 40 = 0.8$  (g) [1]

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#### Question 25

(d) volume of oxygen used = 150 cm<sup>3</sup>  
volume of carbon dioxide formed = 100 cm<sup>3</sup> [1]  
any equation of the combustion of an alkene  
e.g.  $2C_5H_{10} + 15O_2 \rightarrow 10CO_2 + 10H_2O$   
formulae [1]  
COND balancing

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#### Question 26

(b) number of moles of HCl =  $0.020 \times 2.20 = 0.044$  [1]  
number of moles of LiOH = 0.044  
concentration of LiOH =  $0.044/0.025 = 1.769$  (mol / dm<sup>3</sup>) [1]

accept 1.75 to 1.77 need 2 dp  
correct answer scores = 2  
(c) (for  $\text{LiCl}\cdot 2\text{H}_2\text{O}$ )  
mass of one mole = 78.5 [1]  
percentage water =  $36 / 78.5 \times 100$  [1]  
45.9 so is  $\text{LiCl}\cdot 2\text{H}_2\text{O}$  [1]  
only award the marks if you can follow the reasoning and it gives 45.9% of water  
note: if correct option given mark this and ignore the rest of the response  
allow: max 2 for applying a correct method to another hydrate, [1] for the method and [1] for the correct value, working essential

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#### Question 27

(e) if  $\text{C}_5\text{H}_{10}$  is given award 3 marks;;; [3]  
if  $\text{C}_{10}\text{H}_{20}$  is given award 2 marks;;  
if 1:7.5:5 / 2:15:10 is given award 2 marks;;  
in all other cases a mark can be awarded for moles of  $\text{O}_2$  (=  $2.4/32$  =) 0.075 AND moles of  $\text{CO}_2$  (=  $2.2/44$  =) 0.05;  
 $2\text{C}_5\text{H}_{10} + 15\text{O}_2 \rightarrow 10\text{CO}_2 + 10\text{H}_2\text{O}$  [1]  
accept: multiples including fractions  
allow: ecf for correct equation from any incorrect alkene

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#### Question 28

(b) moles of Fe =  $51.85/56 = 0.926$  (0.93); [1]  
moles of O =  $22.22/16 = 1.389$  (1.39); [1]  
moles of  $\text{H}_2\text{O} = 16.67/18 = 0.926$  (0.93); [1]  
if given as 0.9 1.4 0.9  
three of the above correct = [2]  
two of the above correct = [1]  
simplest whole number mole ratio Fe : O :  $\text{H}_2\text{O}$  is 2 : 3 : 2 /  $\text{Fe}_2\text{O}_3\cdot 2\text{H}_2\text{O}$ ; [1]  
allow: ecf for a formula based on an incorrect whole number ratio

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#### Question 29

8 (a) (i) (to avoid) carbon monoxide formation/so complete combustion occurs/avoid incomplete combustion So that  $\text{CO}_2$  is produced [1]  
 $\text{CO}$  does not dissolve/react with alkali [1]  
(ii)  $\text{CO}_2$  is acidic [1]  
(iii) volume of gaseous hydrocarbon 20  $\text{cm}^3$   
volume of oxygen used = 90  $\text{cm}^3$  [1]  
volume of carbon dioxide formed = 60  $\text{cm}^3$  [1]  
no mark for 20  $\text{cm}^3$  of hydrocarbon.  
(iv)  $2\text{C}_3\text{H}_6(\text{g}) + 9\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$  [1]  
OR ...  $\text{C}_3\text{H}_6(\text{g}) + 9/2\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l})$   
 $\text{C}_3\text{H}_6$  [1]  
 $\text{C}_3\text{H}_6$  can be given in the equation for the second mark

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#### Question 30

7 (a) metal A is magnesium [1]  
cond most reactive or fastest reaction [1]  
metal B is aluminium [1]

cond faster reaction after removal of oxide layer / it would give more hydrogen / aluminium more reactive than zinc [1]  
metal C is zinc [1]  
zinc least reactive [1]  
NOTE MAX [5]  
If you encounter different reasoning which is correct, please award the appropriate marks.  
(b) for magnesium and zinc same volume of hydrogen [1]  
because both have valency of 2 / 1 mole of metal gives 1 mole of hydrogen / 1 mole of metal reacts with 2 moles of acid [1]  
bigger volume for aluminium because its valency is 3 / 1 mole of metal gives 1.5 moles of hydrogen / 1 mole of metal reacts with 3 moles of acid [1]  
If you encounter different reasoning which is correct, please award the appropriate marks.  
accept balanced equations  
accept ionic charges as alternative to valency

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#### Question 31

(d) (i) the reaction is exothermic / reaction produces heat/energy [1]  
all the sodium hydroxide used up/neutralised / reaction has stopped [1]  
(ii) adding colder acid / no more heat produced [1]  
if not given in (d)(i) any comments such as "reaction has stopped" can gain mark  
(iii) 1.33 / 1.3 / 1.3333 (mol/ $\text{dm}^3$ ) scores both marks [2]  
not 1.34  
for a correct method –  $M_1 V_1$  / moles of  $\text{NaOH} = 0.02$   
with an incorrect answer only [1]

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#### Question 32

(c) if the final answer is between 86–89% award all 4  
if the final answer is between 66–67% award 3 marks (Mr of 32 must have been used)  
for all other answers marks can be awarded using the mark scheme as below and applying ecf if necessary  
number of moles of  $\text{O}_2$  formed =  $0.16/24 = 0.0067/0.00667$  or  $1/150$   
number of moles of  $\text{Pb}(\text{NO}_3)_2$  in the sample =  $0.0133/0.013$  or  $1/75$   
mass of one mole of  $\text{Pb}(\text{NO}_3)_2 = 331$  g  
mass of lead(II) nitrate in the sample = 4.4(1) g  
percentage of lead(II) nitrate in sample = 88.3% (allow 88–89) [4]  
mark ecf in this question but not to simple integers  
if mass of lead(II) nitrate > 5.00 only marks 1 and 2 available  
If divides by 32 (not 24) only last 3 marks can score consequentially

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#### Question 33

(a)  $72/24 = 3$  and  $28/14 = 2$  [1]  
 $\text{Mg}_3\text{N}_2$  [1]  
accept just formula for [2] even with incorrect or no working

NOT ecf

(b)  $Al_4C_3 + 12H_2O = 4Al(OH)_3 + 3CH_4$  [2]

For  $Al_4C_3$  ONLY [1]

(c) (i) silicon is limiting reagent [1]

0.07 moles of Si and  $25/160 = 0.156$  moles of  $Br_2$  [1]

because  $0.14 (2 \times 0.07) < 0.156$  [1]

If 80 used to find moles of  $Br_2$  the mark 1 and 3 still available arguments based on masses can be used

(ii) 0.07 [1]

NOT ecf

#### Question 34

(b) number of moles of NaOH used =  $0.025 \times 2.24 = 0.056$  [1]

maximum number of moles of  $Na_2SO_4 \cdot 10H_2O$  that could be formed = 0.028 [1]

mass of one mole of  $Na_2SO_4 \cdot 10H_2O = 322g$

maximum yield of sodium sulphate – 10 - water = 9.02g [1]

percentage yield = 42.8% [1]

mark ecf but NOT to simple integers

if ecf marking, mark to at least one place of decimals

if percentage > 100% then 3/4 maximum

#### Question 35

(d) 100g of fat react with 86.2g of iodine

884g of fat react with 762 g of iodine [1]

limit  $762 \times 2$

one mole of fat reacts with 762/254 moles of iodine molecules

one mole of fat reacts with 3 moles of iodine molecules [1]

number of double bonds in one molecule of fat is 3 [1]

limit 6

consequential marking allowed provided the number of double bonds is an integer.

#### Question 36

(d) moles of  $CH_3-CH=CH_2$  reacted =  $1.4/42 = 0.033$  [1]

conseq

maximum moles of  $CH_3-CH(I)-CH_3$  that could be formed = 0.033 [1]

conseq

maximum mass of 2-iodopropane that could be formed = 5.61 g [1]

accept  $170 \times 0.033 = 5.61$  and  $170 \times 0.033333 = 5.67$

conseq unless greater than 100%

percentage yield  $4.0/5.67 \times 100 = 70.5\%$  [1]

Do not mark consequently to a series of small integers. There has to be

a serious attempt to answer the question, then consequential marking is appropriate.

#### Question 37

(d) mass of one mole of  $CaSO_4 = 136$

moles of  $CaSO_4$  in 79.1g = 0.58 accept 0.6 [1]

moles of  $H_2O$  in 20.9 g = 1.16 accept 1.2 [1]

conseq  $x = 2 \times$  given as an integer [1]

#### Question 38

(c)  $I_2 + 3Cl_2 = 2ICl_3$  [2]

For having either reactants or products correct ONLY [1]

#### Question 39

skip

#### Question 40

(c) (i) number of moles  $CO_2 = 0.24/24 = 0.01$

conseq number of moles of  $CaCO_3$  and  $MgCO_3 = 0.01$

conseq number of moles of  $CaCO_3 = 0.005$  [3]

(ii) Calculate the volume of hydrochloric acid, 1.0 mole/dm<sup>3</sup>, needed to react with one tablet.

number of moles of  $CaCO_3$  and  $MgCO_3$  in one tablet = 0.01

Expect same as answer to (c)(i). NO marks to be awarded. Just mark

consequentially to this response

conseq number of moles of HCl needed

to react with one tablet = 0.02

conseq volume of hydrochloric acid, 1.0 mole/dm<sup>3</sup>, needed to react with one

tablet = 0.02 dm<sup>3</sup> or 20 cm<sup>3</sup>

[1]

[1]

#### Question 41

(c) number of moles of HCl in 50 cm<sup>3</sup> of acid, concentration

2.2 mol/dm<sup>3</sup> = 0.11 [1]

maximum number of moles of  $CoCl_2 \cdot 6H_2O$  which could be formed = 0.055 [1]

mass of 1 mole of  $CoCl_2 \cdot 6H_2O = 238 g$

maximum yield of  $CoCl_2 \cdot 6H_2O = 13.09 g$  [1]

percentage yield = 48.2% or ecf mass of  $CoCl_2 \cdot 6H_2O$

above/ $13.09 \times 100\%$  to 1

dp [1]

#### Question 42

(b) (i) 14.3 [1]

(ii)  $85.7 \div 12$  and  $14.3 \div 1$  or 7.14 and 14.3 [1]

ratio 1:2 [1]

$CH_2$  [1]

note: Award all 3 marks for correct answer

allow: alternative working e.g.

$85.7 \times 84 \div 100$  and  $14.3 \times 84 \div 100$  or  $71.988/72$  and

$12/12.012$  [1]

6:12 or ratio 1:2 [1]

$CH_2$  [1]

(iii)  $C_6H_{12}$  [1]

#### Question 43

(iii)  $M_1 = 2.07$  Allow 2.1 or 2.0666...7

$M_2 = 62.8.g$

$M_3 = (M_2/152 =) 0.41(3)$

$M_4 (=M_1/M_3)$  rounded to the nearest whole number  $\times = 5$  [4]

#### Question 44

(ii) number of moles of ethanoic acid = 0.1 [1]  
number of moles of ethanol = 0.12(0) [1]  
the limiting reagent is ethanoic acid [1]  
number of moles of ethyl ethanoate formed = 0.1 [1]  
maximum yield of ethyl ethanoate is 8.8 g [1]

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(c) BrF<sub>3</sub> / F<sub>3</sub>Br; [1]  
BrF<sub>5</sub> / F<sub>5</sub>Br; [1]

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#### Question 45

(ii) mass of AgNO<sub>3</sub> needed is  $170 \times 0.2 \times 0.1 = 3.4\text{g}$  [2]  
NOTE: if answer given is 34 they have omitted 0.1  
ALLOW: (1) ecf  
(iii) number of moles of AgNO<sub>3</sub> used =  $0.02 \times 0.2 = 0.004$  [1]  
number of moles of Ag<sub>2</sub>CrO<sub>4</sub> formed = 0.002 [1]  
mass of one mole of Ag<sub>2</sub>CrO<sub>4</sub> = 332g  
mass of Ag<sub>2</sub>CrO<sub>4</sub> formed = 0.664g [1]  
NOTE: use ecf when appropriate

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#### Question 46

(c) number of moles of CO<sub>2</sub> formed =  $2.112 / 44 = 0.048$  [1]  
number of moles of H<sub>2</sub>O formed =  $0.432 / 18 = 0.024$  [1]  
x = 2 and y = 1 NOT: ecf from this line  
formula is 2PbCO<sub>3</sub>.Pb(OH)<sub>2</sub> / Pb(OH)<sub>2</sub>. 2PbCO<sub>3</sub> [1]

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#### Question 47

(d) number of moles of HCl in 40 cm<sup>3</sup> of hydrochloric acid,  
concentration 2.0 mol / dm<sup>3</sup> =  $0.04 \times 2.0 = 0.08$  [1]  
maximum number of moles of CO<sub>2</sub> formed = 0.04 [1]  
mass of one mole of CO<sub>2</sub> = 44 g [1]  
maximum mass of CO<sub>2</sub> lost =  $0.04 \times 44 = 1.76$  g [1]

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#### Question 48

(b) (i)  $(97.4 / 75 =)$  1.3 and  $(2.6 / 1 =)$  2.6; [1]  
empirical formula AsH<sub>2</sub>; [1]  
note: correct formula with no working = [1]  
(ii) As<sub>2</sub>H<sub>4</sub>; [1]  
(iii) H<sub>2</sub>As–AsH<sub>2</sub> / AsH<sub>2</sub>–AsH<sub>2</sub>; [1]

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#### Question 49

(d) number of moles of Na<sub>2</sub>SO<sub>3</sub> =  $3.15 / 126 = 0.025$  [1]  
number of moles of SO<sub>2</sub> formed = 0.025 [1]  
volume of SO<sub>2</sub> =  $0.025 \times 24 = 0.6$  dm<sup>3</sup>/litres or 600 cm<sup>3</sup> [1]  
allow: ecf  
for 1.6 g of SO<sub>2</sub> [1] only  
If used 22.4 max [2]  
note: need correct units for last mark

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#### Question 50

(c) number of moles of HCl used =  $0.05 \times 2 = 0.1$  [1]  
number of moles of SrCl<sub>2</sub>.6 H<sub>2</sub>O which could be formed. =  
0.05 [1]  
mass of one mole of SrCl<sub>2</sub>.6H<sub>2</sub>O is 267 g  
theoretical yield of SrCl<sub>2</sub>.6H<sub>2</sub>O =  $0.05 \times 267 = 13.35$  g [1]  
percentage yield =  $6.4 / 13.35 \times 100 = 47.9\%$  [1]  
accept: 48%  
allow: ecf

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#### Question 51