



## IB Chemistry – SL

### Topic 8 Answers

1. B
2. B
3. B
4. D
5. D
6. D
7. D
8. A
9. D
10. D
11. D
12. C
13. D
14. B
15. D
16. D
17. D
18. B
19. B
20. A
21. D
22. A

23. (a)  $3\text{Ag}^+(\text{aq}) + \text{XO}_4^{3-}(\text{aq}) \rightarrow \text{Ag}_3\text{XO}_4(\text{s})$ ;  
states;

2

*[1] for balanced equation and [1] for states.*

- (b) (i)  $n_{\text{Ag}^+} = cV = 0.2040 \text{ mol dm}^{-3} \times 0.04118 \text{ dm}^3$   
 $= 0.008401 / 8.401 \times 10^{-3} \text{ mol}$  (*-1 SF*)

1

*Ignore units even if wrong, do not award mark unless 4 sig fig.*

- (ii)  $n_{\text{Ag}_3\text{XO}_4} = \frac{1}{3} n_{\text{Ag}^+} = \frac{1}{3} \times 0.008401 \text{ mol}$



$$= 0.002800 / 2.800 \times 10^{-3} \text{ mol}$$

1

*ECF from (a) and (b)(i)*

(iii) 0.002800 mol weighs 1.172 g

$$1 \text{ mol weighs } \frac{1.172 \text{ g}}{0.002800 \text{ mol}} = 418.6 \text{ g mol}^{-1}$$

2

418.6;

*Accept answer in range 418 to 419.*

*No penalty for too many sig figs.*

*ECF from (b) (ii)*

*g mol<sup>-1</sup>*

*Do not accept g.*

(iv)  $(3 \times 107.87) + x + 4(16.0) = 418.6$

therefore,  $x = 30.99$  (*accept 31.0/31*);

P/phosphorous;

2

[8]

24. (a) (i)  $0.0010 / 1.0 \times 10^{-3} \text{ (mol dm}^{-3}\text{)}$ ;

pH = 3;

2

(ii) HCl: strong acid/fully dissociated;

CH<sub>3</sub>COOH : weak acid/partially dissociated;

HCl less concentrated/CH<sub>3</sub>COOH more concentrated;

only one molecule in 100 dissociates in ethanoic acid so [H<sup>+</sup>]

1/100/*OWTTE*

3

(b) measure electrical conductivity;

strong acids are good conductors/weak acids are poor conductors;

**OR**

react with magnesium or a named active metal/(metal) carbonate;

hydrogen carbonate/bicarbonate;

strong acids have a faster reaction/more gas bubbles (per unit time)

/more heat produced/weak acids have a slower reaction/less gas

bubbles (per unit time)/less heat produced;

2

*titration curves: namely strong acid and strong base will have an equivalence point pH of 7 and a weak acid and strong base will have an equivalence point pH of >7.*

*OR*

*temperature change: on neutralization for temperature change: namely,*

*neutralization (H<sup>+</sup> + OH<sup>-</sup>) is exothermic, weak acid is partially dissociated*

*so some energy used up in dissociation of weak acid – net result, weak acid*

*would produce less energy/less temperature increase compared to*

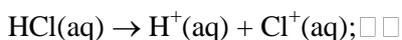
*neutralization of strong acid.*

[7]

25. strong acid completely dissociated/ionized;



weak acid only partially dissociated/ionized;



*Insist on both arrows as shown, state symbols not needed.*

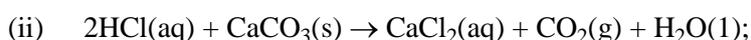
*Also accept  $\text{H}_2\text{O(l)}$  and  $\text{H}_3\text{O}^+(\text{aq})$  in equations*

4

[4]

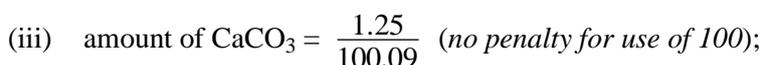
26. (i) bubbling/effervescence/dissolving of  $\text{CaCO}_3$ /gas given off  
(do not accept  $\text{CO}_2$  produced);  
more vigorous reaction with  $\text{HCl}$ /OWTTE;

2



2

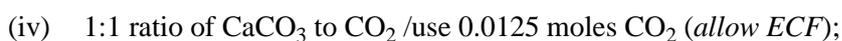
*[1] for correct formulas, [1] for balanced, state symbols not essential.*



amount of  $\text{HCl} = 2 \times 0.0125 = 0.0250$  mol (allow ECF);

volume of  $\text{HCl} = 0.0167 \text{ dm}^3 / 16.7 \text{ cm}^3$  (allow ECF);

3



$(0.0125 \times 22.4) = 0.28 \text{ dm}^3 / 280 \text{ cm}^3 / 2.8 \times 10^{-4} \text{ m}^3$  (allow ECF);

*Accept calculation using  $pV=nRT$ .*

1

[9]

27. (i) X;

1

- (ii) greater in Y/smaller in Z;  
by a factor of 10;

2

- (iii)  $Y > Z > X$ ;  
most ions/greatest concentration of ions in Y/OWTTE;

2

[5]

28. *Brønsted-Lowry acid*  
proton donor/OWTTE;  
 $\text{CH}_3\text{COOH}$  and  $\text{H}_3\text{O}^+$ ;

*Lewis base*

electron pair donor/OWTTE;

$\text{H}_2\text{O}$  and  $\text{CH}_3\text{COO}^-$ ;

4

[4]

29.  $\text{HCl}/\text{H}_2\text{SO}_4/\text{HNO}_3$ /any strong acid;  
 $\text{CH}_3\text{COOH}/\text{H}_2\text{CO}_3$ /any weak acid;

Measure pH – the strong acid has the lower pH;

*Accept universal indicator and two correct colours.*

Measure (electrical) conductivity – this is greater for the stronger acid;

Add magnesium/carbonate – more gas bubbles with the stronger acid/Mg or carbonate would disappear faster with stronger acid;



[5]

30. vinegar and factor of  $10^5$ ;

[1]

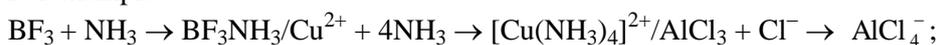
31. *Brønsted-Lowry acid*  
a proton donor;

*Lewis acid*  
electron pair acceptor;

*Brønsted-Lowry acid*  
Any suitable equation;

Lewis acid –  $\text{BF}_3/\text{AlCl}_3$ /transition metal ions that form complex ion  
with ligands;

For example



5

*Or any suitable equation.*

[5]

32. (i)  $\text{HCl}/\text{X}$  is strong and  $\text{CH}_3\text{COOH}/\text{Z}$  is weak;  
 $\text{HCl}/\text{X}$  is fully dissociated and  $\text{CH}_3\text{COOH}$  is slightly dissociated;  
 $[\text{H}^+]$  is greater in  $\text{HCl}/\text{X}$  than in  $\text{CH}_3\text{COOH}/\text{Z}$ ;

2

*Any two for [1] each.*

(ii) a factor of 100;

1

[3]

33. conductivity;  
nitric acid will contain more ions and have a higher conductivity/ethanoic acid  
will have fewer ions and have a lower conductivity;

rate of reaction with metal/carbonate/hydrogencarbonate;  
nitric acid will react more rapidly/produce bubbles faster/ethanoic  
acid will react less rapidly/produce bubbles more slowly;

reaction with alkali;  
temperature change will be less for ethanoic acid;

4

*Accept any two methods and explanations from above.*

[4]

34. (a) an acid that partially dissociates/ionizes/doesn't fully dissociate/ionize;

1

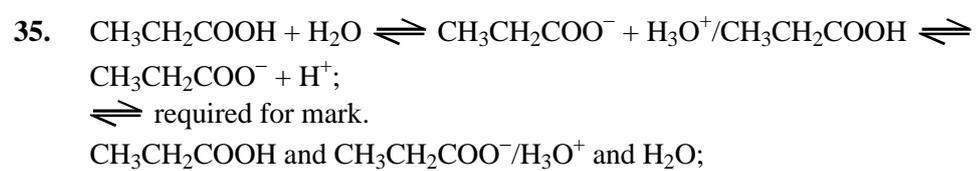
(b) conductivity - propanoic acid will be lower because lower ion concentration  
/less dissociated;  
reaction with metal/metal carbonate/metal hydrogencarbonate - propanoic  
acid will react slower/less vigorously because lower  $[\text{H}^+]$ /less dissociated;  
reaction with alkali - temperature change will be less for propanoic acid  
because lower  $[\text{H}^+]$ /less dissociated;

2

*Award [1] mark each for two.*



[3]



2

[2]