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Phone: +442081445350

www.chemistryonlinetuition.com

Email: asherrana@chemistryonlinetuition.com

CHEMISTRY

PHYSICAL CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	ACIDS AND BASES
PAPER TYPE:	QUESTION PAPER - 3
TOTAL QUESTIONS	10
TOTAL MARKS	43

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Acids and Bases - 3

1. This question is about By reference to the forces between molecules, ammonia.

(a) Explain why ammonia is very soluble in water.

(2)

(b) Aqueous solutions of ammonia have a pH greater than 7.

Write an equation for the reaction of ammonia with water.

(1)

(c) Explain why the pH of a solution containing 1.0 mol dm^{-3} of ammonia is less than 14 at 298 K.

(3)

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(d) An ammonium ion in aqueous solution can behave as a Bronsted–Lowry acid.

State what is meant by the term Bronsted–Lowry acid.

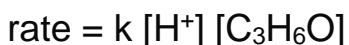
(1)

(e) State what is meant by the term buffer solution.

Identify a reagent which could be added to a solution of ammonia in order to form a buffer solution.

(3)

2. The rate equation for the acid-catalysed reaction between iodine and propanone is:



The rate of reaction was measured for a mixture of iodine, propanone and sulfuric acid at pH = 0.70

In a second mixture the concentration of the sulfuric acid was different but the concentrations of iodine and propanone were unchanged.

The new rate of reaction was a quarter of the original rate.

What was the pH of the second mixture?

- A. 1.00
- B. 1.30
- C. 1.40
- D. 2.80

(1)

3. A solution of a strong acid was found to have a pH of 0.5.

(a) Calculate the hydrogen ion concentration in this solution.

(2)

(b) Calculate the volume of water which must be added to 25.0 cm^3 of this solution to increase its pH from 0.5 to 0.7.

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(3)

4. A 0.10 mol dm^{-3} aqueous solution of an acid is added slowly to 25 cm^3 of a 0.10 mol dm^{-3} aqueous solution of a base.

Which acid–base pair has the highest pH at the equivalence point?

- A. CH_3COOH and NaOH
- B. CH_3COOH and NH_3
- C. HCl and NaOH
- D. HCl and NH_3

(1)

5. When water is cooled, the pH increases but the water remains neutral.

(a) Explain why the pH increases.

(2)

(b) Explain why water remains neutral.

(2)

6. Which one of the following is the change in units of pH which occurs when 10.0 cm^3 of a 1.0 M solution of a strong monoprotic acid are made up to 1.0 dm^3 with water?

- A. 1
- B. 2
- C. 3
- D. 5

(1)

7. This question is about pH.

(a) State what is meant by the term monoprotic acid and give one example

(2)

(b) What is the hydrogen ion concentration in a solution which has $\text{pH} = -0.20$?

(2)

(c) Calculate the pH of the solution formed when 35 cm^3 of 0.12 M NaOH are added to 25 cm^3 of 0.15 M HCl at 25° C .

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(7)

8. The pH of 0.001 M NaOH at 25°C is

- A. 13
- B. 11
- C. 9
- D. 3

(1)

9. An acid HA has $pK_a = 4.20$

(a) Define the term pK_a .

(2)

(b) Calculate the value of the dissociation constant, K_a , for the acid HA and state its units.

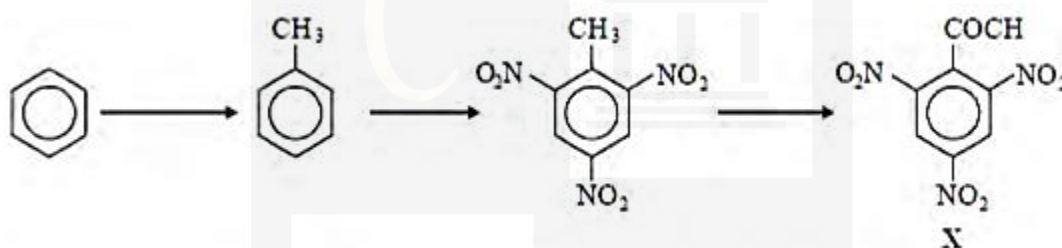
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(2)

(c) Calculate the pH of a 0.830 M solution of the acid HA.

(4)

10. This question is based on the reactions and compounds shown in the scheme below.



0.100 mol dm^{-3} solution of X is found to have a pH of 2.50.

The value of K_a in mol dm^{-3} is

- A. 3.16×10^{-2}
- B. 3.16×10^{-3}
- C. 1.00×10^{-4}
- D. 1.00×10^{-5}

(1)

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DR. ASHAR RANA



CHEMISTRY ONLINE
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Phone: +442081445350
www.chemistryonlinetuition.com
Email: asherrana@chemistryonlinetuition.com

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CONTACT INFORMATION FOR **CHEMISTRY ONLINE TUITION**

- UK Contact: 02081445350
- International Phone/WhatsApp: 00442081445350
- Website: www.chemistryonlinetuition.com
- Email: asherrana@chemistryonlinetuition.com
- Address: 210-Old Brompton Road, London SW5 OBS, UK