18.2 Calculations Involving Acids & Bases

Question Paper

Course	DP IB Chemistry
Section	18. Acids & Bases (HL only)
Topic	18.2 Calculations Involving Acids & Bases
Difficulty	Hard

Time allowed: 10

Score: /5

Percentage: /100

Question 1

The table below shows data for the and values for some acids and bases at 298 K.

Acid	K_a	Base	pK_b
C_5H_6OH	1.02×10^{-10}	$(C_2H_5)_3N$	3.25
$O_2NC_6H_4OH$	7.08×10^{-8}	$C_6H_5NH_2$	9.13

Which two formulas represent the weakest acid and the weakest base in the table?

A. C_5H_6OH and $C_6H_5NH_2$

B. $O_2NC_6H_4OH$ and $C_6H_5NH_2$

C. $O_2NC_6H_4OH$ and $(C_2H_5)_3N$

D. C_5H_6OH and $(C_2H_5)_3N$

[1 mark]

Question 2

The ionisation constant of water, K_w, at 40 °C is 2.92×10^{-14}. Which of the following statements is correct?

A. pH = 7.0

B. The ionisation of water is exothermic

C. The pH of water is lower at 40 °C than at 25 °C

D. $[H^+] > [OH^-]$ at 40 °C

[1 mark]

Question 3

The K_b value for a base is 8.0×10^{-4} at 298 K. What is the pK_a value for the conjugate acid at this temperature?

A. 10

B. 1.3×10^{-11}

C. 3.1

D. 10.9

[1 mark]

Question 4

The pKb value of HPO_4^{2-} is 6.8. What is its conjugate acid and what is the K_a value?

	Conjugate acid	K_a
A.	$H_2PO_4^-$	7.2
B.	H_3PO_4	7.2
C	H_3PO_4	1.67×10^{-7}
D.	$H_2PO_4^-$	6.3×10^{-8}

[1 mark]

Question 5

The strengths of four bases are:

- Phenylamine $pK_b = 9.13$
- Ethylamine $K_b = 4.46 \times 10^{-4}$
- 3–Nitrophenol $pK_b = 8.36$
- Ethanol $K_b = 3.16 \times 10^{-16}$

What is the order of increasing base strength?

A. Ethanol < phenylamine < 3–nitrophenol < ethylamine

B. Ethanol < 3–nitrophenol < phenylamine < ethylamine

C. Ethylamine < 3–nitrophenol < phenylamine < ethanol

D. Ethylamine < phenylamine < 3–nitrophenol < ethanol

[1 mark]