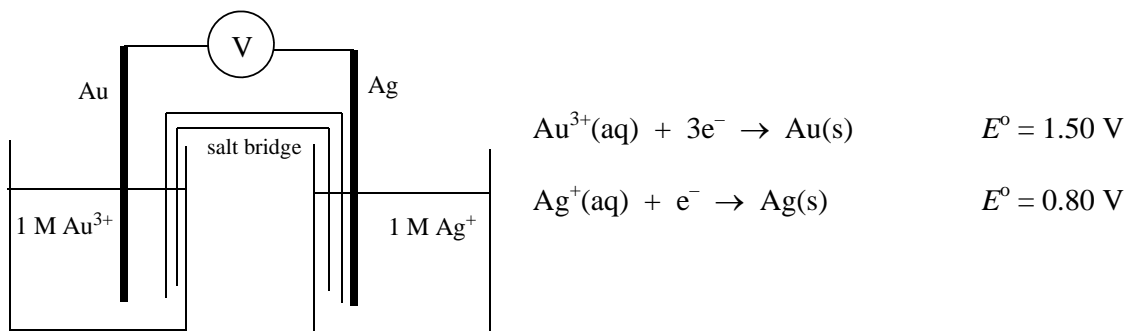


- A particular chemical reaction has  $\Delta H^\circ = +5 \text{ kJ mol}^{-1}$  and  $\Delta S^\circ = +25 \text{ J K}^{-1} \text{ mol}^{-1}$ . Assuming that these values do not change with temperature, in what temperature range is this reaction spontaneous?
  - It is spontaneous at all temperatures
  - It is not spontaneous at any temperature
  - $T > 200 \text{ K}$
  - $T < 200 \text{ K}$
  - $T < -200 \text{ K}$
- A buffered solution is  $0.0500 \text{ M CH}_3\text{CO}_2\text{H}$  and  $0.0400 \text{ M NaCH}_3\text{CO}_2$ . If  $0.0100 \text{ mol}$  of gaseous  $\text{HCl}$  is added to  $1.00 \text{ L}$  of the buffered solution, what is the final pH of the solution? For acetic acid,  $\text{p}K_a = 4.74$  (Hint: Use  $\text{pH} = \text{p}K_a + \log\{[\text{A}^-]/[\text{HA}]\}$ )
  - 4.74
  - 4.44
  - 4.64
  - 4.84
  - 4.56
- What is the pH of a  $0.20 \text{ M}$  solution of boric acid? The  $\text{p}K_a$  of boric acid is  $9.24$ .
  - 0.70
  - 2.73
  - 4.97
  - 5.12
  - 5.87

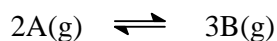
- Consider the following galvanic cell and standard reduction potentials:



Which one of the following statements is FALSE?

- The cell on the left containing  $\text{Au}^{3+}(\text{aq})$  is the cathode.
  - Electrons flow from the cell on the right to the cell on the left.
  - Oxidation occurs in the cell on the right containing  $\text{Ag}^+(\text{aq})$ .
  - Negative charges will flow through the salt bridge from right to left. #
  - Metallic gold will deposit on the electrode in the left hand cell.
- What is  $E^\circ$  for the cell in Q4.
    - $0.70 \text{ V}$
    - $1.50 \text{ V}$
    - $2.30 \text{ V}$
    - $0.90 \text{ V}$
    - $0.00 \text{ V}$

6. Samples of A (2.0 mol) and B (3.0 mol) are placed in a 10.0 L container and the following reaction takes place

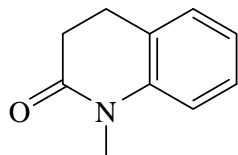


At equilibrium, the concentration of A is 0.14 M. What is the value of  $K_c$ ?

- a) 3.0#      b) 0.33      c) 2.4      d) 0.42      e) 6.8

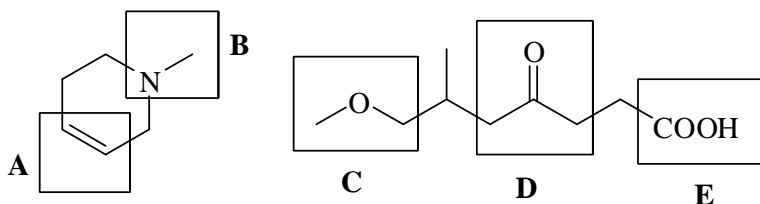
7. What is the molecular formula of the following compound?

- a)  $C_9H_9NO$   
 b)  $C_9H_{10}NO$   
 c)  $C_{10}H_{10}NO$   
 d)  $C_{10}H_{11}NO$ #  
 e)  $C_{10}H_{12}NO$



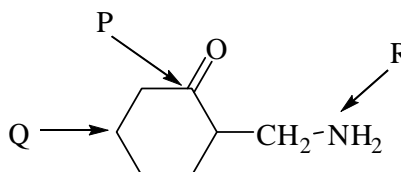
8. Which one of the following functional groups is **incorrectly** labelled?

- a) alkene  
 b) amine  
 c) aldehyde#  
 d) ketone  
 e) carboxylic acid

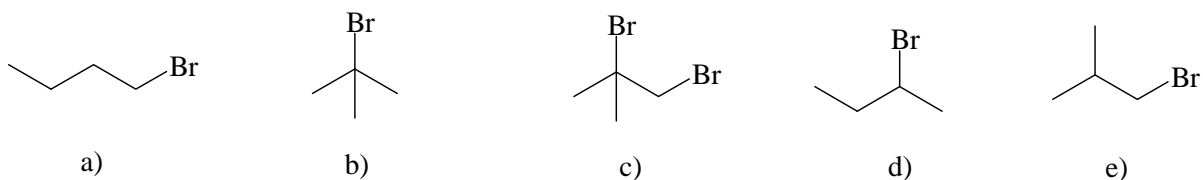


9. What is the hybridisation of the designated atoms in the following compound?

- a)  $P = sp^2$ ,  $Q = sp^3$ ,  $R = sp$   
 b)  $P = sp^3$ ,  $Q = sp^2$ ,  $R = sp^2$   
 c)  $P = sp^2$ ,  $Q = sp^3$ ,  $R = sp^3$ #  
 d)  $P = sp^3$ ,  $Q = sp^3$ ,  $R = sp^3$   
 e)  $P = sp^2$ ,  $Q = sp^3$ ,  $R = sp^2$



10. What is the major product from the addition of HBr to 1-butene? #d



Correct answers: 1C, 2B, 3C, 4D, 5A, 6A, 7D, 8C, 9C, 10D