Question:

Question 13 : If a gas absorbs 1000 J of heat and expands by 0.5 dm3 against a constant pressure of 4 atms (1 atm = 100000 Pa), then the change in internal energy is approximately.
-800 J
1200 J
-1200 J
800 J

Question 14 : The specific heat of silver is 0.0565 cal/g/^{o}C. Assuming no loss of heat to the surroundings or to the container, calculate the final temperature when 100 g of silver at 40 ^{o}C is immersed in 60 g of water at 10 ^{o}C.
21.6 ^{o}C.
25 ^{o}C
12.6 ^{o}C
16.2 ^{o}C

Solution:

Question 13: According to the first law of thermodynamics:

$$Q = \Delta U + p\Delta V$$

$$\Delta U = Q - p\Delta V = 1000 - 400000 \cdot 0.0005 = 800\ J$$

So the correct answer: 800 J.

Question 14: $-Q_{silwer} = Q_{water}$

$$Q = c \cdot m \cdot (T_2 - T_1)$$

$$Q_{silver} = -c_{silver} \cdot m_{silver} \cdot (T_{2,final} - T_{1,silver})_{silver}$$

$$Q_{water} = c_{water} \cdot m_{water} \cdot (T_{2,final} - T_{1,water})_{water}$$

$$-c_{silver} \cdot m_{silver} \cdot (T_{2,final} - T_{1,silver})_{silver} = c_{water} \cdot m_{water} \cdot (T_{2,final} - T_{1,water})_{water}$$

$$T_{2,final} = \frac{c_{silver} \cdot m_{silver} \cdot T_{1,silver} + c_{water} \cdot m_{water} \cdot T_{1,water}}{c_{silver} \cdot m_{silver} + c_{water} \cdot m_{water}}$$

$$T_{2,final} = \frac{0.0565 \cdot 100 \cdot 40 + 1 \cdot 60 \cdot 10}{0.0565 \cdot 100 + 1 \cdot 60} = 12.6\ ^{\circ}\text{C}.$$

So the correct answer: final temperature $T_{2,final}$ = 12.6 ^{o}C

Answer: Question 13: 800 J;

Question 14: 12.6 ^{o}C.