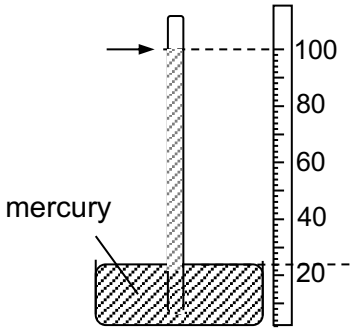
2023 Sec 4 Physics Pressure Assignment 9
A09 Answers

Note:
- Always state the formula or equation used!
- Show all working steps in calculation or reasoning.

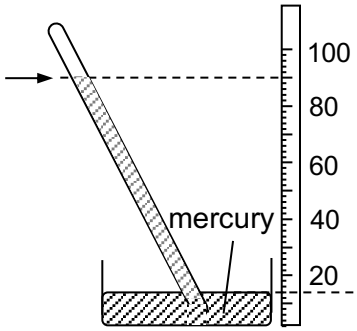
1 (a) (i) 90-14 = **76 cm Hg**

(ii) 90 - 40 = **50 cm Hg**

(b) (i)



(ii)



2 (a) P = 75.0 cm Hg

P = hρg = 0.750 x 13600 x 10 = 1.02 x 10^5 Pa

Note:
- tube P is like a normal mercury barometer, the space at upper end is a vacuum (P = 0)
- tube Q is like a faulty barometer, with air trapped at the upper end space (P_{air})
- Consider two points **A** & **B** at the same level of the mercury in the container which are at the same pressure.

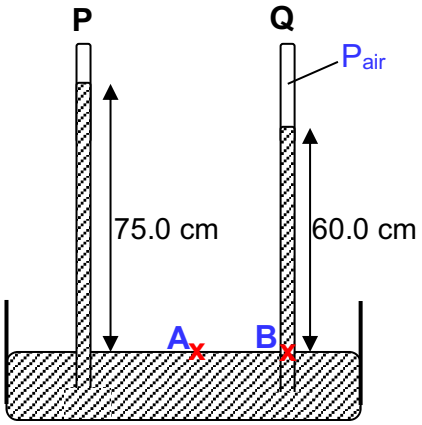
(b) $P_A = P_B$

75.0 cm Hg = P_{air} + 60.0 cm Hg

P_{air} = 15.0 cm Hg

$P_{air} = h \rho_{Hg} g$ = 0.150 x 13600 x 10

= 2.04 x 10^4 Pa



3

(a) $P_C = P_D$

$P_{gas} = P_{atm}$ + (40 – 21) cm Hg

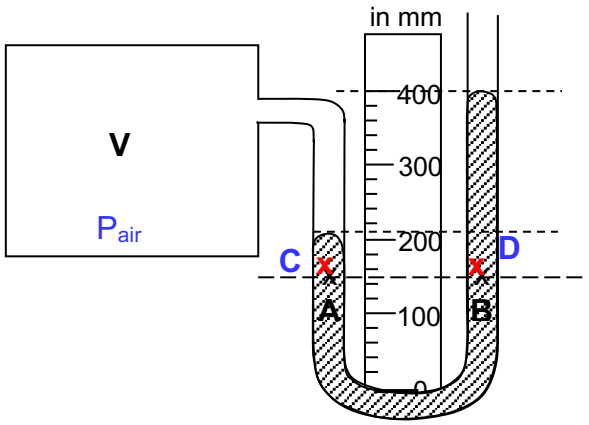
= 75 cm Hg + (40 – 21) cm Hg = 94 cm Hg

Note:
- Consider two points **C** & **D** at the same level of the mercury in the manometer which are at the same pressure (choose the lower of the 2 levels).

Note:

- Consider two points **C** & **D** (label these) at the same level of the mercury in the manometer which are at the same pressure (choose the lower of the 2 levels).

3 (b)



400 – 250 mm = 150 mm

4 (a) P_A = 76 cm Hg

Note:

- Consider a point **C** (label this point) at the same level of the mercury as point **B** so both points are at the same pressure.

(b) P_B = 76 + 22 = **98 cm Hg**

(c) Left tube level: (**42 + 5) cm mark = 47 cm mark**

Right tube level: (2**0 – 5) cm mark = 15 cm mark**

(d) (i) **32 cm mark**

(ii) Since the gas pressure remains constant, the excess pressure remains constant i.e. 22 cm Hg. The height difference between the left and right arm remains at 22 cm.

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$$P_1V_1 = P_2V_2$$
$$(2.0 \times 10^7)(6.0 \times 10^{-3}) = (1.2 \times 10^5)(V_2)$$
$$V_2 = \mathbf{1.0\ m^3}$$

6

Pressure due to column of air of height h = Pressure difference measured at top and base of mountain (using mercury barometer)

$H \rho_{air} g = h_{bottom} \rho_{Hg} g - h_{top} \rho_{Hg} g$

$= (h_{bottom} - h_{top}) \rho_{Hg} g$

$= (0.750 – 0.580) \times 13600 \times 10$

$H \times 1.2 \times 10 = 23120$ Pa

$H = 1926.7 \approx 1930$ m (to 3 s.f.)