# 2022 Sec 4 Physics Pressure Assignment 9

## AS 9 Answers

**Note:**

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

**1**

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

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

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

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

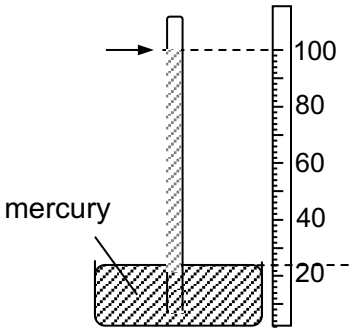
$H \times 1.2 \times 10 = 23120$ Pa

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

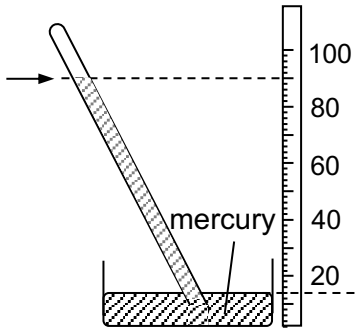
**2** (a) (i) 90-14 = **76 cm Hg**

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

(b) (i)




(ii)




**3** (a) P = 75.0 cm Hg

P = hρg = 0.750 x 13600 x 10 = $1.02 \times 10^5$ 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.

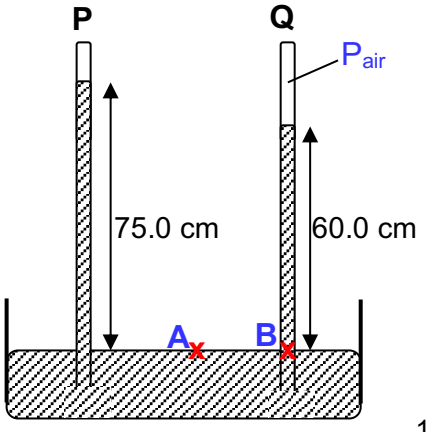
(b) $P_A = P_B$

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

$P_{air}$ = 15.0 cm Hg

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

$= 2.04 \times 10^4$ Pa



**4**

**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).

(a) $P_C = P_D$

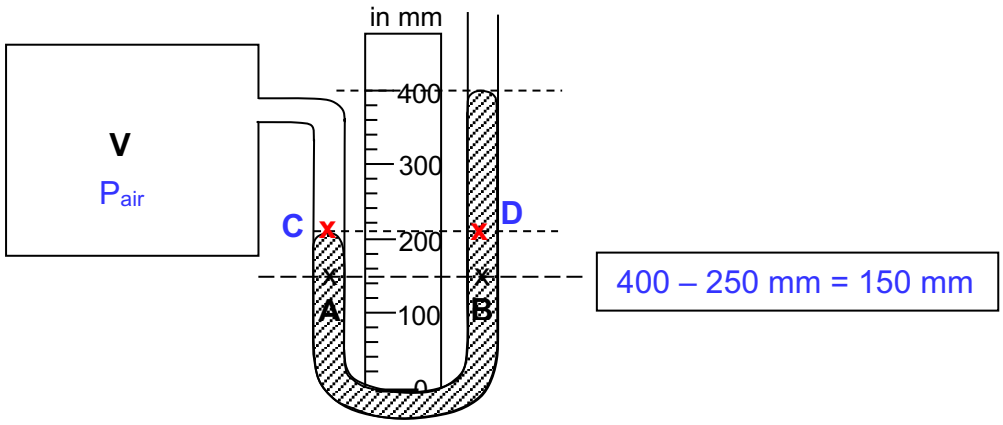
$P_{gas} = P_{atm} + (40 - 21)$ cm Hg

$= 75$ cm Hg $+ (40 - 21)$ cm Hg $= 94$ cm Hg

**Note:**

- Consider two points **C** & **D** (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).

(b)




**5** (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.

**6** (a) $P_1V_1 = P_2V_2$

$(2.0 \times 10^7)(6.0 \times 10^{-3}) = (1.2 \times 10^5)(V_2)$

$V_2 =$ **$1.0\ m^3$**

(b) Number of balloons $= 1.0 / 2.5 \times 10^{-3}$

$=$ **400**

**7** (a) $P_1V_1 = P_2V_2$

$P_{tank}(0.050) = (1.0 \times 10^5)(20)$

$P_{tank} =$ **$4.0 \times 10^7$ Pa**

**(b)** $P_1V_1 = P_2V_2$

$P_{new}(230 + 20) = (1.0 \times 10^5)(20)$

$P_{new} =$ **$8.0 \times 10^3$ Pa**

**(c)** $P_1V_1 = P_2V_2$

$(8.0 \times 10^3)(250) = (85\% \times 1.0 \times 10^5)(V_2)$

$V_{85\%} =$ **$24\ m^3$** (actual volume of air at the required pressure)

Remaining volume of space ($250 - 24\ m^3$) needs additional air from additional air cylinders to reach 85% Patm.

$P_1V_1 = P_2V_2$

$(85\% \times 1.0 \times 10^5)(250\text{-}24) = (4.0 \times 10^7)\ V_{tank}$

$V_{tank} = 0.48\ m^3$

Minimum number of tanks $= 0.48/0.050 = 9.6 = 10$

OR

$p_1V_1 = p_2V_2$

$p_1$ = air pressure in each cylinder

$V_1 = nV_0$ = total volume of air in additional n cylinders each of volume $V_0 = 0.050\ m^3$

$p_2$ = additional air pressure needed to bring the air pressure in (b) to reach 85% Patm

$= 85\%\ (1.0 \times 10^5) - 8.0 \times 10^3$ Pa

$V_2$ = total volume of space $= 230 + 20\ m^3$