Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

(a) $p_1V_1^{1.4} = p_2V_2^{1.4}$

$p_2 = p_1 (V_1/V_2)^{1.4}$

$= 1.2 \times 10^6 (9.0/6.8)^{1.4}$ ✔ $= 1.8 \times 10^6$ (Pa) ✔

$$T_2 \frac{p_2V_2T_1}{p_1V_1} = \frac{1.8\times10^6\times(6.8\times10^{-5})\times290}{1.2\times10^6\times(9.0\times10^{-5})}$$ ✔

$T_2 = 328$ (K) ✔

OR use of $p_1V_1 = nRT_1$ to find n or nR ✔
and substitute in
$p_2V_2 = nRT_2$ to find T_2 ✔

1st mark for substituting correct values into either equation
2nd mark for answer p_2
3rd mark for substituting correct values into
$p_1V_1/T_1 = p_2V_2/T_2$ or $T_2 = \frac{p_2V_2T_1}{P_1V_1}$
4th mark for answer T_2
ECF for p_2
With rounding answers range from 320 to 330 K

4

(b) in adiabatic compression there is no heat transfer/$Q = 0$ ✔

If compression is quick there is no time for heat transfer ✔

(so can be considered adiabatic)

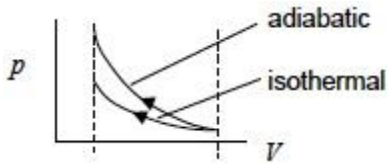
2

(c) For isothermal compression (for same volume change) (final) pressure not as high **OR** adiabatic compression curve is steeper (on p - V diagram) than isothermal ✔ Area under a p - V curve between same volumes would be less OR addition of all $p\Delta V$ during compression will be less ✔

So less work done ✔

Give credit for these ideas shown with help of a diagram or diagrams.

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Award last mark only if either or both of first two marks have been given.

3

[9]

Q2.

(a) The molecules (continually) move about in random motion ✓

Collisions of molecules with each other and with the walls are elastic ✓

Time in contact is small compared with time between collisions ✓

The molecules move in straight lines between collisions ✓

ANY TWO

Allow reference to 'particles interact according to Newtonian mechanics'

2

(b) Ideas of pressure = F / A and F = rate of change of momentum ✓

Mean KE / rms speed / mean speed of air molecules increases ✓

More collisions with the inside surface of the football each second ✓

Allow reference to 'Greater change in momentum for each collision'

3

(c) Radius = 690 mm / 6.28) = 110 mm or T = 290 K ✓ seen

volume of air = 5.55×10^{-3} m^3 ✓

$n \times 29$(g) = 11.4 (g) ✓ n = 0.392 mol

Use of $pV = nRT$ = $\dfrac{0.392 \times 8.31 \times 290}{5.55 \times 10^{-3}\ \text{m}^3}$ ✓

$p = 1.70 \times 10^5$ Pa ✓

Conclusion: Appropriate comparison of their value for p with the requirement of the rule, ie whether their pressure above 1×10^5 Pa falls within the required band ✓

Allow ecf for their n V and T ✓

6

[11]

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