Answers – Thermal Physics

Exercise A

1 13 K
2 **(a)** 46 K.
(b) Number of vapour molecules will increase and their average speed will increase; therefore there will be more and harder collisions with the lid per second; both factors increase the pressure.
3 330 s, 5.5 minutes; it will take much longer as the convector heater will transfer only a fraction of its input power to the air passing through it. Another small effect, for example, will be the energy transfer to the walls and objects within the room by the air.

Exercise B

1 **(a)** **(i)** 2.5×10^6 J kg^{-1};
(ii) 4.5×10^4 J mol^{-1}
(accepted value is 4.07×10^5 J mol^{-1})
(b) Thermal energy transfer to the surroundings
2 **(b)** When p doubles ln p increases by 0.69, so the increase in temperature is about 22 K.

3 The tea is at 0°C, as there was not enough thermal energy in the tea to melt all of the ice.

Exercise C

1 **(a)** 2.6 mm;
(b) the temperature at 40 m will be lower than at the surface, so the bubble will expand further.
2 0.4 m^3
3 760.5 mmHg

Exercise D

1 12 m^3
2 39°C
3 6.0×10^6 Pa or 6.0 MPa
4 $1.2(1) \times 10^5$ Pa

Exercise E

1 **(a)** 0.029 kg mol^{-1}; **(b)** 2.1×10^{25}
2 **(a)** 58; **(b)** 1.6 kg;
(c) 1.4 m^3; **(d)** 58
3 **(a)** 7.2×10^{19}; **(b)** 1.7×10^{-3} kg m^{-3}
4 **(a)** 4.8×10^{22}; **(b)** 1.3×10^5 Pa;
(c) 3.6×10^{22}

Exercise F

1 **(a)** 8.3×10^{-3} m^3;
(b) 3.0×10^5 Pa, 3.0 atm;
(c) Yes, the pressure, double the value
2 **(a)** **(i)** 5.65×10^{-21} J;
(ii) 4.7×10^{-26} kg
(b) **(i)** 5.65×10^{-21} J, 1.70×10^{-20} J;
(ii) 1300 m s^{-1}, 2250 m s^{-1}
3 **(a)** 2.1×10^{-20} J;
(b) **(i)** 3.53 km s^{-1} **(ii)** 2.50 km s^{-1};
(c) No, because r.m.s. speed > 2.2 km s^{-1} for both.
4 530 K
