Answers

1.1

1 **a** 0.20 rad s^{-2}

b **i** 360 rad

ii 57

2 **a** 75 rad s^{-1}

b 1.5 rad s^{-2}

c 29 rad; 4.6 turns

3 **a** 1.4×10^5 rad

b 22 000

4 **a** 107 rad s^{-1}

b **i** 5.0 s

ii 42.4

c 21 rad s^{-1}

5 **a** 17 rad s^{-1}

b **i** 5.0 rad s^{-2}

ii 30 rad, 4.8 turns

1.2

1 0.27 N m

2 **b** **i** 21 rad s^{-2}

ii 376 turns

4 **b** **ii** 17 kg m^2

1.3

1 **a** 9.6 J

b **i** 19 N m

ii 50 rad

2 **a** 12.1 J

b 0.2 J

c **i** 11.9 J

ii 6.3×10^{-4} kg m^2

4 **a** **i** 47 kg

ii 0.57 kg m^2

b **i** 28 kJ

ii 2.0 kW

1.4

1 **a** 4.5 N m s,

b 0.50 N m

2 **a** 1.1 N m s

b 0.022 kg m^2

4 2.6×10^{-2} kg m^2

2.1

1 30 J transferred to the gas

2 **a** 9 J

b **i** 5 J

ii 4 J transferred to the surroundings

3 **b**

Stage	*Q*	ΔU	*W*
gas ignites	>0	>0	0
gas expands	0	<0	>0

4 **a** $W = 80$ J ; heat transfer into the system = work done by the system

b $Q = -220$ J ; heat transfer from the system + work done by the system lowers the internal energy by 400 J

c $Q = 0$; work done on the system is equal to its gain of internal energy

d −260 J ; the internal energy of the system is lowered by 260 J as a result of the difference between 500 J of heat transfer from the system and 240 J of work done on the system

2.2

1 **a** **i** 0.18 moles

ii 400 K

iii +225 J

b 375 J (to the gas)

2 **a** **i** 300 K

ii 75 kPa

b 1.4 kJ

3 **a** 90 kPa, 260 K

b 1.1 J

4 **b** 6.3×10^{-6} m^3

2.3

2 **a** 160 kW b 28%

4 **a** **i** 4.8 MW

ii 4.4 MW

b **i** 13 MW

ii 0.37

2.4

1 **a** **i** 40 J s^{-1}

ii 0.10

b 0.17

2 **a** 0.20

b 16 MW

3 **a** 0.71

b **ii** 35 kW

2.5

1 **a** 5

b 480 W

2 **a** 100 W

4 **a** 9.5 kJ

b 15 W

c 2