THERMAL PHYSICS REVIEW 2012

1. B

2. A

3. A

4. (a) internal energy is the total kinetic and potential energy <u>of the molecules</u> of a body;
thermal energy is a (net) amount of energy transferred between two bodies;
at different temperatures; 3

(b) the internal energy of the iron is equal to the total KE plus PE of the molecules;
the molecules of an ideal gas have only KE so internal energy is the total KE of the molecules; 2

(c) (i) $60 \times [\,\theta - 45]$; 1

(ii) $(2.0 \times 10^3 \times 29) = 5.8 \times 10^4$ J; 1

(iii) $60 \times [\theta - 45] = 5.8 \times 10^4$;
$\theta = 1000$°C;
(*allow 1010°C to 3 sig fig)* 2

[9]

5. (a) (i) evaporation takes place at any temperature/involves a reduction in temperature and boiling takes place at constant temperature; 1

(ii) evaporation takes place at the surface of the liquid/depends on surface area of the liquid and boiling takes place throughout the liquid/is independent of surface area; 1

(b) energy supplied = $15 \times 4.5 \times 10^2 = 6.8 \times 10^3$ (J);

$l\,hv = \dfrac{6.8\times10^3}{1.8\times10^{-2}}$;

$= 3.8 \times 10^5$ J kg^{-1}; 3

(c) (thermal) energy/heat is lost to the surroundings / (thermal) energy is used to heat the calorimeter / some heat is given to the calorimeter;
and so less (thermal) energy/heat is available to boil the liquid / less mass boils away / *OWTTE*; 2

[7]

6. (a) (i) *internal energy:*
the total (potential energy and) kinetic energy of the (copper) molecules/ atoms/particles;

or

amount of stored energy in the copper;

heating:

the (non-mechanical) transfer of energy;
(from the surroundings/source) to the copper; 3

(ii) $c = \dfrac{\Delta Q}{m\Delta T}$;

$= \left[\dfrac{1.2\times10^3}{0.25\times20}\right] = 240\ \text{J kg}^{-1}\ \text{K}^{-1}$; 2

(b) (i) the molecules gain kinetic energy (from the heating); 1

(ii) molecules collide with the walls with a greater velocity /
momentum transferred to the piston greater;
to keep pressure constant frequency of collisions must decrease;
volume must increase; 3

[9]

7. (a) (i) (thermal) energy/heat required to change temperature by 1 K/
1 deg/1°C / mass × specific heat capacity; 1

(ii) rate of energy absorption is equal to the rate of energy emission /
temperature of copper stays constant; 1

(b) (i) use of $mc\Delta T$;
$0.12 \times 390 \times [T - 308] = 0.45 \times 4200 \times 30$;
1520 K / 1250°C; 3

(ii) energy likely to have been lost when moving copper /
during warming of water; hence temperature of flame higher; 2

[7]

8. Specific heat and a domestic shower

(a) the amount of energy/heat required to raise the temperature of 1 kg
of a substance through 1 K / 1 °C; 1

(b) the internal energy is the total energy of the molecules of a substance;
the greater the specific heat (the more energy required to raise unit mass
through 1 K) this means that to increase the temperature by the same amount,
more energy most be given to substance A than to substance B (so internal
energy is greater) / *OWTTE*; 2

(c) (i) energy supplied by heater in 1s = 7.2×10^3 J;
energy per second = mass per second × sp ht × rise in temperature;
7.2×10^3 = mass per second × $4.2 \times 10^3 \times 26$;
to give mass per second = 0.066 kg; 4

(ii) energy is lost to the surroundings;
flow rate is not uniform; 1
Do not allow "the heating element is not in contact with all the water flowing in the unit".

[8]