CHAPTER 3 TEST REVIEW -- MARKSCHEME

1.	C	**5.**	A	**9.**	C
2.	C	**6.**	C	**10.**	C
3.	D	**7.**	D	**11.**	A
4.	B	**8.**	B	**12.**	D

13. (a) in boiling, energy is required to break bonds (in vaporization) **and** to separate molecules;
in melting, (more) energy available to overcome bond energies of molecules without large separation; **2**

(b) (i) evaporation at surface of liquid, boiling occurs throughout liquid;
evaporation occurs at all temperatures, boiling at boiling pt only;
boiling: vapour pressure = atmospheric;
evaporation: vapour pressure < atmospheric; **2 max**

(ii) attempt to equate energy gained by milk to energy lost by steam;
minimum energy required = 0.30 × 3800 × 62 = (70680 J);
energy supplied = [steam mass] × [$2.3 \times 10^6 + 4200 \times 20$];
minimum steam mass = 0.030kg; **4**

(iii) energy required to heat cup;
energy lost to surroundings / steam escapes from system; **2**

14. (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) $Q = \Delta U + W$
$Q = +623$;
$W = +249$;
$\Delta U = [623 - 249] = 374$ J; **3**

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

$= 20.8\ \text{J K}^{-1}$; **2**

(c) less;
because (at constant volume) all the thermal energy supplied goes to increasing the internal energy;
and so the increase in temperature in the constant volume case is greater; **3**

15. (a) energy (released) per unit mass; 1

Accept per unit volume or per kg or per m^3.
Do not accept per unit density.

(b) (i) volume of fuel used per second = $\frac{\text{rate}}{\text{density}}$ (= 1.63×10^{-7} (m^3));

energy per second = $2.7 \times 10^{10} \times 1.63 \times 10^{-7}$;
= (4.3875 =)4.4kW; 3

(ii) power required = ($2.9 \times 10^5 \times 0.13 \times 10^{-3}$ =)38W;
small fraction/less than 1 % of overall power output / *OWTTE*; 2

(c) sensible comment comparing molecular structure;
e.g. liquid molecular structure (more) ordered than that of a gas.
in gas molecules far apart/about 10 molecular spacings apart /
in liquid molecules close/touching

sensible comment comparing motion of molecules; 2
e.g. in liquid: molecules interchange places with neighbouring molecules / no long distance motion.
in gases: no long-range order / long distance motion.

16. (a) (i) use of $R = \frac{pV}{nT}$; (*award mark if correct substitution seen)*

$\left(\frac{5.2\times10^{-3}\times1.0\times10^{5}}{0.23\times290}\right)$ = 7.8 J K mol^{-1}; (*accept Pa* m^3 *mol* K^{-1}) 2

(ii) the gas is ideal; 1

(b) constant temperature required; (*do not allow "isothermal")*
a slow compression allows time for (internal) energy to leave gas / *OWTTE*; 2

(c) (for adiabatic change) $Q = 0$;
W is positive / work is done by the gas;
$\Delta U = -W$ so ΔU is negative;
(*T* is a measure of *U* therefore) *T* less than 290 K. 4