Mark schemes

1. (a) the gradient for ice is steeper than the gradient for water (liquid)

allow the temperature of the ice increased faster than the temperature of the water

1

which means that less energy is needed to increase the temperature by a fixed amount

1

(b) water took more time to vaporise than the ice took to melt

1

which means that less energy is needed to change the state from solid to liquid (than from liquid to vapour)

1

(c) any **two** from:

- ice/water would take more time to increase in temperature
  allow gradients would be less steep
- ice/water would take more time to change state
- the change in temperature with time would not be linear

allow horizontal lines would be longer

2

(d) E = 69 000 (J)

1

69 000 = 0.030 × L

allow a correct substitution of an incorrectly/not converted value of E

1

$$L = \frac{69\,000}{0.030}$$

allow a correct rearrangement using an incorrectly/not converted value of E

1

L = 2 300 000
or
L = 2.3 × 106

allow a correct calculation using an incorrectly/not converted value of E

1

J/kg

allow a unit consistent with their numerical answer
eg 2300 kJ/kg

1

[11]

2. (a) balance / scales

1

(b) $\text{density} = \frac{\text{mass}}{\text{volume}}$

or

$\rho = \frac{m}{V}$

1

(c) $0.68 = \frac{85}{V}$

1

$V = \frac{85}{0.68}$

1

V = 125 (cm3)

1

(d) repeat readings (of volume) need taking (of each fruit) to show that the readings are close together

allow 'the same' for 'close together'

1

[6]

3. (a) 0(.0) to 12(.0)

allow 2(.0) to 12(.0) (N)

1

(b) mass of gas (in the syringe)
or
temperature (of the gas)

1

(c) constant = 60 × 45
or
constant = 2700

1

2700 = p × 40

1

$p = \frac{2700}{40}$

1

p = 67.5 (kPa)

allow 68 (kPa)

1

(d) there is more time between collisions of particles and the walls of the syringe
or
there are less frequent collisions between the particles and the walls of the syringe

1

(causing) a lower (average) force on the walls of the syringe

1

(and) pressure is the total force per unit area

1

[9]

4. (a) The particles move in random directions.

1

The particles move with a range of speeds.

1

(b) 100 000 × 0.030 = 3000

1

p × 0.025 = 3000

allow a correct substitution using an incorrectly calculated value using pV = constant

1

$p = \frac{3000}{0.025}$

allow a correct rearrangement using an incorrect value of the constant

1

p = 120 000 (Pa)

allow a correct calculation using an incorrect value of the constant

allow correct substitution into p1V1 = p2V2 for first 2 marking points

1

(c) particles would have a higher (mean) kinetic energy

allow particles would have a higher (mean) speed
do not accept particles vibrate more

1

(so) increased number of collisions with the walls of the balloon per second

allow greater frequency of collisions with the walls of the balloon

1

greater forces exerted in collisions (between particles and balloon walls)

allow greater rate of change of momentum (of particles)

1

greater force exerted on same area

allow description using p=F/A

1

[10]

5. (a) metre rule has a lower resolution

allow metre rule has a resolution of 1 mm / 1 cm

fewer decimal places is insufficient

1

so is less accurate (than the micrometer screw gauge)

1

(b) record the value of the zero error when there is no object on the balance

subtract / add the value of the zero error

1

subtract / add the value of the zero error

1

(c)

*an answer of 0.0502 (kg) scores **5** marks*

V = (18.45 × 10−3)3

or

V = 0.018453

this mark may be awarded if width is incorrectly / not converted

1

V = 6.28 × 10−6 (m3)

this answer only

1

$$8.0 \times 10^{3} = \frac{m}{6.28 \times 10^{-6}}$$

allow

$$8.0 \times 10^{3} = \frac{m}{\text{their calculated V}}$$

1

m = 8.0 × 103 × 6.28 × 10−6

allow m = 8.0 × 103 × their calculated V

1

m = 0.0502 (kg)

allow an answer consistent with their calculated V

1

[9]

6. (a) the (mean) kinetic energy of the particles increases

allow the (mean) speed of the particles increases

'kinetic energy increases' is insufficient by itself

*do **not** accept particles vibrating*

1

which increases the (internal) energy of the water

ignore description of evaporation

1

(b) Particles in a gas have more potential energy than particles in a liquid.

1

(c) Energy given to water E = mL with quantities defined

1

$$\text{power output (of Bunsen burner)} = \frac{\text{energy transferred (to water)}}{\text{time}}$$

allow $P = \frac{E}{t}$ *with quantities defined*

1

$$\text{power output} = \frac{\text{change in mass} \times \text{specific latent heat}}{\text{time}}$$

allow E = Pt equated with E = mL or stated in words

or

$P = \frac{mL}{t}$ *with quantities defined*

1

time should be converted to seconds

or

use a time of 300 seconds

1

[7]

7. (a) any **two** from:

- calculate a mean
- reduces the effect of random errors

  reduces human error is insufficient
- identify / remove anomalies

  allow to assess the repeatability of the data

2

(b) random error

allow a parallax error

human error is insufficient

1

(because) eye position would not be the same each time (relative to the liquid)

allow systematic error only if it is clear that the student always viewed liquid level from above meniscus (or below)

1

(c) (a temperature increase would) increase the pressure in the tube (even if the volume was constant)

1

(because a higher temperature would mean) higher (average) kinetic energy of molecules / particles

allow higher (average) speed for higher (average) kinetic energy

1

(d) $1.6 \times 105 \times 9.0$ (= 1.44×106)

1

$1.44 \times 106 = 1.8 \times 105 \times V$

*allow for **2** marks*

$$V = \frac{1.6 \times 10^5 \times 9.0}{1.8 \times 10^5}$$

1

or

$$V = \frac{1.44 \times 10^6}{1.8 \times 10^5}$$

V = 8.0 (cm3)

1

*an answer of 8.0 (cm3) scores **3** marks*

(e) work is done on the air (in the tyre)

1

so the temperature (of the air) increases

allow the (average) kinetic energy of the particles increases

1

[11]

8. (a) $1.2 = \frac{m}{2.3 \times 10^4}$

1

$m = 1.2 \times 2.3 \times 104$

1

m = 27 600 (kg)

allow an answer of 28 000 (kg) or 2.8 × 104 (kg)

or

m = 2.76 × 104 (kg)

1

*an answer of 27 600 (kg) scores **3** marks*

(b) mass of air passing the turbine blades is halved which decreases kinetic energy by a factor of two

1

(wind speed is halved) decreasing kinetic energy by a factor of four

1

so kinetic energy decreases by a factor of eight

1

allow power output for kinetic energy throughout

(c) 388 000 = 0.5 × 13 800 × v2

this mark may be awarded if P is incorrectly / not converted

1

$$v^2 = \frac{(2 \times 388\,000)}{13\,800}$$

this mark may be awarded if P is incorrectly / not converted

or

$$v^2 = \frac{388\,000}{(0.5 \times 13\,800)}$$

or

v2 = 56.2

1

v = 7.50 (m/s)

an answer that rounds to 7.50 (m/s) only

1

[9]