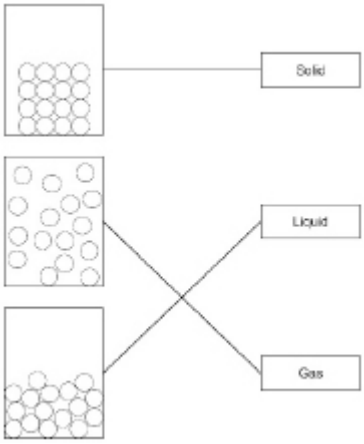
Mark schemes

1. (a)



2 marks for all correct
1 mark for 1 or 2 correct

2

(b) **B**

1

(c) **D**

1

(d) the kinetic energy of the particles

1

(e) E = 0.250 × 334 000

1

E = 83 500 (J)

1

(f) sublimates

1

[8]

2. (a) **Level 2:** The method would lead to the production of a valid outcome. Key steps are identified and logically sequenced.

3–4

Level 1: The method would not necessarily lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

- part fill a measuring cylinder with water
- measure initial volume
- place object in water
- measure final volume
- volume of object = final volume − initial volume

- fill a displacement / eureka can with water
- water level with spout
- place object in water
- collect displaced water
- measuring cylinder used to determine volume of displaced water

(b) $\text{density} = \frac{48.6}{18.0}$

1

density = 2.70 (g/cm^3)

1

*an answer of 2.70 (g/cm^3) scores **2** marks*

(c) limestone

1

(d) eye position when using measuring cylinder
or
water level in can (at start) not at level of spout
or
not all water displaced by stone is collected in container

1

(e) volume would be lower / higher

1

[9]

3. (a) minimum distance between wind turbines is at least 500 m in all directions

turbines can rotate to face into wind and still maintain the minimum distance

1

(b) density = mass/volume

allow ρ = m / V

1

(c) $1.2 = \frac{51000}{V}$

1

$V = \frac{51000}{1.2}$

1

V = 42 500

1

V = 43 000

1

m^3

*an answer of 43 000 scores **4** marks*

*an answer of 42 500 scores **3** marks*

1

(d) $2.4 \times 10^9 / 1.6 \times 10^6$

1

1500

*an answer of 1500 scores **2** marks*

1

(e) wind power is unreliable

1

(very) large numbers of wind turbines would need to be constructed

allow calculation of this (15 625)

1

[11]

4. (a) **Level 2**: The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

3–4

Level 1: The method would not necessarily lead to a valid outcome. Some steps are identified, but the method is not fully logically sequenced.

1–2

No relevant content

0

Indicative content

- use a eureka/displacement can
- fill the eureka/displacement can with water
- fill the eureka/displacement can up to the spout
- place lime in eureka/displacement can
- collect water that overflows
- use a measuring cylinder to measure volume of water

OR

- use a measuring cylinder
- part fill the measuring cylinder with water
- measure the initial volume of water
- place lime in measuring cylinder
- record new volume of water
- volume of lime = new volume – initial volume

(b) mean = $\frac{(2.1+2.1+2.4)}{3}$

1

mean = 2.2 (cm^3)

1

(c) allows anomalous results to be identified and ignored

1

reduces the effect of random errors when using the equipment

1

(d) density = $\frac{84}{120}$

1

density = 0.70 (g/cm^3)

1

[10]

5. (a) range of speeds

1

moving in different directions

accept random motion

1

(b) internal energy

1

(c) density = mass / volume

1

(d) 0.00254 / 0.0141

1

0.18

1

*accept 0.18 with no working shown for the **2** calculation marks*

kg / m^3

1

[7]

6. (a) Student A's measurements had a higher resolution

1

Student B was more likely to misread the temperature

1

(b) a random error

1

(c) 8.4 °C

1

(d) 740 (seconds)

allow answers in the range 730 – 780

1

(e) 0.40 × 199 000

1

79 600 (J)

1

*accept 79 600 (J) with no working shown for **2** marks*

(f) stearic acid has a higher temperature than the surroundings

accept stearic acid is hotter than the surroundings

1

temperature will decrease until stearic acid is the same as the room temperature / surroundings

1

[9]

7. (a) 0 to 25 cm^3

1

(b) temperature

1

(c) 101 000 × 12 = constant

1

constant = 1 212 000 (Pa cm^3)

1

(d) $p \times 24 = 1\ 212\ 000$

allow ecf from question (c)

1

$$p = \frac{1\ 212\ 000}{24}$$

1

$p = 50\ 500$ (Pa)

1

(e) there is more space between the gas particles

1

[8]

8.

(a) **Level 2:** The method would lead to the production of a valid outcome. Key steps are identified and logically sequenced.

3–4

Level 1: The method would not necessarily lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content:

- record the initial volume of air
- record the initial pressure
- push the plunger of the syringe
- to decrease the volume of air
- read the new value on the pressure gauge
- record the new value of the volume
- repeat for different volumes

(b) (when the volume is halved) the pressure doubles

*allow for **1** mark when the volume is halved the pressure increases*

2

(c) kinetic energy

1

speed

1

[8]

9.

(a) greater than

1

less than

1

in this order only

(b) boiling

ignore evaporation

1

temperature is constant

allow temperature remains the same

1

(c)

*a correct answer that rounds to 140 000 (J) scores **2** marks*

E = 0.063 × 2 260 000

1

E = 140 000 (J)

allow 142 380 (J)

1

(d)

*an answer of 0.6 scores **2** marks*

$$\text{density} = \frac{0.063}{0.105}$$

1

density = 0.6

1

kg / m^3

1

[9]

10. (a) chemical

1

kinetic

1

in this order only

(b) $E_k = 0.5 \times 80 \times 12^2$

1

E_k = 5760 (J)

1

*an answer of 5760 (J) scores **2** marks*

(c) E = 0.040 × 480 × 50

1

E = 960 (J)

1

*an answer of 960 (J) scores **2** marks*

(d) increased

1

[7]

11. (a) 0 to 25 cm^3

1

(b) control

1

(c) 2 sets of data recorded from line of best fit to show that the product is the same in both cases (1600)

*allow for **1** mark one set of calculated data for one point on the line of best fit*

2

(d) decreases

1

increases

1

increases

1

[7]

12. (a) the heating element of the kettle takes time to heat up

allow the kettle takes time to heat up

1

(b) $\Delta\Theta = 78$ (°C)

1

$155\,000 = m \times 4200 \times 78$

allow a correct substitution using an incorrect value of $\Delta\Theta$

1

$m = \frac{155\,000}{4200 \times 78}$

allow a correct rearrangement using an incorrect value of $\Delta\Theta$

1

m = 0.4731 (kg)

allow a correct calculation of mass using an incorrect value of $\Delta\Theta$

1

m = 0.47 (kg)

1

(c) Gradient = $\frac{\Delta\theta}{t}$

allow gradient = rate of temperature increase
allow calculation of gradient

1

$Pt = mc\Delta\Theta$

1

P = gradient × mc

1

[9]