

M1. (a) air molecules colliding with a surface create pressure 1

at increasing altitude distance between molecules increases

or

at increasing altitude fewer molecules (above a surface) 1

so number of collisions with a surface decreases

or

or so always less weight of air than below (the surface) 1

(b) atmospheric pressure = 20 kPa from graph **and** conversion of 810 cm² to 0.081 m²
allow ecf for an incorrect value clearly obtained from the graph 1

$$5 \times 10^4 = \frac{F}{0.081} \quad \text{1}$$

$$F = 5 \times 10^4 \times 0.081 \quad \text{1}$$

4050 1

4100 (N) 1

allow 4100 (N) with no working shown for 5 marks

allow 4050 with no working shown for 4 marks

(c) force from air pressure acting from inside to outside bigger than force acting inwards

1

so keeps the window in position

1

[10]

M2. (a) (i) liquids are (virtually)
incompressible

1

(b) 84

allow 1 mark for correct substitution, ie

$$1.5 \times 10^6 = \frac{F}{5.6 \times 10^{-5}}$$

numbers may not be written in standard form, ie

$$1\,500\,000 = F \frac{F}{0.000\,056}$$

allow 1 mark for an answer 216

2

(c) it (the force on the slave pistons) is greater / larger
accept force (at slave piston) = 216 (N)

1

the area (touching the liquid) of the slave piston is greater than the area of the master piston

accept it has a bigger area

just quoting numbers, eg the master piston is 5×10^{-5} and the slave piston is 14.4×10^{-5} is insufficient

1

[5]

M3. (a) 3000

correct substitution of 24 / 0.008 gains 1 mark provided no subsequent steps are shown

2

N / m² or Pa

1

(b) (i) K

accept ringed K in table

1

(ii) water exiting bottle one-third of vertical height of K

allow less than half vertical height of spout shown, judged by eye

1

water landing twice the distance of the spout shown in the diagram

accept at least one and a half times further out than spout shown, judged by eye

*do **not** accept water hitting the side of the sink*

ignore trajectory

1

(c) water will land on the (vertical) side of the sink

*accept sink **not** long / wide / big enough*

or

water will dribble down very close to the bottle

or

that part of the bottle is curved

*do **not** accept goes out of the sink*

1

[7]

M4. (a) hydraulic (system)

1

(b) 15.40×10^2
or
1540

allow 1 mark for correct substitution, ie

$$8.75 \times 10^4 = \frac{F}{1.76 \times 10^{-2}}$$

or

$$87\,500 = \frac{F}{0.0176}$$

or

$$F = 8.75 \times 10^4 \times 1.76 \times 10^{-2}$$

or

$$F = 87\,500 \times 0.0176$$

2

(c) any **one** environmental **advantage**:

stating a converse statement is insufficient, or a disadvantage of the usual oil, ie the usual oil is non-renewable

plant oil is renewable

using plant oil will conserve (limited) supplies **or** extend lifetime of the usual / crude oil.

plant oil releases less carbon dioxide (when it is being produced / processed)

plant oil will add less carbon dioxide to the atmosphere (when it is being produced / processed, than the usual oil)

plant oil removes carbon dioxide from **or** adds oxygen to the air when it is growing

stating that plant oil is carbon neutral is insufficient

1

(d) (the current flowing through the coil) creates a magnetic field (around the coil)

1

(this magnetic field) interacts with the permanent magnetic field
or
current carrying conductor is in a (permanent) magnetic field
it must be clear which magnetic field is which

1

this produces a (resultant) force (and coil / cone moves)

1

when the direction of the current changes, the direction of the force changes
to the opposite direction

*accept for 2 marks the magnetic field of the coil interacts with
the permanent magnetic field*

1

[8]