**Mark schemes**

Q1.

(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 × 104 = F

0.081

1

F = 5 × 104 × 0.081

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]

Q2.

(a) The pressure at X is the same as at Y

1

(b) larger than

1

(c) (i) 3 (N/mm2)

accept 3 000 000 Pa (correct unit must be given)

allow 1 mark for correct

substitution, ie

provided no subsequent step

2

(ii) pascal

1

(d) the brakes would not work

allow the vehicle (car/bike etc) would not stop

accept they would freeze solid or seize up

1

[6]

Q3.

(a) rate of flow of water less

1

because pressure is less

or

because force acting is less

or

because height of water above tap is less

1

(b) (i) at short lengths water collected is the same

accept rate of flow for water collected

1

at longer lengths water collected decreases as the length of pipe increases

if no other mark gained allow as the length increases the flow decreases for 1 mark

1

(ii) max 4 marks

take more readings to calculate a mean (1)

take more readings is insufficient

to reduce effect of random errors (1)

or

take more readings between 5.0 m and 10.0 m (1)

see where the change occurs (1)

or

take more readings above 15.0 m (1)

accept take more readings at longer lengths

to see if trend continues (1)

maximum of 2 marks for more readings and max 2 for reasons

4

(c) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a ‘best-fit’ approach to the marking.

0 marks

No relevant content

Level 1 (1−2 marks)

There is a basic description of the measurement of time or volume or diameter of pipe

Level 2 (3−4 marks)

There is a description of the measurement of the time taken to collect a fixed volume or the volume collected in a fixed time

and a description of an additional control variable

Level 3 (5−6 marks)

There is a description of the measurement of the time taken to collect a fixed volume

or the volume collected in a fixed time

and a description of an additional control variable

and a description of appropriate equipment

examples of the points made in the response

equipment

• tape measure or rule

• stopwatch

• container for collecting water

• measuring cylinder.

measurements

• diameter of hosepipe

• length of hosepipe

• volume of water collected

• time taken for collecting water

• repeat for different diameters.

control factors

• height of water in water butt (achieved by using a tap)

• length of hosepipe and how it is achieved by measuring and cutting.

6

[14]

Q4.

(a) (i) the line of action of the weight (of the bus) lies / acts outside of the base (of the bus)

allow line of action through the centre of mass lies / acts outside the base

1

there is a resultant moment (acting on the bus)

1

(ii) in normal use the centre of mass may be in a different position

1

or

passengers on the bus may affect the position of the centre of mass

for safety, buses should always be tested beyond the normal operating conditions / parameters

for safety is insufficient

accept in case something unexpected happens

1

(b) (i) a liquid is (virtually) incompressible

accept a liquid cannot be squashed

a liquid is difficult to compress is insufficient

1

(ii) 84000

award 2 marks for

or

or award 1 mark for

or

300 000 (Pa)

seen anywhere

3

[8]

Q5.

(a) make the rod longer

1

push down on the rod with a greater force

1

(b) particles are close together

1

so no room for more movement

dependent on 1st marking point

1

(c) (i) downward force produces pressure in liquid

reference to compression of liquid negates this mark

1

this pressure is the same at all points in a liquid

or

this pressure is transmitted equally through the liquid

and P = F / A or F = P × A

1

area (at load) bigger (so force bigger)

1

(ii) the force acting on the car moves less distance than the effort force

1

[9]

Q6.

(a) hydraulic

1

(b) 9

allow 1 mark for a correct substitution, ie provided no subsequent step

2

(c) an environmental

1

[4]

Q7.

(a) hydraulic (system)

1

(b) 15.40 ×102

or

1540

allow 1 mark for correct substitution, ie

8.75 × 104 =

or

87 500 =

or

F = 8.75 × 104 × 1.76 ×10-2

or

F = 87 500 × 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]

Q8.

(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]

Q9.

(a) (i) are incompressible

1

(ii) in all directions

1

(b) 1.6

allow 1 mark for correct substitution, ie provided no

subsequent step shown

an answer 0.032 gains 0 marks

2

(c) Pa

1

(d) increases

1

[6]

Q10.

(a) (i) liquids are (virtually)

incompressible

1

(b) 84

allow 1 mark for correct substitution, ie

1.5 × 106 =

numbers may not be written in standard form, ie

1 500 000 = F

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]