

Quiz Topic: Speed and Density
Possible Score: 30 Marks

Section A: MCQ (10 Marks)

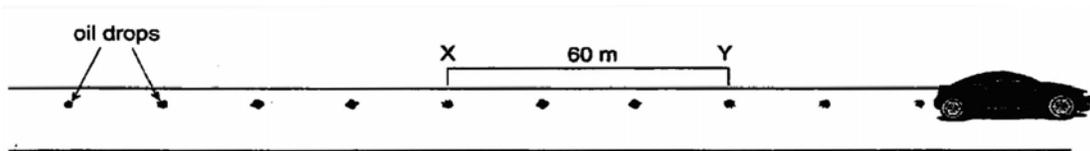
1. Water of volume 1500 cm^3 flows through a water pipe in 1 minute. What is the rate of flow of water in cm^3/s ?

- A. 15
- B. 25
- C. 50
- D. 100

2. The unit of speed measured on a car's speedometer is _____.

- A. m/s
- B. g/cm^3
- C. km/h
- D. kg/m^3

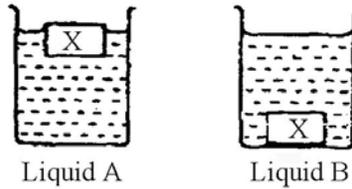
3. Peter's car has an oil leak. It drips oil once every second.
This diagram below shows the drops left on the road by Peter's car.



What is the speed of the car between points X and Y?

- A. 10 m/s
 - B. 20 m/s
 - C. 30 m/s
 - D. 60 m/s
4. A toy car travels at a constant speed of 2 m/s for 6 s . Thereafter, it moves at a higher speed of 4 m/s for 4 s . What is its average speed during this time?
- A. 0.6 m/s
 - B. 2.8 m/s
 - C. 4 m/s
 - D. 6 m/s
5. The volume of a quantity of mercury increases when heated. What other change is expected?
- A. Increase in mass
 - B. Increase in density
 - C. Decrease in mass
 - D. Decrease in density

6. An object X floats on liquid A but sinks in liquid B, as shown in the diagram below. Which of the following statements is correct?



- A. Liquid A is denser than liquid B.
B. Liquid A is less dense than liquid B.
C. Both liquids A and B have the same density.
D. Object X is denser than liquid A.
7. Three different liquids were poured into a measuring cylinder. Liquid A floats on top of liquid B, which in turn floats on top of liquid C (i.e. C is at the bottom of the three liquids). Arrange the density of these liquids in increasing order.
- A. C, A and B
B. B, A and C
C. A, B and C
D. C, B and A
8. A rectangular block has length 10 cm, width 5 cm, and height 4 cm. Given also that it has a mass of 0.54 kg, what is its density?
- A. 1.03 g cm^{-3}
B. 2.7 g cm^{-3}
C. 5.4 g cm^{-3}
D. 10.8 g cm^{-3}
9. The volume of substance A is twice that of another substance B. If the mass of A is half that of B, what can we infer about their densities?
- A. They have the same density.
B. The density of A is one quarter that of B.
C. The density of A is twice that of B.
D. The density of A is four times that of B.
10. Mercury has a density of 7.8 g/cm^3 . What is its density in kg/m^3 ?
- A. 0.0078 kg/m^3
B. 7.8 kg/m^3
C. 780 kg/m^3
D. $7\,800 \text{ kg/m}^3$

Section B: Structured Questions (20 Marks)

1. A steady stream of water flows out from the tap into a measuring cylinder.
If the volume of water flowing into the measuring cylinder for every 2 minutes is 0.012 m^3 ,
find the rate of water flow in cm^3/s . (2)

- 2(a) Define speed. (1)

- (b) A car took 30 minutes to travel a distance of 15 km. The speed of the car was then increased to 80 km/h for 40 km. Calculate the average speed of the car. (2)

3. A car moves with a constant speed of 60 km/h in 1 h 15 min. Showing full workings, determine the distance travelled? (2)

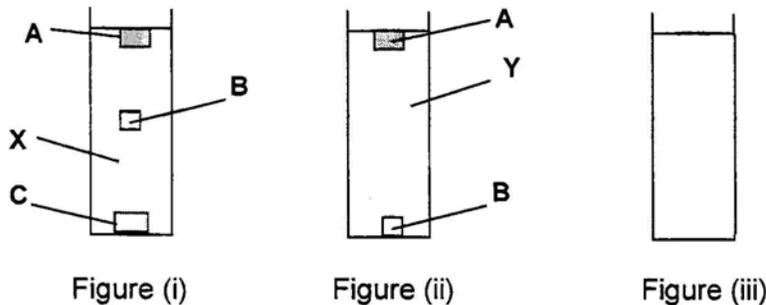
- 4(a) Define 'density' and 'mass'. (2)

- (b) It is commonly said that oil floats on water "because it weighs less than water". Comment on the correctness of this statement. (2)

- (c) It was found that 1 980 kg of oil has a volume of 2.20 m^3 . Calculate the density of oil in g/cm^3 . (2)

5. A thick-walled flask of volume 500 cm^3 is used to determine the density of a gas. The results obtained are as follows.
Mass of the flask containing air = 414 g
Mass of the flask containing gas = 416 g
If the density of the air = $1.3 \text{ kg}/\text{m}^3$, calculate
(a) the mass of air in the flask. (2)
(b) the mass of the flask when empty. (1)
(c) the density of the gas, in kg/m^3 . (2)

6. Figure (i) shows the objects A, B and C in liquid X. Figure (ii) shows the objects A and B in liquid Y.



The two liquids X and Y, and three solids A, B and C are put into one container. Draw and label clearly, in Fig (iii), the most likely positions of all the substances in the flask. (2)

Answers:

1	2	3	4	5	6	7	8	9	10
B	C	B	B	D	A	C	B	B	D

$$\begin{aligned} 1. \text{ Rate} &= \text{Volume} \div \text{Time} \\ &= (0.012 \times 1\,000\,000 \text{ cm}^3) \div (2 \times 60 \text{ s}) \\ &= \underline{100 \text{ cm}^3/\text{s}} \end{aligned}$$

2(a) Speed is the rate of change of distance.

$$\begin{aligned} \text{(b) Time taken to travel 20 km} &= \text{Distance} \div \text{Speed} \\ &= 40 \text{ km} \div 80 \text{ km/h} \\ &= 0.5 \text{ h} \end{aligned}$$

$$\begin{aligned} \text{Average speed} &= \text{Total distance} \div \text{Total time} \\ &= (15 + 40 \text{ km}) \div (30 / 60 + 0.5 \text{ h}) \\ &= \underline{55 \text{ km/h}} \end{aligned}$$

$$\begin{aligned} 3. \text{ Distance} &= \text{Speed} \times \text{Time} \\ &= 60 \text{ km/h} \times (1 \text{ h } 15 \text{ min}) \\ &= 60 \text{ km/h} \times (75 \text{ min}) \\ &= 60 \text{ km/h} \times (75 \div 60 \text{ h}) \\ &= 60 \text{ km/h} \times 1.25 \text{ h} \\ &= \underline{75 \text{ km}} \end{aligned}$$

4(a) - The density of a substance is its mass per unit volume.
- Mass is a measure of the amount of matter in a substance.

(b) - The statement is not correct.
- Oil floats on water because it is less dense than water, not because it weighs less.

$$\begin{aligned} \text{(c) Density} &= \text{Mass} \div \text{Volume} \\ &= (1\,980 \times 1\,000 \text{ g}) \div (2.20 \times 1\,000\,000 \text{ cm}^3) \\ &= \underline{0.9 \text{ g/cm}^3} \end{aligned}$$

5(a) Volume of air = 500 cm^3

$$\begin{aligned} \text{Mass of air} &= \text{Density} \times \text{Volume} \\ &= 1.3 \text{ kg/m}^3 \times (500 \div 1\,000\,000 \text{ m}^3) \\ &= 0.00065 \text{ kg} \\ &= \underline{0.65 \text{ g}} \end{aligned}$$

$$\begin{aligned} \text{(b) Mass of flask when empty} &= 414 - 0.65 \text{ g} \\ &= \underline{413.35 \text{ g}} \end{aligned}$$

(c) Mass of gas = 416 – 413.35 g
= 2.65 g

Density of gas = Mass ÷ Volume
= (2.65 ÷ 1 000 kg) ÷ (500 ÷ 1 000 000 m³)
= 5.3 kg/m³

6.

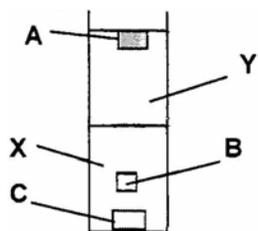


Figure (iii)