Measurement – Foundation of Science (Advanced)

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. A corridor measures 9 lengths of a 20 cm stick. How many lengths of a 30 cm stick will it measure?
(a) 6 **(b)** 7 **(c)** 9 **(d)** 13.5

2. A force of 750 N, written in the CGS unit (dyne, g cm/s^2), is:
(a) 7.5 × 10^5 dyne **(b)** 7.5 × 10^4 dyne **(c)** 7.5 × 10^7 dyne **(d)** 7.5 × 10^9 dyne

3. A liquid has a density of 2.4 g/cm^3. In kg/m^3 this is:
(a) 2,400,000 kg/m^3 **(b)** 240 kg/m^3
(c) 2,400 kg/m^3 **(d)** 24 kg/m^3

4. In the MKS system, the unit of mass is the:
(a) kilogram (kg) **(b)** foot (ft) **(c)** pound (lb) **(d)** gram (g)

5. Measurement is the process of:
(a) writing a quantity without a unit
(b) comparing an unknown quantity with a known standard of the same kind
(c) guessing a quantity by looking at it
(d) comparing two quantities of different kinds

6. A floor's area is 432 square units when a stick is used as the unit of length. A second stick is 2 times as long. The area in square units of the second stick is:
(a) 108 **(b)** 864 **(c)** 216 **(d)** 1,728

7. A student estimates a length as 162 cm. A metre scale shows it is 186 cm. The percentage error in the estimate is: (Give the answer to 2 decimal places where needed.)
(a) 12.90% **(b)** 25.81% **(c)** 14.81% **(d)** 24%

8. Assertion (A): A rod 552 cm long is 5,520 m long.
Reason (R): The numerical value of a quantity is inversely proportional to the size of the unit ($n_1u_1 = n_2u_2$).
(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. A sprinter runs at 40 m/s. Express this speed in km/h.

10. A bag of flour has a mass of 37 kg. If 1 kg = 2.2 pounds, what is its mass in pounds?

11. A force of 5,120,000 dyne acts on a trolley. Express it in newtons.

12. A table is 13 hand-spans long. One hand-span is 21 cm. What is its length in metres? (Use $Q = n_1u_1 = n_2u_2$.)

13. With a 1-unit stick, a room is 52 units long and 40 units wide. Find its area in square units when a stick 4 units long is used.

14. The density of a solid is 10,650 kg/m^3. Express it in g/cm^3.

15. Dev estimates the height of a door as 833 cm. Its measured height is 900 cm. Find the percentage error in the estimate. (Give the answer to 2 decimal places where needed.)

16. A book is 34 inches long. If 1 inch = 2.54 cm, find its length in cm.

Section C — Word problems — 4 × 4 = 16 marks

17. Three groups measure a classroom floor with sticks of length 1 : 2 : 3 units. With the 1-unit stick it is 18 units long and 36 units wide. (a) What is the length with the 2-unit stick? (b) What is the width with the 3-unit stick? (c) What is the area with the 2-unit stick? (d) How many times the area with the 3-unit stick is the area with the 1-unit stick?

18. Rice costs Rs 56 per kg. A visitor asks for 44 pounds of rice. (a) Using 1 kg = 2.2 pounds, how many kilograms is that? (b) How much will it cost?

19. In an estimation game: the blackboard: estimated 256 cm, measured 260 cm; a bench: estimated 196 cm, measured 180 cm; a cupboard: estimated 92 cm, measured 120 cm. Find the percentage error for (a) the blackboard, (b) a bench and (c) a cupboard. (d) Which estimate was the most accurate? Name the object. (Give the answer to 2 decimal places where needed.)

20. A car moves at 90 km/h and a cheetah runs at 28 m/s. (a) Express the car's speed in m/s. (b) Express the cheetah's speed in km/h. (c) Which is faster? (d) By how many m/s?

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Answer key

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Q	Answer	Working
1	**(a) 6**	$n_1u_1 = n_2u_2$: $n_2 = 9 \times 20 \div 30 = 6$
2	**(c) 7.5 × 10^7 dyne**	1 N = 1,000 g × 100 cm/s^2 = 10^5 dyne; 750 × 10^5
3	**(c) 2,400 kg/m^3**	1 g/cm^3 = 1,000 kg/m^3 (10^{-3} kg ÷ 10^{-6} m^3); 2.4 × 1,000
4	**(a) kilogram (kg)**	MKS: metre, kilogram, second
5	**(b) comparing an unknown quantity with a known standard of the same kind**	a measurement always needs a standard (the unit)
6	**(a) 108**	area unit = (stick length)^2: 432 ÷ $(2)^2$ = 108
7	**(a) 12.90%**	error = |162 − 186| = 24 cm; 24 ÷ 186 × 100
8	**(d) A is false, but R is true.**	A is false: 1 m = 100 cm, so 552 ÷ 100 = 5.52, not 5,520. R is true.
9	**144 km/h**	× 3,600 ÷ 1,000 = × 18/5: 40 × 18/5
10	**81.4 pounds**	37 × 2.2
11	**51.2 N**	1 N = 10^5 dyne; 5,120,000 ÷ 100,000
12	**2.73 m**	13 × 21 cm = 273 cm; ÷ 100
13	**130 square units**	13 × 10; or 2080 ÷ 4^2
14	**10.65 g/cm^3**	1 g/cm^3 = 1,000 kg/m^3; 10,650 ÷ 1,000
15	**7.44%**	|833 − 900| = 67; 67 ÷ 900 × 100
16	**86.36 cm**	34 × 2.54
17	**(a) 9 units; (b) 12 units; (c) 162 square units; (d) 9**	$n_2 = n_1 \times u_1/u_2$: 18 ÷ 2, 36 ÷ 3; area 9 × 18; area unit 9 times larger, so 9 times smaller number
18	**(a) 20 kg; (b) Rs 1,120**	(a) 44 ÷ 2.2 = 20; (b) 20 × 56
19	**(a) 1.54%; (b) 8.89%; (c) 23.33%; (d) blackboard**	percentage error = |estimate − measured| ÷ measured × 100; the smallest error is the most accurate
20	**(a) 25 m/s; (b) 100.8 km/h; (c) the cheetah; (d) 3 m/s**	(a) 90 × 5/18; (b) 28 × 18/5; compare in the same unit

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