CHAPTER 1: PHYSICAL QUANTITIES AND MEASUREMENTS

9th Class | Physics | Punjab Board

MUHAMMAD ALI PHOTO STATE ZAFARWAL

MULTIPLE CHOICE QUESTIONS (MCQS)

Exercise MCQs

No.	Question	Option A	Option B	Option C	Option D
01	The instrument that is most suitable for measuring the thickness of a few sheets of cardboard is a:	measuring tape	metre rule	Vernier Callipers	**micrometer screw gauge** ✓
02	One femtometre is equal to:	**10^{-15} m** ✓	10^{-9} m	10^{9} m	10^{15} m
03	Which one is a non-physical quantity?	distance	density	**colour** ✓	temperature
04	When using a measuring cylinder, one precaution to take is to:	look at the meniscus from below the level of the water surface	check for the zero error	take several readings by looking from more than one direction	**position the eye in line with the bottom of the meniscus** ✓
05	A displacement can is used to measure:	mass of a solid	mass of a liquid	volume of a liquid	**volume of a solid** ✓
06	Four students measure the diameter of a cylinder with Vernier Callipers. Which of the following readings is correct?	3.475 cm	3.4 cm	**3.47 cm** ✓	3.5 cm
07	Which of the following measures are likely to represent the thickness of a sheet of this book?	**1×10^{-4} m** ✓	6×10^{-25} m	1.2×10^{-15} m	4×10^{-2} m

Chapter Internal MCQs (Topic-Wise) - Physical and Non-Physical Quantities

08	Which of the following can be measured using an instrument?	love	fear	**length** ✓	beauty
09	The time duration of an event is measured using a:	**clock** ✓	ruler	thermometer	spring balance
10	Non-physical quantities mostly help to understand and analyse:	**human behaviour, emotions and social interactions** ✓	speed of light	mass of objects	volume of liquids

Base and Derived Physical Quantities

11	Speed is a:	**derived quantity** ✓	base quantity	non-physical quantity	unit

No.	Question	Option A	Option B	Option C	Option D
12	Which of the following is a base quantity?	area	volume	density	**time ✓**
13	Density of a material is described in terms of:	**mass and volume ✓**	mass and time	length and time	force and area
14	A measurement is a process of comparison of an unknown quantity with a:	derived quantity	**widely accepted standard quantity ✓**	non-physical quantity	another unknown quantity

International System of Units

15	The international committee on weights and measures recommended SI in:	1931	1951	**1961 ✓**	1981
16	The number of base units in SI is:	five	six	**seven ✓**	eight
17	The SI unit of temperature is:	celsius	**kelvin ✓**	fahrenheit	candela
18	The SI unit of amount of substance is:	**mole ✓**	ampere	candela	kelvin
19	The SI unit of force is:	pascal	**newton ✓**	coulomb	radian
20	The SI unit of pressure is:	newton	**pascal ✓**	radian	coulomb
21	The SI unit of speed is:	ms	**ms^{-1} ✓**	m^2	m^3
22	The only base unit that has a prefix is:	metre	second	**kilogram ✓**	kelvin

SI Prefixes

23	The symbol of the prefix micro is:	m	**μ ✓**	M	n
24	The prefix for 10^3 is:	milli	centi	**kilo ✓**	mega
25	The prefix for 10^9 is:	mega	**giga ✓**	tera	nano
26	5000 mm is equal to:	0.5 m	**5 m ✓**	50 m	500 m
27	1 tonne is equal to:	10 kg	100 kg	**1000 kg ✓**	10000 kg

Scientific Notation

28	The quantity 50000000 m can be written as:	5×10^6 m	**5×10^7 m ✓**	5×10^8 m	50×10^6 m
29	The quantity 0.00004 m can be written as:	4×10^{-4} m	**4×10^{-5} m ✓**	4×10^5 m	4×10^{-6} m
30	When the decimal point is moved to the right, the exponent of 10 is:	positive	**negative ✓**	zero	fractional

Length Measuring Instruments

31	The least count of a metre rule is:	1 cm	**1 mm ✓**	0.1 mm	0.01 mm
32	The least count of Vernier Callipers is:	1 mm	0.5 mm	**0.1 mm ✓**	0.01 mm
33	The least count of a micrometer screw gauge is:	1 mm	0.5 mm	0.1 mm	**0.01 mm ✓**
34	The tail or depth gauge of Vernier Callipers is used to measure:	external dimension	internal dimension	**depth of a hollow object ✓**	mass of an object

No.	Question	Option A	Option B	Option C	Option D
35	The pitch of the screw gauge in the textbook is:	**0.5 mm ✓**	0.01 mm	5 mm	1 cm

Volume Measuring Instruments

36	The surface of water in a measuring cylinder is:	convex	plane	**concave ✓**	flat
37	A displacement can is used when the body:	is a liquid	**does not fit into the measuring cylinder ✓**	is very light	is a gas

Significant Figures

38	The number of significant figures in 5.06 m is:	1	**3 ✓**	4	2
39	In 2.40 mm the number of significant digits is:	1	**3 ✓**	4	2

Rounding off the Digits

40	2.512×10^3 m rounded off to 2 significant figures is:	2.4×10^3 m	**2.5×10^3 m ✓**	2.6×10^3 m	2.51×10^3 m
41	4.55×10^2 m rounded off to 2 significant figures is:	4.4×10^2 m	4.5×10^2 m	**4.6×10^2 m ✓**	4.7×10^2 m

SHORT QUESTIONS

Exercise Short Questions

Q.01 Can a non-physical quantity be measured? If yes, then how?

Answer: No, a non-physical quantity cannot be measured using tools and instruments. It can only be described or compared qualitatively using pre-determined criteria, indices or survey techniques.

Q.02 What is measurement? Name its two parts.

Answer: A measurement is a process of comparison of an unknown quantity with a widely accepted standard quantity. Its two parts are a number and a unit.

Q.03 Why do we need a standard unit for measurements?

Answer: A standard unit does not vary from person to person, so measurement by any person gives the same result. It avoids confusion and helps in trade and sharing scientific information.

Q.04 Write the name of 3 base quantities and 3 derived quantities.

Answer: Base quantities: length, mass, time. Derived quantities: speed, area, volume.

Q.05 Write the name and symbols of all SI base units.

Answer: metre (m), kilogram (kg), second (s), kelvin (K), ampere (A), candela (cd), mole (mol).

Q.06 Why prefix is used? Name three sub-multiple and three multiple prefixes with their symbols.

Answer: The SI is a decimal system; prefixes write big and small quantities in powers of 10 simply.
Sub-multiples: milli (m), micro (μ), nano (n).
Multiples: kilo (k), mega (M), giga (G).

Chapter Internal Short Questions

Q.07 Differentiate between physical and non-physical quantities.

Answer: Physical quantities can be measured using instruments and have a numerical value and unit. Non-physical quantities cannot be measured by instruments and depend on the perception of the observer.

Q.08 On what does the foundation of physics rest?

Answer: The foundation of physics rests upon physical quantities through which the laws and principles of physics are expressed.

Q.29 What is a measuring cylinder?

Answer: It is a cylinder made of glass or transparent plastic with a scale divided in cm^3 (cc) or mL, used to find the volume of liquids and non-dissolvable solids.

Q.30 How is the volume of a solid found using a measuring cylinder?

Answer: Note the initial position of the liquid surface, put the solid in and note the new position. The difference of the two readings is the volume of the solid.

Q.31 Describe the displacement can method.

Answer: The solid body is tied with a thread and lowered gently into a can filled up to its opening. The overflowing water collected in a beaker is measured by a measuring cylinder; it equals the volume of the solid.

Q.32 Why is the reading of mercury taken at the top edge?

Answer: The mercury curves upward, so its surface is convex and the reading is taken corresponding to the top edge.

Significant Figures

Q.33 Define significant figures.

Answer: The significant figures or digits are the digits of a measurement which are reliably known.

Q.34 What is a doubtful digit?

Answer: The digit determined by estimation only, which has a probability of error, is called a doubtful digit.

Q.35 State the rules for zeros in significant figures.

Answer: A zero between two digits is significant; zeros on the left of the measured value are not significant; zeros on the right of a decimal are significant; in scientific notation all digits before the exponent are significant.

Rounding off the Digits

Q.36 How are numbers rounded off to certain significant figures?

Answer: Round off to the nearest value. If the last digit is more than 5, the retained digit is increased by one; if less than 5, it is retained as such.

Q.37 State the arbitrary rule for the integer 5.

Answer: If the number before the 5 is odd, one is added to the last digit retained. If it is even, it remains the same.

EXERCISE CONSTRUCTED RESPONSE QUESTIONS

Q.01 The minimum main scale reading of a micrometer screw gauge is 1 mm and there are 100 divisions on the circular scale. When thimble is rotated once, 1 mm is its measurement on the main scale. What is the least count of the instrument? The reading for thickness of a steel rod as shown in the figure. What is the thickness of the rod?

Answer: Least count = pitch / number of divisions on circular scale = 1 mm / 100 = 0.01 mm.
Thickness = main scale reading + (circular scale reading × 0.01 mm), using the readings shown in the figure.

Q.02 The end of a metre scale is worn out. Where will you place a pencil to find the length?

Answer: The worn-out end should not be used as zero. Place one end of the pencil against a clear mark (for example 1.0 cm) of the scale, note the reading at the other end and subtract the starting mark from it.

Q.03 Why is it better to place the object close to the metre scale?

Answer: When the object is close to the scale, the reading is taken directly in front of the edge and the error due to the angle of the eye (parallax error) is reduced.

Q.04 Why a standard unit is needed to measure a quantity correctly?

Answer: A standard unit does not vary from person to person and is understood by all scientists. Measurements by different people then give the same result, avoiding confusion.

Q.05 It is difficult to locate the meniscus in a wider vessel. Why?

Answer: In a wider vessel the liquid surface is almost flat over most of its area and curves only at the edges, so the meniscus is hard to locate and the eye cannot be kept in line with it easily.

EXERCISE COMPREHENSIVE QUESTIONS

Q.01 What is meant by base and derived quantities? Give the names and symbols of SI base units.

Base quantities: Out of the many measurable features of objects, scientists have selected arbitrarily some quantities to play a key role. They are called base quantities, e.g. length, mass, time, temperature, electric current.

Derived quantities: All the quantities which can be described in terms of one or more base quantities are called derived physical quantities. For example, speed is a derived quantity which depends on distance and time, which are base quantities, whereas density of a material is described in terms of mass and volume.

SI base units: The international committee on weights and measures in 1961 recommended a system of seven base units known as the International System of Units, abbreviated as SI.

1. Length - metre - m
2. Mass - kilogram - kg
3. Time - second - s
4. Temperature - kelvin - K
5. Electric current - ampere - A
6. Intensity of light - candela - cd
7. Amount of substance - mole - mol

Base units cannot be derived from one another and neither can they be resolved into anything more basic. Their values are fixed with reference to international standards.

Q.02 Give three examples of derived unit in SI. How are they derived from base units? Describe briefly.

Derived units: The units which can be expressed in terms of base units are called derived units.

(1) Unit of area: Area = length × breadth = metre × metre = square metre = m^2

(2) Unit of volume: Volume = length × breadth × height = metre × metre × metre = cubic metre = m^3

(3) Unit of speed: Speed = distance / time = metre / second = ms^{-1}

Thus area, volume and speed are derived from the base units metre and second.

Some derived units have specific names and symbols, such as force (newton, N), pressure (pascal, Pa), electric charge (coulomb, C) and plane angle (radian, rad).

EXERCISE NUMERICAL PROBLEMS (SOLVED)

Numerical 01: Calculate the number of seconds in a (a) day (b) week (c) month and state your answers using SI prefixes.

Given Data: 1 day = 24 h | 1 h = 60 min = 60 × 60 s | 1 week = 7 days | 1 month = 30 days
Required Data: Seconds in (a) day (b) week (c) month = ?
Solution:
(a) 1 day = 24 × 60 × 60 s = 86400 s = 86.4 × 10^3 s → 1 day = 86.4 ks
(b) 1 week = 7 × 86400 s = 604800 s = 604.8 × 10^3 s → 1 week = 604.8 ks
(c) 1 month = 30 × 86400 s = 2592000 s = 2.592 × 10^6 s → 1 month = 2.592 Ms

Numerical 02: Solve the following addition or subtraction. State your answers in scientific notation. (a) 4 × 10^{-4} kg + 3 × 10^{-5} kg (b) 5.4 × 10^{-6} m - 3.2 × 10^{-5} m

Given Data: (a) 4 × 10^{-4} kg and 3 × 10^{-5} kg | (b) 5.4 × 10^{-6} m and 3.2 × 10^{-5} m
Required Data: Sum in (a) = ? | Difference in (b) = ?
Solution:
(a) 4 × 10^{-4} + 0.3 × 10^{-4} = (4 + 0.3) × 10^{-4} kg → Answer = 4.3 × 10^{-4} kg
(b) 0.54 × 10^{-5} - 3.2 × 10^{-5} = (0.54 - 3.2) × 10^{-5} m → Answer = -2.66 × 10^{-5} m

Numerical 03: Solve the following multiplication or division. State your answers in scientific notation. (a) (5 × 10^4 m) × (3 × 10^{-2} m) (b) (6 × 10^8 kg) / (3 × 10^4 m^3)

Given Data: (a) 5 × 10^4 m and 3 × 10^{-2} m | (b) 6 × 10^8 kg and 3 × 10^4 m^3
Required Data: Product in (a) = ? | Quotient in (b) = ?
Solution:
(a) (5 × 3) × $10^{4+(-2)}$ m^2 = 15 × 10^2 m^2 → Answer = 1.5 × 10^3 m^2
(b) (6 / 3) × 10^{8-4} kg m^{-3} → Answer = 2.0 × 10^4 kg m^{-3}

Numerical 04: State the number of significant digits in each measurement. (a) 0.0045 m (b) 2.047 m (c) 3.40 m (d) 3.420 × 10^4 m

Given Data: (a) 0.0045 m (b) 2.047 m (c) 3.40 m (d) 3.420 × 10^4 m
Required Data: Number of significant digits = ?
Solution:
(a) Zeros on the left are not significant, so 4 and 5 only: **2**
(b) Zero between two digits is significant: **4**
(c) Zero on the right of a decimal is significant: **3**
(d) All digits before the exponent are significant: **4**

Numerical 05: Write using correct prefixes: (a) 5.0×10^4 cm (b) 580×10^2 g (c) 45×10^{-4} s

Given Data: (a) 5.0×10^4 cm | (b) 580×10^2 g | (c) 45×10^{-4} s
Required Data: Values with correct prefixes = ?
Solution:
(a) $5.0 \times 10^4 \times 10^{-2}$ m = 5.0×10^2 m = 500 m → = 0.5 km
(b) 580×10^2 g = 58000 g = 58000 / 1000 kg → = 58 kg
(c) 45×10^{-4} s = 4.5×10^{-3} s → = 4.5 ms

Numerical 06: Express the density of mercury given as 13.6 g cm^{-3} in kg m^{-3}.

Given Data: Density = 13.6 g cm^{-3} | 1 g = 10^{-3} kg | 1 cm^3 = 10^{-6} m^3
Required Data: Density in kg m^{-3} = ?
Solution:
Density = (13.6 × 10^{-3} kg) / (10^{-6} m^3)
= 13.6 × 10^3 kg m^{-3}
∴ Density = 1.36 × 10^4 kg m^{-3}

MUHAMMAD ALI PHOTO STATE ZAFARWAL
All Types of Printing, Photocopying & Stationery Services Available