Standard High School

Mughalabad Road, Tench Bhatta, Rwp Cantt.
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السلام و علیکم!

ہم سب آپ کے لیے دُعا گو ہیں کہ اللہ تعالیٰ آپ سب کو اپنی حفظ و امان میں رکھے۔ اُمید ہے آپ سب خیریت سے ہوں گے۔

آپ کے خیر خواہ

سٹینڈرڈ ہائی سکول انتظامیہ بمعہ سٹاف

شکریہ

"Education is Chief Defence of Nations."

SHAHID STANDARD ACADEMY

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Name: _____ Class: _____ Subject: _____ Date: _____

UNIT:1 PHYSICAL QUANTITIES AND MEASUREMENTS

Science: The knowledge gained through observations and experimentations is called Science.

Natural philosophy: Until eighteenth century, various aspect of material objects were studied under a single subject called Natural philosophy.

Physical sciences — which deal with the study of non-living things.

Biological sciences — which are concerned with the study of living things.

Physics: Physics is a branch of Science that deals with matter, energy and their mutual relationships.

BRANCHES OF PHYSICS

Mechanics: It is the study of motion of objects, its causes and effects.

Heat: It deals with the nature of heat, modes of transfer and effects of heat.

Sound: It deals with the physical aspects of sound waves, their production, properties and applicatio ns.

Light (Optics): It is the study of physical aspects of light, its properties, working and use of optical instruments.

Electricity and Magnetism: It is the study of the charges at rest and in motion, their effects and thei r relationship with magnetism.

Atomic Physics: It is the study of the structure and properties of atoms.

Nuclear Physics: It deals with the properties and behaviour of nuclei and the particles within the nuc lei.

Plasma Physics: It is the study of production, properties of the ionic state of matter - the fourth state of matter.

Geophysics: It is the study of the internal structure of the Earth.

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Q:Why do we study physics ?

A: Physics helps us to understand nature .It is the study of universe from the smallest sub-atomic part icles to the largest galaxies. Most of the technologies of our modern society throughout the world are related to Physics. Similarly the means of communication such as radio, T.V, telephone and comput er are the result of applications of the Physics.

Q: Which role Physics have played in our daily life?

Physics plays an important role in our daily life. For Example electricity is widely used everywh ere, domestic appliances, office equequipments machines used in industry. Means of transport and co mmunication etc. work on the basic laws and principles of Physics. In our daily life, we hardly find a device where Physics is not involved.

PHYSICAL QUANTITIES: All measurable quantities are called physical quantities such as length, mass, time and temperature. A physical quantity possesses at least two characteristics in common. O ne is its numerical magnitude and the other is the unit in which it is measured. For example, if the len gth of a student is 104 cm then 104 is its numerical magnitude and centimeter is the unit of measure ment. . Physical quantities are divided into base quantities and derived quantities

Q: How can you differentiate between base and derived quantities?

Base Quantities	Derived Quantities
1. There are seven physical quantities physical quantities which form the foundation for other physical quantities. These physical quantities are called base quantities.	**1.** Those physical quantities which are expressed in terms of base quantities are called derived qua ntities.
2.These are length, mass, time, electric current, temperature, intensity of light and the amount of a substance	**2.**These include area, volume, speed, force, work , energy, power, electric charge, electric potential etc.

Q. Identify the following as base or derived quantity:

Density, force, mass, speed, time, length, temperature and volume.

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Base Quantities	Derived Quantities
1. Length **2.**mass. **3.**time **4.**temperature	**1.**volume **2.**speed **3.**force **4.**density

INTERNATIONAL SYSTEM OF UNITS:A world-wide system of measurements is known as Int ernational system of units(SI).In SI, the units of seven base quantities are meter, kilogramme, second , ampere, Kelvin, candela and mole.

QUESTION:1.6 What role SI units have played in the development of science?
A. With the developments in the field of science and technology, the need for a commonly acceptabl e system of units was seriously felt all over the world particularly to exchange scientific and technica l information. The eleventh General Conference on Weight and Measures held in Paris in 1960 adopt ed a world-wide system of measurements called **International System Of Units**. The International s ystem of units is commonly rereferred as SI.

Base Units: The units that describe base quantities are called base units. Each base quantities has its SI unit.

Base quantities, their SI units with symbols

Name	Symbol	Name	Symbol
Length	L	metre	m
Mass	M	kilogramme	kg
Time	T	second	s
Electric	I	ampere	A

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current			
Intensity of lig ht	L	candela	cd
Temperature	T	Kelvin	k
Amount of a su bstance	N	mole	mol

QUESTION:1.3 Pick out the base units in the following:

joule, newton, kilogramme, hertz, mole, ampere, metre, kelvin, coloumb and watt.

A. kilogramme, mole, ampere, metre, kelvin.

Derived Units: The units used to measure derived quantities are called derived units.

Derived quantities and their SI units with symbols.

Name	**Symbol**	**Name**	**Symbol**
Speed	V	metre per second	ms^{-1}
Acceleration	a	metre per second per se cond	ms^{-2}
Volume	V	cubic metre	m^3
Pressure	P	pascal	Pa
Density	ϱ	Kilogramme per cubic	Kgm^{-3}

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		metre	
Charge	Q	coulomb	C

Prefixes: The words or letters added before a unit and stand for the multiples or sub-multiples of t hat unit is known as prefixes. For example, kilo, mega, milli, micro, etc.

TABLE :Some Prefixes.

Prefix	**Symbol**	**Multiplier**
exa	E	10^{18}
peta	P	10^{15}
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
hecto	h	10^{2}
deca	da	10^{1}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}

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micro	Ų	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}
atto	a	10^{-18}

Q. Name five prefixes most commonly used.

A. 1.kilo **2.**milli **3.**micro **4.**centi **5.**nano

PROBLEMS 1.1 Express the following qauntities using prefixes.

a.5000g

Solution:

$=5X10^3$

$=5kg$ $10^3=k$

b.2000000W

Solution:

$=2X10^6 W$

$=2MW$ $10^6=M$

c. $52x10^{-10}$kg

Solution:

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$=5.2 \times 10^{1} \times 10^{-10} \times 10^{3}$ g k=10^{3}

$=5.2 \times 10^{1-10+3}$ g

$=5.2X10^{-6}$ g

=5.2μ g. 10^{-6} = μ

d. $225X10^{-8}$ s

Solution:

$=2.25X10^{2} X10^{-8}$

$=2.25X10^{2-8}$ s

$=2.25X10^{-6}$ s

=2.25 μ s 10^{-6}= μ

Q:1.2How do prefixes micro, nano and pico relate the each other.

A. Micro = μ = 10^{-6}

$=10^{3} X10^{-3}X10^{-6}$

$=10^{3}X10^{-3-6}$

$=10^{3}X10^{-9}$

μ =10^{3}n 10^{-9}=n

Nano = n= 10^{-9}

$n=10^{3} X10^{-3} X10^{-9}$

$n=10^{3} X10^{-12}$

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$n=10^3$ p $10^{-12}=p$

$\mu = 10^{-6}$

$\mu = 10^6 X10^{-6}X10^{-6}$

$=10^6X10^{-12}$

$\mu = 10^6 p$ $10^{-12}=p$

Q:1.3 Your hair grow at the rate of 1mm per day. Find their growth rate in nms^{-1} ($11.57nms^{-1}$)

A. Hair Growth rate = $\frac{1mm}{Day}$ m = 10^{-3} & day = $8.64X10^4$ s

$= \frac{1X\ 10^{-3}\ m}{8.64X10^4 s}$

$= 0.1157X10^{-3-4}\ ms^{-1}$

$= 0.1157X10^{-7}\ ms^{-1}$

$= 11.57X10^{-2}X10^{-7}\ ms^{-1}$

$= 11.57X10^{-9}\ ms^{-1}$

$= 11.57nms^{-1}$ $10^{-9} = n$

SCIENTIFIC NOTATION: A way to express a given number as a number between 1 and 10 multi plied by 10 having an appropriate power is called scientific notation or standard form.

Example: The Moon is 384000000 metres away from the Earth. Distance of the moon from the Eart h can also be expressed as $3.84X10^8$ m.

Q. The sun is one hundred and fifty million kilometre away from the Earth. Write this.

(a)as an ordinary whole number.

(b)in scientific notation.

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A.(a)150,000000km.

(b)$1.5X10^8$ km.

Q. Write the numbers given below in scientific notation.

(a) 3000000000ms^{-1}

(b)6400000m

(c)0.0000000016g

(d)0.0000548s

A.(a)$3X10^9$ ms^{-1}

(b)$6.4X10^6$ m

(c)$1.6X10^{-9}$g

(d) 5.48 x 10^{-5}s

PROBLEM:1.4:Rewrite the following in standard form.

(a) $1168x10^{-27}$ = $1.168 X 10^3 x 10^{-27} = 1.168 X 10^{24}$
(b) $32X10^5 = 3.2X10^1 X10^5 = 3.2X10^6$
(c) $725 X10^{-5}kg = 7.25 X10^2 X10^{-5} X10^3g = 7.25g$
(d) $0.02X10^{-8} = 2x 10^{-2} X10^{-8} = 2 X10^{-10}$

Q.5 Write the following quantities in standard form.

(a) 6400km = 6.4 x 10^3km
(b)380 000 km = 3.8 x 10^5 km
(c)300 000 000 ms^{-1} = 3 x 10^8ms^{-1}
(d)seconds in a day = 86400s = 8.64 x 10^4 s

MEASURING INSTRUMENTS: Measuring instruments are used to measure various physical quantities

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THE METRE RULE: A metre rule is a length measuring instrument. It is commonly used in the laboratories to m easure length of an object or distance between two points.It ss one metre long which is equal to 100 centimeters. Ea ch centimeter(cm) is divided into 10 small divisions called millimeter (mm).Thus one millimetre is the smallest rea ding that can be taken using a metre rule and is called its least count.

THE MEASURING TAPE: Measuring tapes are used to measure length in metres and centimeters. A measuring t ape consists of a thin and long strip of cotton,metal or plastic generally 10m,20m,50m or 100m long. Measuring tap es are marked in centimeters as well as in inches.

VERNIER CALLIPERS: The accuracy obtained in measurements using a metre rule is upto 1 mm. However an ac curacy greater than 1 mm can be obtained by using someother instruments such as a Vernier Callipers. A Vernier C allipers consists of two jaws.One is a fixed jaw with main scale attached to it. Main scale has centimetre and millim etre marks on it. The other jaw is a moveable jaw. It has vernier scale having 10 divisions over it such that each of i ts division is 0.9 mm. The difference between one small division on main scale division and one vernier scale divisi on is 0.1 mm. It is called least count (LC) of the Vernier Callipers. Least count of the Vernier Callipers can also be found as given below:

Least count of vernier ccalliper =smallest reading on main scale/no. of divisions on vernier scale

=1mm/10 divisions =0.1mm

Hence LC = 0.1mm = 0.01cm

QUESTION:1.7What is meant by vernier constant?

A. The difference between one small division on main scale division and one vernier scale division is 0.1 mm.It is c alled vernvernierstant or least count of vernier calliper .Vernier constant or least count of the vernier callipers.Verni er constant or least count of the verniercalliperss can also be found as given below:

Vernier constant = least count of vernier calliper =smallest reading on main scale /no. of divisions on vernier scale

= 1mm/10 divisions = 0.1mm

Hence vernier constant = 0.1mm = 0.01cm

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Q.1.8 What do you understand by the zero error of a measuring instrument?

A.Zero Error: To find the zero error ,close the jaws of verniercalliperss gently.If zero line of the vernierr scale coin cides with the zero of the main scale then the zero error is zero. Zero error will exist if zero line of the vernier scale is not coinciding with the zero of the main scale. Zero error will be positive if zero line of vernier scale is on the rig ht side of the zero of the main scale and will be negative if zero line of vernier scale is on the left side of the main s cale.

Q.1.9Why is the use of zero error necessary is a measuring instrument?

A.First of all find the error, if any,in the measuring instrument.It is called the zero error of the instrument.Knowing the zero error necessary correction can be made to find the correct measurement. Such a correction is called zero co rrection of the instrument.Zero correction is the negative of zero error.

PROBLEM:1.6On closing the jaws of a vernvernierlipers,zero of the vernvernierle is on the right of its main scale such that fourth division of thevernierr scale coincides with one of the main scale division.Find its zero error and zero correction.

Solution:

Zero of V.S is on right side of main scale so zero error is positive

No. of V.S.D = 4th

Zero error =?

Zero Correction =?

By definition

Zero error = (No. of V.S.D)XL.C

= 4(0.01cm) L.C=0.01cm

Zero erro r= 0.004cm

So zero correction = -0.04cm

SCREW GAUGE:A screw guage is an instrument that is used to measure small lengths with accuracy greater than a V.C.It is also called as micrometer screw guage.A simple screw gauge consists of aU-shapedd metal frame with a mtall stud at its one end.A hollow cylinder has a millimetre scale over it along a line called index line parallel to it s axis.The hollow cylinder acts as a **nut**.It is fixed at the end ofU-shaped frame opposite to the stud.A Thimble has a threaded spindle inside it.As the thimble completes one rotation,the spindle moves 1mm along the index line.It is because the distance between consecutive threads on the spindle is 1mm.This distance is called the pitch of screw o n the spindle.The thimble has 100 divisions around its one end.It is the circular scale rotation,100 divisions pass the

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index line and thus each division of circular scale crossing the index line moves the thimble through 1/100mmor 0. 01mm on the main scale.Least count of a screw gauge can also be found as given below:

Least count = pitch of screw gauge/no.of divisions on circular scale

= 1mm/100

= 0.01mm = 0.001cm

Thus least count of the screw gauge is 0.01mm or 0.001cm

ZERO ERROR: To find the zero error,close the gap between the spindle and the stud of the screw gauge by rotatin g the ratchet in the clockwise direction. If zero of the circular scale coincides with the index line,then the zero error will be zero.

Zero error will be positive if zero of circular scale is behind the index line. In this case,multiply the number of divis ions of the circular scale that has not crossed the index line with the least count of screw gauge to find zero error.

Zero error will be negative if zero of circular scale has crossed the index line.In this case,multiply the number of di visions of the circular scale that has crossed the index line with the least count of screw gauge to find the negative z ero error.

Q What is the pitch of your laboratory screw gauge?

A.Pitch is the distance covered on main scale by one complete rotation of circular scale which is equ al to the distance between two consecutive threads on main scale.In our laboratory there are two scre w gauge.One has 1mm pitch and other has 0.5mm pitch.

PROBLEM:.1.7A screw gauge has 50 divisions on its circular scale.The pitch of the screw gaug e is 0.5mm.What is its least count?

Solution:

No. of divisions on circular scale = 50

Pitch of screw gauge = 0.5mm

Least count of screw gauge = ?

Least count of screw gauge = pitch of screw gauge/no. of divisions on circular scale

= 0.5mm/50

= 0.01mm

MASS MEASURING INSTRUMENTS: Pots were used to measure grain in various part of the wo rld in the ancient times. However, balances were also in use by Greeks and Romans. Beam balances are still in use at many places. In a beam balance, the unknown mass is placed in one pan. It is balanc ed by putting known masses in the other pan. Today people use many types of mechanical and electr onic balances. You might have seen electronic balances in sweet and grocery shops. These are more precise than beam balances and are easy to handle.

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Physical Balance: A physical balance is used in the laboratory to measure the mass of various objects by comparison. It consists of a beam resting at the centre on a fulcrum. The beam carries scale pans over the hooks on either side. Unknown mass is placed on the left pan. Find some suitable standard masses that cause the pointer to remain at zero on raising the beam.

Lever Balance: A lever balance consists of a system of levers. When lever is lifted placing the object in one pan and standard masses on other pan, the pointer is brought to zero by varying standard masses.

Electronic Balance: Electronic balance come in various ranges. Before measuring the mass of a body, it is **switched ON** and its reading is **set to zero**. Next place the object to be weighed. The reading on the balance gives you the mass of the body placed over it

Stopwatch: A stopwatch is used to measure the time interval of an event. There are two types of stopwatches; mechanical and digital. A mechanical stopwatch can measure a time interval up to a minimum 0.1 second. Digital stopwatches commonly used in laboratories can measure a time interval as small as 1/100second or 0.01second.

How to use a stopwatch: A mechanical stopwatch has a knob that is used to wind the spring that powers the watch. It can also be used as a start-stop and reset button. The watch starts when the knob is pressed once. When pressed second time, it stops the watch while the third press brings the needle back to zero position.

The digital stopwatch starts to indicate the time lapsed as the start/stop button is pressed. As soon as start/stop button is pressed again, it stops and indicates the time interval recorded by it between start and stop of the event. A reset button restores its initial zero setting.

QUESTION.1.10What is a stopwatch? What is the least count of a mechanical stopwatch you have used in your laboratories?

A. A stopwatch is used to measure the time interval of an event. The least count of a mechanical stop watch used in our laboratory can measure a time interval up to minimum 0. 1seconds.

Measuring Cylinder: A measuring cylinder is a glass or transparent plastic cylinder. It has a scale along its length that indicates the volume in millimetre(ml).Measuring cylinders have different capacities from100mL to 2500mL.They are used to measure the volume of a liquid or powdered substance .It is also used to find the volume of an irregular shaped solid insoluble in a liquid by displacement method. The solid is lowered in to a measuring cylinder containing water/liquid. The level of water/liquid rises. The increase in the volume of water/liquid is the volume of the given solid object.

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How To Use A Measuring Cylinder: While using a measuring cylinder, it must be kept vertical on a place surface .Take a measuring cylinder. Place it vertically on the table. Pour some water into it. N ote that the surface of water is curved. The meniscus of the most liquids curve downwards while the meniscus of mercury curves upwards. The correct method to note the level of a liquid in the cylinder is to keep the eye at the same level as the meniscus of the liquid. It is incorrect to note the liquid leve l keeping the eye above the level of liquid. When the eye is above the liquid level, the meniscus appe ars higher on the scale. Similarly when the eye is below the liquid level, the meniscus appears lower t han actual height of the liquid.

Measuring Volume Of An Irregular Shaped Solid: Measuring cylinder can be used to find the vol ume of a small irregular shaped solid that sinks in water. Let us find the volume of a small stone. Tak e some water in a graduated measuring cylinder. Note the volume Vi of water in the cylinder. Tie the solid with a thread. Lower the solid into the cylinder till it is fully immersed in water. Note the volu me V_f of water and the solid. Volume of the solid will be V_f-Vi.

SIGNIFICANT FIGURES: All the accurately known digits and the first doubtful digit in an expres sion are called significant figures. It reflects the precision of a measured value of a physical quantity.

Rules:

1.Digits other than zero are always significant.

27 has 2 significant digits.

275 has 3 significant digits.

2.Zeros between significant digits are also significant.

2705 has 4 significant digits.

3.Final zero or zeros after decimal are significant.

275.00 has 5 significant digits.

4.Zeros used for spacing the decimal point are not significant.Here zeros are placeholders only.

0.03 has 1 significant digit.

0.027 has 2 significant digits.

PROBLEM:.1.8Which of the following quantities have three significant figures?

(a)3.0066m

Sol:

It has 5 significant figures.

(b)0.00309kg

Sol:

It has 3 significant figures.

(c)$5.05X10^{-27}$kg

Sol:

It has 3 significant figures.

(d)301.0s

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Sol:
It has four significant figures.

In above b and c have three significant figures.

Q.1.9What are the significant figures in the following measurements?
(a)1.009
Sol:
It has four significant figures.
(b)0.00450kg
(c)$1.66X10^{-27}$kg
Sol:
It has three significant figures.
(d)2001s
Sol.:
It has four significant figures.
Q.1.10A chocolate wrapper is 6.7cm long and 5.4cm wide.Calculate its area upto reasonable nu mber of significant figures.
Sol:
Length = L= 6.7cm
Width = W = 5.4cm
Area = A = ?
By Definition

$$A = L \times W$$
$$= 6.7cm \times 5.4cm$$
$$= 36.18cm^2$$
$$= 36.2cm^2$$
$$A = 36cm^2$$

Rounding the Numbers
1.If the last digit is less than 5 then it is simply dropped.This decreases the number of significan t digits in the figure.
For Example,
1.943 is rounded to 1.94 (3significant figures)
2.If the last digit is greater than 5,then the digit on left is increased by one.This also decreases t he number of significant digits in the figure.
For Example,
1.47 is rounded to two significant digits 1.5
3.If the last digit is 5,then it is rounded to get nearest even number.
For Example,

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1.35 is rounded to 1.4 and 1.45 is also rounded to 1.4.

Laboratory Safety Rules: The students should know what to do in case of an accident.The charts or posters are to be displayed in the laboratory to handle situation arising from any mishap or accident.For your own safety and for the safety of others in the laboratory,follow safety rules given below:

- Do not carry out any experiment without the permission of your teacher.
- Do not eat,drink,play or run in the laboratory.
- Read the instructions carefully to familiarize yourself with the possible hazards before handling equipments and materials.
- Handle equipments and materials with care.
- Do not hesitate to consult your teacher in case of any doubt.
- Do not temper with the electrical appliances and other fittings in the laboratory.
- Report any accident or injuries immediately to your teacher.

LABORATORY SAFETY EQUIPMENTS

A school laboratory must have safety equipments such as:

1. Waste-disposal basket
2. Fire extinguisher.
3. Fire alarm.
4. First Aid Box.
5. Sand and water buckets.
6. Fire blanket to put off fire.

QUESTION: 1.5. Estimate your age in seconds.

Age = 14yrs

Age in seconds = 14X365X24X60X60

= 441,504,000s

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Q. Encircle the correct answer from the given choices.

1.The number of base units in SI are:

(a)3 **(b)**6 **(c)7** **(d)**9

2.Which one of the following unit is not a derived unit?

(a)pascal **(b)kilogramme** **(c)**newton **(d)**watt

3.Amount of a substance in terms of numbers is measured in:

(a)gram **(b)**kilogramme **(c)**newton **(d)mole**

4.An interval of 200μs is equivalent to

(a)0.2s **(b)**0.02s **(c)$2X10^{-4}$ s** **(d)**$2X10^{-6}$ s

5.Which one of the following is smallest quantity?

(a)0.01g **(b)**2mg **(c)**100μg **(d)5000ng**

6.Which instrument is most suitable to measure the internal diameter of a test tube?

(a)metre rule **(b)Vernier Callipers** **(c)**measuring tap **(d)**screw gauge

7.A student claimed the diameter of a wire as 1.032cm using Vernier Callipers.Upto what exten t do you agree with it?

(a)1cm **(b)**1.0cm **(c)1.03cm** **(d)**1.032cm

8.A measuring cylinder is used to measure:

(a)mass **(b)**area **(c)volume** **(d)**level of the liquid

9.A student noted the thickness of a glass sheet using a screw gauge.On the main scale,it reads 3 divisions while 8^{th} division on the circular scale coincides with index line.Its thickness is:

(a)3.8cm **(b)3.08mm** **(c)**3.8mm **(d)**3.08m

10.Significant figures in an expression are:

(a)all the digits **(b)**all the accurately known digits

(c)all the accurately known digits and the first doubtful digit

(d)all the accurately known and all the doubtful digits