PHYSICS

BOOKS - S CHAND PHYSICS (ENGLISH)

UNITS

Solved Problems

1. A par sec is a convenient unit of length on the astronomical scale. It is the distance o an object that will show a parallax of 1 s of arc

from opposite ends of a base line equal to the distance from the earth to the sun. How much is a sec in terms of metre?

2. The nearest star from our solar system is 4.29 light year away. How much is this distance in terms of par sec? How much parallax would this star (named Alpha Centauri) show when viewed from two locations of the earth six months apart in its orbit around the sun?

3. How many significant figures are there is each of the following numberS?

(i) 123 g (ii) 0.123 m (iii) 0.0456 g (iv) $1.20 \times 10^3 W$

4. Determine the number of significant figures in the following numbers.

(i)46 cm (ii) 4.589 g (iii) 5.67×10^3 m/s (iv)

0.0023 m

5. How many significant figures are there in the following numbers?

(i) 67.8 ± 0.3 (ii) 4.899×10^9 (iii) 3.56×10^{-6}

(iv) 0.0065

6. Round off the following numbers to 3 significant figures

(i) 23.63 m (ii) 40.47 kg (iiii) $0.05935m^2$ (iv) $0.009865m^3$

7. 0.1203 gm of copper is deposited on a copper plate of mass 9.2 g. What is the total mass of the copper plate?

8. A gold ring has a mass of 8.123 g. It is rubbed against a metal piece and 0.89 g of gold is removed. What is the new mass of the ring?

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9. The radius of a sphere is 1.23 cm. What is its surface area?

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10. The mass of a body is 4.35 kg and its volume is $2.1 m^3$. What is its density?

11. The length of a cylinder was measured using a vernier calipers several times. The following reading were obtained (in cm) : 1.12, 1.11,1.13, 1.10,1.14,1.15,1.16. Calculate (i) mean value of the length (ii) the absolute error in each measurement (iii) mean absolute error (iv)

relative error and (v) percentage error. Write down the result in terms of mean absolute error and percentage error.

12. The focal length of a convex lens was measured a number of time.s The mean focal length was found to be 10.41 cm. If the mean absolute error in the value of focal length is 0.13 cm. Calculate the relative error and the percentage error.

13. The length of the plastic tube of the refill of a dot pen is (12.7 ± 0.1) cm and the length of the metal nib is $(1.40 \pm 0.2)cm$. What is the total length of the refill?

14. The length of an iron rod is $(16.4 \pm 0.1)cm$. If a small piece of length $(1.2 \pm 0.1)cm$ is cut out, what is the length of the remaining rod?

15. The length and width of a rectangular plate are (16.30 ± 0.05) and (13.80 ± 0.05) cm respectively. Calculate the area of the plate and also find the uncertainty in the area.

16. The resistivity of the material of a wire of length 1 and diameter d and resistance R is

given by $\rho = \dfrac{\pi Rd^2}{4l}$. The length of the wire

l=100.0 cm is measured using a metre scale

with a least count of I mm, the diameter

d=0.22 cm is measured using an instrument

with a least count of 0.01 cm and resistnce

R=5.00 ohm is measured with an accuracy of

0.01 ohm. What is the percentage error?

Suggest a method to reduced the percentage

error.

17. Express the following in terms of power of ten

(i) 4375 g (ii) 983 m(iii) 0.0010 kg

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18. The relative density of lead is 11.3. What is its density in (1) C.G.S system (2) S.I. unit?

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19. Convert (i) $1 kgm^2 s^2$ into $gcm^2 s^{-2}$ and (ii) 1 m into light year

20. The calorie is a unit of heat or energy and it equals about 4.2 J where $1J = 1kgm^2 s^{-2}$. Suppose we employ a system of units in which the unit of mass equals α kg, the unit of length equals β m and the unit of time is γ s.

Show that the calorie has a magnitude of $4.2\alpha^{-1}\beta^{-2}\gamma^2$ in terms of the new units.

21. State the number of significant figures in the following

(a)$0.007m^2$ (b)$2.64 \times 10^{24}kg$ (c) $0.2370g/cm^{-3}$

22. The length, breadth and thickness of a rectangular sheet of metal are 4.234 m, 1.005 m, and 2.01 cm respectively. Give the area and volume of the sheet to correct significant figures.

23. A physical quantity P is related to four observably a,b,c and d as follows $P = a^3 b^3 / c^{1/2}$ d. The percentage errors of

measurement in a,b,c and d are 1%, 3%, 4% and 2% respectively. What is the percentage error in the quantity P? If the value of P calculated using the above relation turns out to be 3.763, to what value should you round off the result?

24. You are given two resistance $R_1 = (4.0 \pm 0.1)\Omega$ and $R_2 = (9.1 \pm 0.2)\Omega$. Calculate their effective resistance when they

are connected (i) in series and (ii) in parallel. Also calculate the percentage error in each case.

25. Using a screw gauge the diameter was measured. The readings are given belwo: 0.39 mm, 0.38 mm, 0.39 mm, 0.41 mm, 0.38 mm, 0.37 m, 0.40 mm,0.39 mm. Calculate (i) the most accurate value of the diameter (ii) the relative error and (iii) percentage error.

26. A physical quantity is represented by $X = M^a L^b T^{-c}$.If the percentage error in the measurement of M,L and T are $\alpha\%$, $\beta\%$ and $\gamma\%$ to respectively, what is the total percentage error in X?

27. In an experiment to determine the acceleration due to gravity at a place a stop

watch with a resolution of 0.2 s was used and total time for a certain number of oscillations was measured as 100.2s. Claculate the maximum error in the time period? If the percentage error in measuring the length of he pendulum is 0.3%, what is the percentage error in the value of g?

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28. If (2, 3, 5) is one end of a diameter of the sphere

$$x^2 + y^2 + z^2 - 6x - 12y - 2z + 20 = 0 \quad ,$$

then the coordinates of the other end of the diameter are (1) $(4, 9, -3)$ (2) $(4, -3, 3)$ (3) $(4, 3, 5)$ (4) $(4, 3, -3)$

29. Find the order of magnitude of the number of breaths a person takes during an average span of 70 years. Assume that a person 15 breaths per minute.

1. Every great physical therory starts as a heresy and ends as a dogma. Give some examples from the history of science of he validity of the incisice remark.

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2. No physicist has ever seen an atom. Yet all physicist believe in the existence of atoms. An intelligent but superstitions man advances this analogy to argue that ghosts exist even though no one has seen one. How will you refuse his argument?

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3. Some of the most profound statements on the nature of science have come from Abert

Einstein, one of the greatest scientists of all time. What do you think kid Einstein mean when he said, The most incomprehensible thing about the word is that it is comprehensible?

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4. It is more important to have beauty in the equations of physics that to have them agree with experiments. The great British physics

P.A.M. Dirac held the view. Criticize this statement.

5. If is often said that the world is witnessing now a second industrial revolution, which will transform the society as radically as did the first. List some key contemporary areas of science and technology which are responsible for the revolution.

1. Write in about 1000 words a fiction piece based on your speculation on the science and technology of the twenty second century.

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2. Through India now has a large base in science and technology, which is fast expanding, it is still a long way from realizing

its potential of becoming a world leader in science. Name some important factors, which in your view have hindered the advancement of science in India.

3. "Politics is the art of the possible". Similarly "Science is the art of soluble". Explain this with reference to the nature and practice of science.

Module 1 Short Answer Questions

1. Name the various steps involved in the formation of a scientific concept.

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2. What is meant by unification?

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3. What is meant by serendipity?

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4. Name the different forces in nature.

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5. What one are the fundamental forces?

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6. What is the mechanism of hearing ?

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7. What is meant by grand unified theory?

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8. What are conservation laws?

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9. Name the conservation laws.

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1. Who told that heavy bodies fall faster than light ones?

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2. Who was burned alive, for telling that the sun is the centre of our solar system?

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3. Give one example each for (i) macroscopic quantiy and (ii) microscopic quanity.

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4. What is the range of length which we come across in Physics?

5. Name that invention which created the first information explosion.

6. Name the strongest and the weakest force.

7. Name the particle responsible for (i) electromagnetic interaction and (ii) gravitational interaction.

8. Who unified the weak force and the electromagneetic force?

9. What was the temperature of the universe during the time of Big Bang?

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10. What are strange particles? Why are they called so?

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Module 1 Match The Following

1. Match the name of the scientist in column A against the country of origin in Column B.

'A' Scientist	'B' Country of Origin
1. Albert Einstein	1. Pakistan
2. CV Raman	2. Germany
3. Archimedes	3. India
4. JC Bose	4. England
5. James-Watt--	5. India
6. Bhabha6.	6. Greece
7. Roentgen	7. USA
8. Alfred Noble	8. India
9. Edison A	9. Sweden
10. Adbus Salman	10. Germany

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2. Match the name of the scientist in column A against the country of origin in Column B.

'A' Scientist	'B' Discovery
1. SN.Bose	1. Measurement of electronic change
2. Heisenberg	2. Holography
3. Edwin Hubble	3. Laser
4. John Bardeen	4. Wireless telegraphy
5. James Chadwick	5. Uncertainty principle
6. Neils Bohr	6. Uncertainty principle
7. Millokan	7. Expanding universe
8. Marconi	8. Transistor
9. Gabor D	9. Neutron
10. CH Townes	10. Qnatum Model of Hydrogen atom

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3. Match the technology in column A to the

corresponding scientific principles/laws in

Column B.

'A' Technology	'B' Scientific principles/Laws
1. Optical fibre	1. Wave nature of electrons
2. Photo cell	2. Superconductivity
3. Sonar	3. Digital logic
4. Rocket propulsion	4. Laws of thermodynamics
5. Electric generator	5. Motion of chanrged particles in an electromagnetic field.
6. Computer	6. Total internal reflection of light
7. Electron microscope	7. Photoelectric effect
8. Partide accelerator	8. Reflection of ultrasonic waves
9. Steam energie	9. Newtons laws of motion
10. Production of ultra high magnetic fields	10. Faraday's laws of electromàgnetic induction

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Module 3 Short Answer Questions With Answers

1. What is one micron?

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2. Give the advantages of selecting wavelength of light as a standard of length.

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3. Name the unit in which size of a nucleus is measured.

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4. What is the new name of litre?

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5. What is a light year? How is it related to metre?

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6. Is there any difference between Å and A.U.?

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7. The mean diameter of a thin brass rod is to be measured by a vernier calipers. Why is a set of 100 measurements of the diameter expected to yield a more reliable estimate than a set of 5 measurements only?

8. If you lok out of the window of a fast moving train the nearby trees, houses etc,. Seem to

move rapidly in a direction opposite to the train's motion, but the distant objects seem to be stationary. Why?

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9. If $f = x^2$ then what is the relative error in f?

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10. Which of the following length measurements is/are the most accurate and

why?

A. 5.0 cm

B. 0.006 cm

C. 0.0005 cm

D. 5.000 cm

Answer:

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Module 3 Long Answer Questions

1. What are the fundamental quantities and supplementary quantities is S.I.? Give their units.

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2. Define metre, kilogram and second in S.I.

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3. What are the advantages of S.I.?

4. What is an error?

5. Explain absolute error, mean absolute error

and percentage error.

6. Discuss the combination of errors in the various cases.

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7. Explain parallax.

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8. How is the method of parallax used to find the distance of a planet.

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9. How is the distance from the moon to the earth determined?

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Module 3 Short Answer Questions

1. What is meant by scientific method?

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2. What are fundamental quantities? Why are they called so?

3. Why do we call density as a derived quantity?

4. What is a unit? What are its characteristics?

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5. Name the base units is S.I.

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6. What are the supplementary units in S.I.

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7. The definition of metre based on velocity of light is considered to be absolutely constant, why?

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8. What is Plank length?

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9. What is one fermi?

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10. What is the differences between Å and A.U.?

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11. Define par sec and light year. How are they related?

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12. Do we have an atomic standard of mass? Why?

13. What is u?

14. Which is greater, pound or kilogram?

15. Is there any specific reason for using Cesium-133 atom for defining one second?

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16. Why do we go for an atomic standard for defining metre and second?

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17. What is a mole?

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18. What is steradian?

▶ Watch Video Solution

19. Mention four advantages of S.I.?

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20. What is (i) yocto, (ii) yotta?

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21. What is parallax?

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22. What is the differences between accuracy and precision?

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23. Is there any difference between an error and a mistake ? Explain.

24. Mention the causes which give rise to errors during the measurement of physical quantities.

25. What are systematic errors? Why are they called so?

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26. To which group of error do zero error, back lash error and end error in metre bridge belong?

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27. How will you rectify the systematic errors?

28. What are random errors? They are called accidental errors. Why?

29. To avoid random errors, what should wo do?

30. What is absolute error?

31. What is meant by an environment error?

32. Define relative error and percentage error?

33. What is the use of calculating percentage error?

34. Write down the expression for finding the maximum absolute error in the case of addition and sub traction.

35. What is the expression for finding the percentage error in the case of (i) multiplication and (ii) division?

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36. What are significant figures?

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37. Mention the rules for finding the significant figures.

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38. Does the number of significant figures used depend on the system of unit used?

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39. What is meant by rounding off?

40. What is meant by standard form or numerical abbreviation?

41. Explain with examples the meaning of order of magnitude.

42. Mention the advantages of writing the final results in significant figures.

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Module 3 Very Short Answer Type

1. Derive the S.I. unit of joule in terms of fundamental units.

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2. Suppose the universe were shrunk to the size of the earth how large would the earth be onn such a scale?

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3. Define light year.

▶ **Watch Video Solution**

4. Define Parsec.

▶ **Watch Video Solution**

5. What is shake?

▶ **Watch Video Solution**

6. What is lunar month?

▶ **Watch Video Solution**

7. What is the size of our galaxy?

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8. Which is the most accurate clock?

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9. What is micron?

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10. Name the unit used for measuring small area of cross section like nuclear cross section.

11. What is solar year?

Module 3 Selected Problems

1. Relative density of a liquid is 0.8. What its density in (i) C.G.S. system (ii) S.I. unit.

2. Convert (i) $1Nm^2kg^{-2}$ into dyne cm^2g^{-2},

(ii) $60Kmhr^{-1}$ into ms^{-1},

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3. If year is taken as the unit of time and

velocity of light as the unit of velocity what is

the unit of length ?

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4. A new unit of length is chosen such that the speed of sound at room temperature is taken as unit. The sound of an explosion reaches a listener in 10s. Find the distance between the listener and the place where explosion took place.

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5. Find the number of significant figures in the following

(i) 1234 N (ii) 0.012 (iii) $1.530 \times 10^8 m$

6. What is the distance in km of quasar from whigh light takes 3 billion years to reach us? $c = 3 \times 10^5$ km/s.

7. The mass of sunis $2.0 \times 10^{30} kg$ and its radius is $7.0 \times 10^8 m$. Find the mass density?

8. A new unit of length is chosen such that the speed of light is vacuum is unity. What is the distance between the sun and the Earth in terms of the new unit if light takes 8 min and 20 s to cover this distance?

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9. The length, breadth the thickness of rectangular sheet of wood are 3.230 m, 1.49 m and 1.99 cm respectively. Give the total surface

area and volume of the sheet correct to the significant figures.

10. The mass of a box measured by grocer's balance is 4.2 kg. Two additional masses 10.20 g and 15.25 g are added to the box. What is the total mass of the box?

11. The mass of an electron is 9.11×10^{-31} kg and the velocity of light is $3.00 \times 10^8 ms^{-1}$. Calculate the energy of the electron using Einstein's mass energy relation $E = mc^2$, correct ot the significant figures?

12. Each side of a cube is measured to be 6.230 m. What is the total surface area and the

volume of cube to appropriate significant figures?

13. The mass of a box measured by a grocer's balacne is 2.3 kg. Two gold pieces of masses 20.15 g and 20.17 g are added to the box. What is (a) the total mass of the box. (b) the difference in the masses of the pieces to correct significant figures?

14. Round off to three significant figures (i) 9.745 g (ii) 9.835 cm (iii) 28457 m.

15. Solve the following with regard to the correct significant figures (i) $\sqrt{4.8 - 2.35}$ (ii) $2.35 \times 10^3 - 1.2 \times 10^3 / 2.0 \times 10^2$

16. The diameter of a sphere is 1.23 m. Find its volume with due regard to the significant figures.

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17. A simple pendulum makes 100 oscillation in 25 s. What is the frequency of the pendulum correctto the significant figures?

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18. In an experiment the valno of refractive index of glass was found to be 1.54, 1.53, 1.44,1.54, 1.56 and 1.45 m in successive measurement. Calculate (i) the mean vlaue of refractive index (ii) absolute error of each measurement (iii) mean absolute error (iv) relative error and (v) percentage error.

19. Add 38.8 ± 0.4 and 29.7 ± 0.3.

20. Two forces P and Q are acting on the same body. If $P = (25 \pm 0.2)N$ and $Q = (16 \pm 0.7)N$ find their resultant when the two forces are (i) in the same direction and (ii) in opposite direction.

21. What is the difference between the temperature of two bodies, if their

temperatures are $(50 \pm 0.2)\,^{\circ}C$ and $(25 \pm 0.6)\,^{\circ}C$?

22. The length of a pencil is (15.1 ± 0.1) cm. A small piece of length is cut out so that the length of the remaining pencil is (11.9 ± 0.2) cm what is the length of the small piece?

23. The length and breadth of a table are $(125 \pm 0.4)cm$ and $(75 \pm 0.5)cm$ respectively. What is the area of the table?

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24. The radius of a circle is measured to be $(10.8 \pm 0.3)m$. Calcualte the area of the circle.

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25. Calculate the density of a body of mass $(10 \pm 0.6)g$ and volume $(4.4 \pm 0.7)cm^3$, to the correct significant figures?

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26. The resistant R=V/I where $V = 100 \pm 0.5V$ and $I = 10 \pm 0.2A$. The percentage error in V is 5% and in I is 2%. Find the total percentage error is R.

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27. The radius of a sphere is $(4.5 \pm 0.2)cm.$ What is the percentage error in volume?

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28. One side of a square is measured as 16.7 cm to an accuracy of 0.1 cm. What is the percentage error in area?

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29. The diameter of a sphere is measured as 1.71 cm using an instrument with a least count 0.01 cm What is the percentage error in its surface area?

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30. The percentage error in the calculation of the volume of a sphere is 4.8%. What is the percentage error in the measurement of radius of the sphere.

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31. If the least count of a screw gauge is 0.001 cm and diameter of a wire measured by it is 0.236 cm, find the permissible percentage error in the measurement.

32. The centripetal force acting on a body of mass 4 kg moving in a circle of radius 0.3 m with a unifrom speed 5 m/s is calculated using the equation $F = \dfrac{mv^2}{r}$. If m,v and r are

measured to accuracies of 0.04 kg, 0.01 m/s and 0.009 m respectively, find the percentage error in the force?

33. Calculate the percentage error in the volume of a cylinder of diameter 2.4 cm and height 10.5 cm, both measured using a metre scale of least count 0.1 cm. What will be the percentage error if dimensions are measured using a vernier calipers of least count 0.01 cm?

34. In an experiment to determine the coefficient of viscosity of a liquid using the formual $\eta = \dfrac{\pi P r^4}{8lQ}$ the radius of the capillary tube was measured to be 0.41 mm using an instrument of least count 0.001 cm, length l was measured usinga metre scale as 15 cm. The percentae error in the pressure difference is 0.4% and the percentage error in the volume of the liquid flow out per second Q is

0.3% what is the maximum percentage error in the coefficient of viscosity?

35. The percentage error in the evaluation of the area of one surface of a rectangular sheet is 2.2%. The length and breadth are measured using a meter scale. If the breadth is 7.9 cm, calculate the length of the sheet?

36. The resistance R of a metallic conductor is equal to the ratio of potential difference V across the resistor to the current I through the conductor. Calculate R given tat $V = (11.1 \pm 0.1)$ volt and $I = (5.5 \pm 0.5)A$

37. A physical quantity X is related to three observable a,b and c as $X = \dfrac{b^2 \sqrt{a}}{c}$. The errors of measuremnts in a,b and c are 4%, 3%

and 2% respectively. What is the percentage error in the quality X?

38. Find the order of magnitude of the number of atom in $1 cm^3$ of a solid. Given that the diameter of an atom is about $10^{-10} m$