PHYSICS CLASS XI
CHAPTER – 2 UNITS AND MEASUREMENT

Q.1. Which is the most accurate clock?

Ans. A cesium clock is most accurate. Two cesium clocks may differ only by 1 after running for 5000 years.

Q.2. Are initial and gravitational mass of a body different from one another?

Ans. No, the initial and gravitational mass of a body are equivalent.

Q.3. How are the pitch and least count of a spherometer related?

Ans. Least count = $\frac{Pitch}{Total\ number\ of\ division\ on\ the\ circular\ scale}$

Q.4. What is meant by angular diameter of moon?

Ans. Angular diameter of moon is the angle subtended at a point on the earth, by two diameterically opposite ends of the moon. Its value is about 0.5°.

Q.5. Round off to four significant figures (i) 36.879 (ii) 1.0084

Ans. (i) 36.88, (ii) 1.008

Q.6. In a number without decimal, what is the significance of zeroes on the right of non-zero digits?

Ans. All such zeroes are not significant. e.g., x = 678000 has only three significant figures.

Q.7. Precisions describe the limitation of the measuring instrument. Is the statement false?

Ans. No, the statement is true.

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Q.8. Which of the following length measurement is most accurate and why?

(i) 2.0 cm (ii) 2.00 cm (iii) 2.000 cm

Ans. (iii) 2000 cm is most accurate because it is correct upto third place of a decimal.

Q.9. What is percentage error in volume of a sphere, when error in measuring its radius is 2%?

Ans. As volume of a sphere (V), i.e.,

$$\frac{\Delta V}{V} = 3\frac{\Delta r}{r} = 3\times(\pm\ 2\%) = \pm 6\%$$

Q.10. If $f = x^2$, relative error in f then how many times the relative error would be in x?

Ans. It would be two times.

Q.11. Solve with due regard to significant figures $\sqrt{6.5 - 6.32}$

Ans. $\sqrt{6.5 - 6.32} = \sqrt{0.18} = \sqrt{0.2}$, upto one decimal place = 0.44 (having 2 significant figures).

Q.12. Calculate the length of the arc of a circle of radius 31.0cm which subtends an angle of $\frac{\pi}{6}$ at the centre.

Ans. Hence, length of the arc = ?

Radius = 31.0 cm, $\theta = \frac{\pi}{6}$

From, length of the arc of a circle (l) = rθ

$$= 31.0 \times \frac{\pi}{6} = 16.2 \text{ cm}$$

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Q.13. The mass of a body is measured by two persons is 10.2 kg and 10.23 kg. Which one is more accurate and why?

Ans. The value m = 10.23 kg is more accurate, being correct upto 2nd place of decimal.

Q.14. If all measurements in an experiment are taken upto same number of significant figures, then which measurement is responsible for maximum error?

Ans. The maximum error will be due to

(i) measurement which is least accurate.

(ii) measurement of the quantity which has maximum power in the formula.

Q.15. Suppose we use a physical balance to measure the mass of an object and find the mean value of our observation to be 156.28 g. Represent this result correctly.

Ans. If least count of physical balance is 0.1 g, the mass measured will be correctly represented as m = (156.3 $\pm$ 0.1)g

Q.16. Why parallax method cannot be used for measuring distances of stars more than 100 light years away?

Ans. When a star is more than 100 light years away, then the parallax angle is so small that it cannot be measured accurately.

Q.17. What is the technique used for measuring large time intervals?

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Ans. When a star is more than 100 light years away, then the parallax angle is so small that it cannot be measured accurately.

Q.18. What is the technique used for measuring large time intervals?

Ans. For measuring large time intervals, we use the technique of radioactive dating. Large time intervals are measured by studying the ratio of number of radioactive atoms decayed to the number of surviving atoms in the specimen.

Q.19. Add 6.75×10^3 cm to 4.52×10^2 cm.

Ans. $x + y = (6.75 \times 10^3 + 0.452 \times 10^3)$ cm

$= 7.202 \times 10^3$ cm

$= 7.20 \times 10^3$ cm

Q.20. The resistance R is the ratio of potential different C and current I. What is the percentage error in R if V is (100 ± 5) V and I is (10 ± 2)A?

Ans. $\frac{\Delta R}{R} \times 100 = \pm \left[\frac{\Delta V}{V} + \frac{\Delta I}{I}\right] \times 100$

$= \pm \left[\frac{5}{100} + \frac{0.2}{10}\right] \times 100$

$= \pm 7\%$

Q.21. Which of the following length measurement is most accurate and why?

(i) 4.00 cm, (ii) 0.004 mm and (iii) 40.00 cm

Ans. (i) $\frac{\Delta x}{x} = \frac{0.01}{4.00} = 0.0025$

(ii) $\frac{\Delta x}{x} = \frac{0.001}{0.004} = 0.25$

(iii) $\frac{\Delta x}{x} = \frac{0.01}{40.00} = 0.00025$

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The last observation has the least fractional error and hence it is more accurate.

Q.24. A jeweller put a diamond weighing 5.42 g in a box weighing 1.2 kg. Find the total weight of the box and the diamond to correct number of significant figures.

Ans. Weight of diamond = 5.42 g = 0.00542 kg

Total weight = 1.2 + 0.00542

= 1.20542 = 1.2 kg

Q.25. If displacement of a body is S = (200 $\pm$ 0.5) m and time taken by it is t = (20 $\pm$ 0.2) s, then find the percentage error in the calculation of velocity.

Ans. Here, S = 200m, ΔS = 10.5 m, t = 20 s, Δt = 10.2 s

As, velocity v = $\frac{s}{t}$

Therefore Percentage error in velocity

$$\frac{\Delta v}{v} = \left[\frac{\Delta S}{S} + \frac{\Delta t}{t}\right] \times 100\%$$

$$= \left[\frac{0.5}{200} + \frac{0.2}{20}\right] \times 100\% = 1.25\%$$

Q.26. The voltage across a lamp is V = (6.0 $\pm$ 0.1) Volt and the current passing through it I = (4 $\pm$ 0.2) ampere. Find the power consumed by the electric lamp. Give that power, P = VI

Ans. As, V = (6.0$\pm$ 0.1) V, I = (4.0$\pm$0.2)A

Power P = VI = 6.0 $\times$ 4.0 = 24 W = 24 W

And maximum error in power measurement

$$\frac{\Delta P}{P} = \frac{\Delta V}{V} + \frac{\Delta I}{I} = \frac{0.1}{6.0} + \frac{0.2}{4.0}$$

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= 0.017 + 0.050 = 0.067

ΔP = 0.067 ×P = 0.067 × 24 = 1.6 W

Power consumed by the electric lamp within error limit is (24 $\pm$ 1.6) W.

Q.27. State the number of significant figures in the following.

(i) 0.007 m^2 **(ii) 2.64 × 10^{24} kg**

(iii) 0.2370 g/cm^3 **(iv) 6.320 J**

(v) 6.032 N/m^2 **(vi) 0.0006032 m^2**

Ans. The number of significant figures in the given quantities are given below.

(i) In 0.007, the number of significant figures is 1
because in a number less than 1, the zero's on the right of the decimal point but to the let of the first non-zero digit are not significant.

(ii) In 2.64 × 10^{24}, the number of significant figure is 3. Because all non-zero digits are significant, power of 10 are not taken in significant figue.

(iii) In 0.2370, the number of significant figures is 4, as all non-zero digits left to decimal and trailing zero are significant.

(iv) In 6.320, the number of significant figures is 4 (reason is same as in part 'c')

(v) In 6.032, the number of significant figures is 4 (reason is same as in part 'c').

(vi) In 0.0006032, the number of significant figures is 4 (reason is same as in part 'a').

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Q.28. Explain the statement clearly "To call a dimensional quantity large or small is meaningless without specifying a standard for comparison". In view of this, reframe the following statements wherever necessary

(i) Atoms are very small objects.

(ii) A jet plane moves with great speed.

(iii) The mass of Jupiter is very large.

(iv) The air inside this room contains a large number of molecules.

(v) A proton is much more massive than an electron.

(vi) The speed of sound is much smaller than the speed of light.

Ans. The statement is true. Any dimensional physical quantity can be called large or small by specifying a standard for comparison. For example, the mass of a boy is 40 kg, which is very small in comparison to the mass of the earth (6×10^{24} kg) but very large in comparison to the mass of an electron (9.1×10^{-31} kg).

(i) The size of an atom is very small in comparison to the size of a sugar cube.

(ii) A jet plane moves faster than a superfast train.

(iii) The mass of Jupiter is very large as compared to the mass of Uranus.

(iv) The air inside this room contains large number of molecules than in one mole of air.

(v) The statement is already correct.

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(vi) The statement is already correct.

Q.29. When the planet Jupiter is at a distance of 824.7 million kilometers from the earth, its angular diameter is measured to be 35.72 of arc. Calculate the diameter of Jupiter.

Ans. r = 824.7×10^6 km

θ = 35.72" = $\frac{35.72}{60\times60} \times \frac{\pi}{180} rad$

Diameter, l = ?

As $l = r\theta \Longrightarrow l = 824.7 \times 10^6 \times \frac{35.72\times\pi}{60\times60\times60}$ km

$= 1.429 \times 10^5$ km

Q.30. Write the dimensional formula of the wavelength and frequency of a wave.

Ans. Wavelength [λ] = [L]

Frequency [v] = [T^{-1}]

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