

# Physics

## (Chapter 1 and 2)(Physical World, Units and Measurements)

(Class 11)

### Very Short Answer Type Questions

(1 mark each)

#### Question 1:

State one law that holds good in all natural processes.

#### Answer 1:

One such law is the Newton's gravitation law, According to this law everybody in this nature are attracts with other body with a force of attraction which is directly proportional to the product of their masses and inversely proportionally to the square of the distance between them.

#### Question 2:

Among which type of elementary particles does the electromagnetic force act?

#### Answer 2:

Electromagnetic force acts between on all electrically charged particles.

#### Question 3:

Name the forces having the longest and shortest range of operation.

#### Answer 3:

Longest range force is gravitational force and nuclear force is shortest range force.

#### Question 4:

If 'slap' times speed equals power, what will be the dimensional equation for 'slap'?

#### Answer 4:

$$\text{Slap} \times \text{speed} = \text{power}$$

$$\text{Or } \text{slap} = \text{power}/\text{speed} = [\text{MLT}^{-2}]$$

#### Question 5:

If the units of force and length each are doubled, then how many times the unit of energy would be affected?

#### Answer 5:

Energy = Work done = Force x length

So when the units are doubled, then the unit of energy will increase four times.

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### Question 6:

Can a quantity has dimensions but still has no units?

### Answer 6:

No, a quantity having dimension must have some units of its measurement.

### Question 7:

Justify  $L + L = L$  and  $L - L = L$ .

### Answer 7:

When we add or subtract a length from length we get length,

So  $L + L = L$  and  $L - L = L$ .

### Question 8:

Can there be a physical quantity that has no unit and no dimensions?

### Answer 8:

Yes, like strain.

### Question 9:

Given relative error in the measurement of length is 0.02, what is the percentage error?

### Answer 9:

Percentage error = 2 %

### Question 10:

If  $g$  is the acceleration due to gravity and  $\lambda$  is wavelength, then which physical quantity does represented by  $\sqrt{g\lambda}$ .

### Answer 10:

Speed or velocity.

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### Short Answer Type Questions

(2 marks each)

#### Question 1:

If heat dissipated in a resistance can be determined from the relation:

$$H = I^2 R t \text{ joule}$$

If the maximum error in the measurement of current, resistance and time are 2%, 1% and 1% respectively, what would be the maximum error in the dissipated heat?

#### Answer 1:

% error in heat dissipated is  $\pm 6\%$ .

#### Question 2:

Name any three physical quantities having the same dimensions and also give their dimensions.

#### Answer 2:

Any group of physical quantities, like work, energy and torque and their dimensions  $[ML^2 T^{-2}]$ .

#### Question 3:

In Van der Waal's equation  $(P + a/V^2)(V - b) = RT$ , Determine the dimensions of a and b.

#### Answer 3:

$[a] = [ML^5 T^{-2}]$  and  $[b] = [M^0 L^3 T^0]$ .

#### Question 4:

Give the limitations of dimensional analysis.

#### Answer 4:

Dimensional analysis is very useful in deducing relations among the interdependent physical quantities. However, dimensionless constants cannot be obtained by this method. The method of dimensions can only test the dimensional validity, but not the exact relationship between physical quantities in any equation. It does not distinguish between the physical quantities having same dimensions.

#### Question 5:

If  $X = a + bt^2$ , where X is in meter and t is in second. Find the unit of a and b?

#### Answer 5:

Unit of a is meter and unit of b is  $m/sec^2$ .

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### Question 6:

What is meant by significant figures? State the rules for counting the number of significant figures in a measured quantity?

 **Answer 6:** Do yourself.

### Question 7:

Show that the maximum error in the quotient of two quantities is equal to the sum of their individual relative errors.

 **Answer 7:**

For  $x = a/b$ , 
$$\Delta x/x = \pm (\Delta a/a + \Delta b/b)$$

### Question 8:

Deduce the dimensional formulae for the following physical quantities.

(A) Gravitational constant.

(B) Power

(C) Coefficient of viscosity

(D) Surface tension.

 **Answer 8:**

(A) Gravitational constant =  $[M^{-1} L^3 T^{-2}]$ ,

(B) Power =  $[ML^2T^{-3}]$

(C) Coefficient of viscosity =  $[ML^{-1} T^{-1}]$

(D) Surface tension =  $[ML^0T^{-2}]$

### Question 9:

Name the four basic forces in nature. Arrange them in the order of their increasing strengths.

 **Answer 9:**

Gravitational force

Weak force

Electromagnetic force

Nuclear force

The relative strengths of these forces are

$$F_g : F_w : F_e : F_s = 1 : 10^{25} : 10^{36} : 10^{38}$$

### Question 10:

Convert 1 Newton force in to Dyne.

 **Answer 10:**

1N =  $10^5$  Dyne.

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### Short Answer Type Questions

(3 marks each)

#### Question 1:

If E, M, J and G respectively denote energy, mass, angular momentum and gravitational constant, Calculate the dimensions of  $EJ^2/M^5G^2$

#### Question 2:

The frequency  $\nu$  of vibration of stretched string depends on its length L its mass per unit length m and the tension T in the string obtain dimensionally an expression for frequency  $\nu$ .

#### Question 3:

What is meant by significant figures .State the rules for counting the number of significant figures in a measured quantity?

#### Question 4:

A physical quantity X is given by  $X = A^2B^3/C\sqrt{D}$  , If the percentage errors of measurement in A,B,C and D are 4%,2%,3% and 1% respectively, then calculate the % error in X.

#### Question 5:

If two resistors of resistance  $R_1=(4 \pm 0.5)\Omega$  and  $R_2=(16 \pm 0.5)\Omega$  are connected (1) In series and (2) Parallel . Find the equivalent resistance in each case with limits of % error.

#### Question 6:

The length of a rod measured in an experiment was found to be 2.48m, 2.46, 2.50m and 2.48m and 2.49m, Find the average length , the absolute error in each observation and % error.

#### Question 7:

A famous relation in physics relates moving mass m to the rest mass  $m_0$  of a particle in terms of its speed v and the speed of the light c. A boy recalls the relation almost correctly but forgets where to put the constant c. He writes:

$$m = m_0 / (1 - v^2)^{1/2}$$

Guess where to put the missing c.

#### Question 8:

A calorie is a unit of heat energy and it equals about 4.2 J, where  $1 \text{ J} = 4.2 \text{ kgm}^2\text{s}^{-2}$ . Suppose we employ a system of units in which the unit of mass equals  $\alpha$  kg, the unit of length equals  $\beta$  m, the units of time is Y sec. show that a calorie has a magnitude  $4.2 \alpha^{-1} \beta^{-2} Y^2$  in terms of the new units.

#### Question 9:

In the formula  $X = 3YZ^2$ , X and Z have dimensions of capacitance and magnetic induction respectively, what are the dimensions of Y in MKS system?

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### Question 10:

In an experiment, on the measurement of  $g$  using a simple pendulum the time period was measured with an accuracy of 0.2 % while the length was measured with accuracy of 0.5%. Calculate the percentage error in the value of  $g$ .

### Long Answer Type Questions

(5 marks each)

#### Question 1:

Explain:

- |                     |                           |
|---------------------|---------------------------|
| (i) Absolute error  | (iii) Mean absolute error |
| (ii) Relative error | (iv) percentage error     |
| (v) Random error    |                           |

#### Question 2:

Convert:

- (i) Gravitational constant ( $G$ ) =  $6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$  to  $\text{cm}^3 \text{ g}^{-1} \text{ s}^{-2}$
- (ii) The escape velocity  $v$  of a body depends on, the acceleration due to gravity 'g' of the planet and the radius  $R$  of the planet, Establish dimensionally for relation for the escape velocity.

#### Question 3:

Name the four basic forces in nature. Write a brief note of each, hence compare their strengths and ranges.

### HOTs

#### Question 1:

What are the dimensions of  $1/u_0\epsilon_0$ , where symbols have their usual meaning?

 **Answer 1:**

$[M^0 L^2 T^{-2}]$

#### Question 2:

What is the dimensions of  $(1/2)\epsilon_0 E^2$ , Where  $E$  electric field and  $\epsilon_0$  permittivity of free space.

 **Answer 2:**

$[M^1 L^{-1} T^{-2}]$

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### Question 3:

The pairs of physical quantities that have the same dimensions are:

- (a) Reynolds's number and coefficient of friction,
- (b) Curie and frequency of a light wave
- (c) Latent heat and gravitational potential
- (d) Planck's constant and torque.

### Answer 3:

(a), (b).

### Question 4:

If L,C,R represent inductance , capacitance and resistance respectively, the combinations having dimensions of frequency are

- (a)  $1/\sqrt{CL}$       (b) L/C      (c) R/L      (d) R/C

### Answer 4:

(a) and (c).

### Question 5:

If the error in radius is 3%, what is error in volume of sphere?

- (a) 3 %      (b) 27 %      (c) 9 %      (d) 6 %

### Answer 5:

(c) 9%.