



## The Times Secondary School

Dillibazar, Kathmandu

First Terminal Examination – 2076

Grade: - XI

Set – A

Full Marks:-75

Stream: Science

Pass Marks: 30

Subject: Physics

Time : 3 hrs

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate the full marks

### GROUP A

#### 1. Answer in brief any SIX questions: (6×2=12)

- If the unit of force is 100m, unit of length is 10m and unit of time is 100s, what is the unit of density in this system?
- A stone is thrown horizontally with a speed  $(2gh)^{1/2}$  from the top of the wall of a height  $h$ . It strikes the level ground through the foot of the wall at a distance  $x$  from the wall. What is the value of  $x$ ?
- A ball is thrown straight up. What is its velocity and acceleration at the top.
- A body is projected horizontally from the top of the cliff with a velocity 9.8m/s. What time elapses before horizontal and vertical velocity becomes equal?
- Is it possible that the resultant of two vectors be smaller than the smaller of the two vectors? If so, under what condition?
- Two equal forces have their resultant vector equal to either. What is the inclination between them?
- A wire is cut into half of its length, how would it affect the elongation under a given load?

#### 2. Answer in brief any TWO questions: (2×2=4)

- When we rub our hands, they are warmed but only to a certain maximum temperature, why? Explain.
- If the diameter of a wire is increased by 20%, What is the fractional change in its superficial expansivity?
- Two bodies at different temperature  $T_1$  and  $T_2$ , if brought in thermal contact do not necessarily settle at the mean temperature  $(T_1+T_2)/2$ , why?

#### 3. Answer, in brief, any one question: (1×2=2)

- What is the advantage of using a parabolic concave mirror as compared to a convex lens as the objective of a telescope?
- The bottom of the passenger side mirror on your car notes, "Objects in mirror are closer than they appear". Is this true? Why?

#### 4. Answer, in brief, any ONE question: (1×2=2)

- Does the Coulombian force obey Newton's third law of motion? Explain.
- Two identical metallic plates of exactly equal masses are taken, one is given a positive charge and the other an equal negative charge. Are their masses after charging equal?

### GROUP B

#### 5. Answer any three questions: (3×4=12)

- State the triangle law of vector addition. Obtain an expression for the resultant of two vectors  $P$  and  $Q$  inclined at an angle  $\theta$  with each other.
- What is horizontal projectile? Show that the path of the body is parabolic in nature when it is projected from a certain height. Derive an expression for the time of flight.
- The time period of a bob of a simple pendulum depends on the length of the pendulum and the acceleration due to gravity. Find the expression for the time period by dimensional method.
- What is elastic potential energy? Derive an expression for the energy stored in a stretched wire.

#### 6. Answer any two questions: (2×4=8)

- Define linear and cubical expansion of a solid and establish a relation between their coefficients.
- Distinguish between real and apparent expansion of a liquid. Describe with mathematical detail a method to determine the absolute expansivity of a liquid.
- What is specific heat capacity of a substance? Find the specific heat capacity of a solid by the method of mixture.

#### 7. Answer any one question: (1×4=4)

- Prove the relation  $1/f = 1/u + 1/v$ , for a concave mirror when the image formed is virtual, where  $u$ ,  $v$  and  $f$  have their usual meanings.

- b. What is spherical mirror? Derive the relation between radius of curvature and focal length of a convex mirror.

**8. Answer any one questions: (1×4=4)**

- a. What are inducing and inducing charges? How can you charge a metal rod positively by method of induction?
- b. State and explain Coulomb's law in electrostatics. Also define the dielectric constant and define one coulomb charge.

**GROUP C**

**9. Answer any three numerical problems: (3×4=12)**

- a. A body is projected at an angle of  $\theta$  and another ball is thrown at an angle of  $90^\circ - \theta$  with the horizontal direction from the same point with a velocity of 39.2m/s. The second ball reaches the 50m higher than the first ball. Find their individual heights ?
- b. How much force is required to punch a hole 1cm in diameter in a steel sheet 5mm thick whose shearing strength is  $2.76 \times 10^8 \text{N/m}^2$ .
- c. A stone is dropped from the top of a tall building and 1 second later, a second stone is thrown vertically down with a velocity of 20m/s. When and where will the second stone overtake the first.
- d. Assuming that the mass 'm' of the largest stone that can be moved by a flowing river depends on the velocity 'v', the density 'ρ' and acceleration due to gravity 'g'. Show that 'm' varies with sixth power of the velocity of the flow.

**10. Answer any two numerical questions: (2×4=8)**

- a. In an experiment of the specific heat of metal, a 0.2kg block of metal at  $150^\circ\text{C}$  is dropped in a copper calorimeter (of water equivalent 0.025kg) containing  $150\text{cm}^3$  of water at  $27^\circ\text{C}$ . The final temperature is  $40^\circ\text{C}$ . Compute the specific heat of the metal?
- b. What is the percentage change in length of a steel rod if the temperature changes from  $20^\circ\text{C}$  to  $30^\circ\text{C}$  (linear expansivity for steel is  $12 \times 10^{-6}/^\circ\text{C}$ )
- c. A steel tank is completely filled with 2.8 cubic meter of ethanol when both tank and ethanol are at a temperature of  $32^\circ\text{C}$ . When the tank and its contents have cooled to  $18^\circ\text{C}$ , what additional volume of ethanol can be put into the tank? (cubical expansivity for ethanol is  $75 \times 10^{-5}/\text{k}$ )

11. When a distance of an object from a concave mirror is decreased from 15cm to 9cm, the image gets magnified 3 times than that in first case. Calculate the focal length of the mirror? (4)

12. How far apart should the two electrons be if the force each exerts on the other is equal to the weight of the electron? (Given,  $e = 1.6 \times 10^{-19}\text{C}$  and  $m_e = 9.1 \times 10^{-31}\text{kg}$ ) (3)

**The End**



# The Times Secondary School

Dillibazar, Kathmandu

First Terminal Examination – 2076

Grade: - XI

Set – B

Full Marks:-75

Stream: Science

Pass Marks: 30

Subject: Physics

Time : 3 hrs

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate the full marks

## GROUP A

### 1. Answer, in brief, any SIX questions: (6×2=12)

- If the unit force is 100, unit of length is 10m and unit of time is 100s, what is the unit of mass in this system of unit?
- Why spring balance used for long time shows incorrect reading?
- Elasticity has a different meaning in physics than that in daily life?
- What should be the angle between the two vectors of same magnitude so that their resultant vector is equal to either of them.
- What is the angle of projection for a projectile motion whose range is  $n$  times the maximum height?
- The displacement of a body is proportional to the cube of time elapsed. What is the nature of the acceleration?
- Show that  $\vec{A} = (3\hat{i} + \hat{j} + \hat{k})$  and  $\vec{B} = (\hat{i} + 2\hat{j} - 5\hat{k})$  are perpendicular to each other.

### 2. Answer, in brief, any two questions: (2×2=4)

- The difference between lengths of a certain brass rod and that of steel rod is claimed to be constant at all temperature? Explain.
- If the length of a conductor is increased by 50%, What will be the percentage change in its linear expansivity?
- A body at a higher temperature contains more heat. Comment on it. Explain.

### 3. Answer, in brief, any one questions: (1×2=2)

- Two concave mirrors have the same focal length but the aperture of one is larger than that of other. Which mirrors form a sharper image?
- What do you mean by a virtual object? Explain how a plane mirror forms a real image?

### 4. Answer, in brief, any one questions: (1×2=2)

- What is the difference between charging a body by friction and induction?

- Describe the electronic theory of frictional electricity. Is the mass of a body affected during charging? Explain.

## Group B

### 5. Answer any three questions: (3×4=12)

- State the parallelogram law of vector addition. Derive the expression for the magnitude and direction of the resultant vectors inclined at an angle  $\theta$  with each other.
- What is projectile? Show that the path of the angular projectile is parabolic in nature?
- Define elastic limit and state Hooke's law and verify it experimentally.
- Using the method of dimensions derive an expression for the centripetal force 'F' acting on a particle of mass 'm' moving with velocity 'v' in a circle of radius 'r'.

### 6. Answer any two questions: (2×4=8)

- Define the coefficients of real and apparent expansion of liquid and derive the relation between them.
- Describe a method to determine the linear expansivity of a solid. Can the cubical expansivity be derived from this value?
- What is specific heat capacity of a substance? Determine the specific heat capacity of a spherical ball by method of mixture?

### 7. Answer any one questions: (1×4=4)

- Prove that  $1/f = 1/u + 1/v$ , for concave mirror, when image formed is real where  $u, v$  and  $f$  have their usual meanings.
- Prove the magnification for the convex mirror. Can it be expressed in terms of volume. Explain.

### 8. Answer any one questions: (1×4=4)

- What is electrostatic induction? How can you charge a given sphere negatively by method of induction?
- What is electric field and intensity? Show that the ratio of electrostatic force in a vacuum to the force in a medium is equal to dielectric constant.

## Group C

### 9. Answer any three numerical problems: (3×4=12)

- A body is dropped from the top of the tower 90m high and at the same time, another stone is projected vertically upward from the bottom. If they meet half way up, find the initial velocity of the projected body.
- The orbital velocity  $v$  of a satellite may depend on its mass  $m$ , distance  $r$  from the centre of the earth and acceleration due to gravity  $g$ . Obtain an expression for the orbital velocity.

- c. A body cover 12m in 2<sup>nd</sup> second and 20m in 4<sup>th</sup> seconds. What is the initial velocity of the body?
- d. A copper wire is 2m long is stretched by 1mm.If the load is suddenly withdrawn, calculate the rise in temperature of the wire?(Density of copper=8890 kg/m<sup>3</sup>, Young's modulus of wire= $11 \times 10^{10}$  Nm<sup>-2</sup>,sp.heat of copper=390J/kgK)

**10. Answer any two numerical problems: (2×4=8)**

- a. A one litre flask contains some mercury. It is found that at different temperature, the volume of air remains constant. What is the volume of the mercury? ( $\alpha$  for glass= $9 \times 10^{-6}/^{\circ}\text{C}$ ,  $\gamma$  for mercury= $1.8 \times 10^{-4}/^{\circ}\text{C}$ )
- b. A steel wire 8m long and 4mm in diameter is fixed to two rigid supports. Calculate the increase in tension when the temperature falls by 10<sup>o</sup>C.( $\alpha$  for steel = $12 \times 10^{-6}/^{\circ}\text{C}$ , Young's modulus for steel = $2 \times 10^{11}$ N/m<sup>2</sup>)
- c. The co-efficient of volume expansion of glycerine is  $49 \times 10^{-5}/^{\circ}\text{C}$ .What is the fractional change in its density for 30<sup>o</sup>C rise in temperature?
- 11. A object of 1cm<sup>2</sup> face area is placed at a distance of 1.5m from a screen. How far from the object should a concave mirror be placed so that it forms 4cm<sup>2</sup> image of an object o the screen? Also calculate the focal length of the mirror? (4)**
- 12. Four equal point charges each 16 $\mu$ C are placed on the four corners of a square of side 0.2m.Calculate the force on any charges. Given, $\epsilon_0=8.85 \times 10^{-12}\text{C}^2/\text{m}^2$  (3)**

**The End**