ST. LAWRENCE SECONDARY SCHOOL

CHABAHIL, KATHMANDU

SET-A

SECOND TERMINAL EXAMINATION – 2075

Grade: XI	Faculty: Science	FM: 75
Time: 3:00 Hrs.	**Subject: Physics (110)**	PM: 30

Group – A

1. Answer, in brief, any **SIX** questions. (6×2=12)
   a) In one of the printed documents the unit of universal gravitational constant is given as $Nmkg^{-2}$. Check its correctness from dimensional analysis.
   b) If $\vec{A}$ and $\vec{B}$ are non-zero vectors, is it possible for $\vec{A}\times\vec{B}$ and $\vec{A}$. $\vec{B}$ both to be zero? Explain.
   c) What would be the effect on maximum range in doubling the initial velocity of a projectile?
   d) It is easier to pull a lawn roller than to push it, why?
   e) A man carrying a bucket of water is walking on a level road with a uniform velocity. Does he do any work on the bucket while carrying it?
   f) Why is it more difficult to revolve a stone by tying it to a longer string than by tying it to a shorted string?
   g) Differentiate between elasticity and plasticity.
2. Answer, in brief, and **TWO** questions. (2×2=4)
   a) Explain why water remains cool in earthen pot in summer.
   b) What physical concept is provided by universal gas constant? Write its unit.
   c) Why do gases have two different specific heat capacities however liquid and solid have single?
3. Answer, in brief, any **ONE** question. (1×2=2)
   a) An empty test tube dipped into water in a beaker appears silvery when viewed from a suitable direction, why?
   b) A spherical mirror is immersed in water. Will its focal length change?
4. Answer, in brief, any **ONE** question. (1×2=2)
   a) Sharp projections are avoided in machines. Why?
   b) Why does a body get electrified when they are rubbed together for a while?

Group – B

5. Answer any **THREE** questions. (3×4=12)
   a) What are the laws of friction? How they are experimentally verified?
   b) Write expressions for workdone by a constant and a variable force. Show that the workdone by the resultant force on a particle is equal to the change in kinetic energy of the particle.
   c) Define centripetal force. Derive an expression for the force acting on a body moving with non uniform speed along a vertical circular path.
   d) What is young's modulus of elasticity? Deduce and expression for the energy stored in a stretched wire.
6. Answer any **TWO** questions. (2×4=8)
   a) Distinguish between real and apparent expansion of liquid. Describe with mathematical detail, a method to determine the real expansivity of a liquid.
   b) Define latent heat of fusion of ice. Describe the method for the measurement of it in the laboratory.
   c) State Boyle's and Charles's law. Describe how these laws are combined to derive ideal gas equation.
7. Answer any **ONE** question. (1×4=4)
   a) What causes the bending of light when it passes from one medium to another medium?

      Deduce the relation, $\mu = \frac{\text{Real depth}}{\text{apparent depth}}$
   b) Discuss the phenomenon of refraction through prism and show that the deviation of incident ray produced by a small angled prism for small angle of incident is independent of the angle of prism.

8. Answer any **ONE** question. (1×4=4)

a) State Gauss theorem in electrostatics. Use it to calculate electric field near an infinite plane sheet of charge.

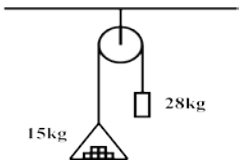
b) Define potential gradient and electric field intensity. Establish a relation between them.

Group – C

9. Solve any **THREE** numerical questions. (3×4=12)

a) A body is projected upwards making an angle θ with the horizontal with a velocity of 300m/s. Find the value of θ so that the horizontal range will be maximum. Hence find its range and time of flight.

b) A 15kg load of bricks hangs from one end of a rope that passes over a small frictionless pulley. A 28kg counterweight is suspended from the other end of the rope as shown in figure. The system is released from rest. Using free body diagram method, find the magnitude of upward acceleration of the load and the tension in the rope while the load is moving.



c) An object of mass 0.5kg is rotated in a horizontal circle by a string in 1m long. The maximum tension in the string before it breaks in 50N. What is the greatest number of revolutions per second of the object?

d) The rubber cord of a catapult has cross-sectional area 1.0mm^2 and total unstretched length 10cm. it is stretched to 12cm and then released to project a missile of mass 5g. Calculate the velocity of projection (Young's modulus of elasticity = $5 \times 10^8 N/m^2$).

10. Solve any **TWO** numerical questions. (2×4=8)

a) A brass pendulum clock keeps correct time at 15^{0}C. How many seconds per day it will lose or gain at 0^{0}C? (linear expansivity of brass = $2\times10^{-5}K^{-1}$)

b) What is the result of mixing 100g of ice at 0^{0}C and 100g of water at 100^{0}C? (Latent heat of fusion of ice = 336×10^3 J/kg, sp. heat capacity of water = 4200 J/kg^{0}K).

c) A copper wire of diameter 0.5mm is stretched between two points at 25^{0}C. Calculate the increase in tension in the wire if the temperature falls to 0^{0}C. (Young's modulus of copper = 1.2×10^{11} N/m^2, linear expansivity for copper = 18×10^{-6} K^{-1}).

11. A pole 4m long is laid along the principal axis of a convex mirror of focal length 1m. The end of the pole nearer the mirror is 2m from it. Find the length of the image of the pole. [4]

12. What distance must an electron move in a uniform potential gradient of 200v/cm in order to gain kinetic energy 3.2×10^{-18}J? [3]

Best of Luck

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SET-B

SECOND TERMINAL EXAMINATION – 2075

Grade: XI	Faculty: Science	FM: 75
Time: 3:00 Hrs.	**Subject: Physics (110)**	PM: 30

Group – A

1. Answer, in brief, any **SIX** questions. (6×2=12)
   a) A students writes an expression of the force causing body of mass(m) to move in a circular motion with velocity (v) as $F = mv^2$. Use the dimensional method to check it correctness.
   b) Should a quantity having magnitude and direction be necessarily a vector? Give examples.
   c) In rain a scooter may slip on the turning of a road. Why?
   d) A stationary mass suddenly explodes into two fragments; one heavy and another light. Which one has greater kinetic energy and why?
   e) Explain why cyclist inclines himself to the vertical while moving round a circular path?
   f) Can an object with constant acceleration reverse its direction?
   g) What is elastic limit and breaking stress?
2. Answer, in brief, and **TWO** questions. (2×2=4)
   a) Why do you feel cool in the mouth when you eat halls?
   b) Derive the numerical value of universal gas constant R in SI system.
   c) During the change of phase of a substance, heat is absorbed but temperature remains constant. Why?
3. Answer, in brief, any **ONE** question. (1×2=2)
   a) Why does sun looks slightly oval when it is near the horizon?
   b) When a burning candle is held in front of a thick glass mirror and viewed obliquely, a number of images of the candle are seen. Why?
4. Answer, in brief, any **ONE** question. (1×2=2)
   a) No two lines of force in an electric field ever intersect each other. Why?
   b) If the electric potential is zero at a point, is the electric field intensity also zero at that point? Explain.

Group – B

5. Answer any **THREE** questions. (3×4=12)
   a) State the laws of limiting friction. How would you measure the coefficient of friction between a body and an inclined plane?
   b) Define work. Derive an expression to calculate the work done by a variable force.
   c) What is conical pendulum? Derive an expression for its time period i.e. $T = 2\pi\sqrt{\frac{l\cos\theta}{g}}$
   d) Define young's modulus of elasticity. Explain how would you determine young's modulus for a material in the form of wire.
6. Answer any **TWO** questions. (2×4=8)
   a) Define the coefficient of real and apparent expansions of a liquid and derive a relation between them.
   b) What is specific heat capacity? Explain how you determine the specific heat capacity of a solid by the method of mixture.
   c) Derive expression for the pressure exerted by a gas on the basis of kinetic theory.
7. Answer any **ONE** question. (1×4=4)
   a) Derive mirror formula in the case of concave mirror. Also discuss the nature of the image formed due to object placed a different position.

b) Derive an expression for the refractive index of the material of the prism in terms of the refracting angle and angle of minimum deviation.

8. Answer any **ONE** question. (1×4=4)

a) State and explain Gauss theorem and use it to find the electric field intensity due to line charge.

b) Define electric field intensity and electric potential. Deduce an expression for the potential difference between two points in an electric field.

Group – C

9. Solve any **THREE** numerical questions. (3×4=12)

a) A baseball is thrown towards a player with an initial velocity 20m/s and 45^0 with the horizontal. At the moment the ball is thrown, the player is 50m from the thrower. At what speed and in what direction must be run to catch the ball at the same height at which it was released?

b) A light rope is attached to a block with mass 4kg that rests on a frictionless, horizontal surface. The horizontal rope passes over a frictionless pulley and a block with mass m is suspended from the other end. When the blocks are released, the tension in the rope is 10N. Draw free body diagrams and calculate the acceleration of either block and the mass m of the hanging block.

c) A stone with mass 0.8kg is attached to one end of a string 0.9m long. The string will break if its tension exceeds 600N. The stone is whirled in a horizontal circle, the other end of the string remains fixed. Find the maximum speed, the stone can attain without breaking the string.

d) A wire of length 2.5m and area of cross-section $1\times10^{-6}m^2$ has a mass of 15 kg hanging on it. What is the extension produced? How much is the energy stored in the extended wire if Young's modulus of elasticity $2 \times 10^{11}N/m^2$.

10. Solve any **TWO** numerical questions. (2×4=8)

a) A second pendulum made of brass keeps correct time at 10^0C. How many seconds it will lose or gain per day when the temperature of its surrounding rises to 35^0C? (linear expansivity of brass = $2\times10^{-5}K^{-1}$)

b) 10gm of steam at 100^0C is passed into a mixture of 100gm of water and 10gm of ice at 0^0C. Find the resulting temperature of the mixture.(Latent heat of ice = 80cal/gm, Latent heat of steam= 540cal/gm).

c) A glass flask of volume $400cm^3$ is just filled with mercury at 0^0C. How much mercury overflows when the temperature of the system is raised to 80^0C? (Coefficient of cubical expansion of glass is $1.2\times10^{-50}C^{-1}$ and that of mercury is $1.8\times10^{-50}C^{-1}$.

11. Light from a luminous point on the lower face of a rectangular glass slab, 2cm thick, strikes the upper face and the totally reflected rays outline a circle of 3.2cm radius on the lower face. What is the refractive index of the glass? [4]

12. An electron of charges $1.6\times10^{-19}C$ is situated in a uniform electric field of intensity 120,000V/m. Find the force on it and its acceleration.

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SET-A

SECOND TERMINAL EXAMINATION – 2075

Grade: XII	Faculty: Science	FM: 75
Time: 3:00 Hrs.	**Subject: Physics (210)**	PM: 30

Group – A

1. Answer in brief **any four** questions. (4×2=8)

   a) A uniform wire of resistance RΩ is bent in the form of circle. What is the effective resistance across two ends of diameter?

   b) How is magnetic field made radial in a moving coil galvanometer?

   c) "The potentiometer wire must be long and uniform thickness" why?

   d) What is self inductance? Explain.

   e) Define magnetic field in terms of force on conductor.

   f) Lenz law follows the principle of conservation of energy. Explain.

2. Attempt **any four** questions. (4×2=8)

   a) Explain why a discharge tube appears dark when evacuated to very low pressure.

   b) According to properties of charges, like charges repel each other. Then, how do the protons in a nucleus stay together?

   c) In TV usually a magnetic field is used to deflect the electron beam and not electric field why?

   d) A photon and electron have got same De-Broglie wavelength. Which has greater total energy? Explain.

   e) If a radioactive nucleus has a half life of one year, will it be completely decayed at the end of two years? Explain.

   f) What is energy crisis? Explain.

3. Attempt **any one** questions. (1×2=2)

   a) Although the density of solid is high, the velocity of sound is greater in solid. Why?

   b) If water used in a resonance tube is replaced by oil then is there any change in the resonating length and frequency?

4. Attempt **any one** questions (1×2=2)

a) What will be the effect on the fringes formed in Young's double slit experiment, if the apparatus is immersed in water?

b) Can two wavefronts intersect each other?

Group – B

5. Attempt **any three** questions. (3×4=12)

a) State Biot-Savart law and use it to find magnetic field due to a long straight current carrying conductor.

b) State and explain Kirchhoff's laws of current and voltage. Explain how these laws are used to obtain balance condition of Wheatstone bridge.

c) Describe the principle and working of a.c generator.

d) What is angle of dip? Show that $cot^2\partial = cot^2\partial_1 + cot^2\partial_2$, where the symbols have their usual meanings.

6. Attempt **any three** questions. (3×4=12)

a) Discuss the theory of Millikan's oil drop experiment to determine the charge of an electron.

b) Define binding energy. Draw a graph showing the relation between the binding energy per nucleon and atomic number.

c) State the law of radioactive disintegration. Derive a relation between half life and decay constant.

d) State Bohr's postulate and hence derive expression for the radius of n^{th} orbit to hydrogen atom.

7. Attempt **any one** questions. (1×4=4)

a) Discuss transverse vibrations in a stretched string. Derive the formula for the frequency of various mode of vibration.

b) Write down the Newton's formula for the velocity of sound in air. Explain why this formula has to be modified. Discuss Laplace's correction on it.

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

a) Describe Michelson's method to determine the velocity of light.

b) Explain the Newton's ring to calculate the radius of bright and dark fringes.

Group – C

9. Attempt **any two** questions. (2×4=8)

a) A long solenoid of 1000 turns and cross sectional area $2x10^{-3}$ m^2 carries a current of 2A and produces a flux density $52x10^{-3}$T inside it. Calculate the self-inductance of the coil.

b) A jet plane is travelling due west at the speed of 1800km/hr. What is the voltage difference developed between the ends of the wings 25m long, if the earth's magnetic field at the location is $5x10^{-4}$T and the dip angle is 30^o.

c) A moving coil meter has a resistance of 25Ω and indicates full scale deflection when a current of 4 mA flows through it. How could this meter be converted to voltmeter with 0-3 range and to ammeter with 0-1 range.

10. Attempt **any two** questions. (2×4=8)

a) At certain instant a piece of radioactive material contained 10^{12} atoms. The half-life of the material is 15 days. Calculate the rate of decay after 30days have elapsed.

b) The energy by fission of one U^{235} atom is 235MeV. Calculate the energy released in Kwhr, when one gram of uranium undergoes fission.

c) Compute the de Broglie wave length of a proton whose kinetic energy is equal to the rest mass energy of an electron. Mass of proto is 1836 times that of electron. (m=9.1 $\times 10^{-31}$kg, C= 3×10^8 m/s h=6.62×10^{34}Js)

11. An open pipe 30 cm long and a closed pipe 23 cm long both of the same diameters are each sounding its first overtone and they are in unison. What is the end correction of these pipes? (4)

12. The interference pattern is observed at 4.75m from the slit of the coherent source of two Wave length 700nm and 400m pass through two thin slit separation of 0.275mm. What is the distance on the screen between 3rd order bright fringes for two light waves? (3)

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SECOND TERMINAL EXAMINATION – 2075

Grade: XII	Faculty: Science	FM: 75
Time: 3:00 Hrs.	**Subject: Physics (210)**	PM: 30

Group – A

1. Answer in brief **any four** questions. (4×2=8)
   a) If a square is made of uniform wire of resistance R on each side, what is the equivalent resistance between the ends of a diagonal?
   b) Free electron always keep on moving in a conductor. But no force acts on them in a magnetic field unless a current is passed through it. Why?
   c) Birds sitting on a high tension line wire fly off when current is switched ON. Why?
   d) Distinguish between Dia and para-magnetic substances on the basis of susceptibility.
   e) What is the significance of the area of a hysteresis loop?
   f) What is eddy current? Write down its uses.
2. Attempt **any four** questions. (4×2=8)
   a) Explain why clock oil used in Millikan's experiment? Can we use water in place of clock oil.
   b) Why is neutron considered the most effective bombarding particle in a nuclear reaction?
   c) Why is sunlight not deflected when passes through either electric field or magnetic field?
   d) What would be the kinetic energy of the particle if De-Broglie wavelength is doubled?
   e) Which has more energy a photon in infrared or in ultraviolet? Give reason.
   f) What are the main sources of energy in context of Nepal.
3. Attempt **any one** questions. (1×2=2)
   a) Explain with figure, the formation of second overtone of waves in an open organ pipe.

b) Justify the proverbs "An empty vessel makes much noise".

4. Attempt **any one** questions (1×2=2)

a) When a low flying aircraft passes overhead, a slight shaking of the picture on TV screen is noticed, why?

b) Which parameter of light does not change on refraction?

Group – B

5. Attempt **any three** questions. (3×4=12)

a) State and explain Ampere's theorem and use it to calculate the magnetic field due to a long solenoid.

b) State Joule's law of heating and verify it experimentally.

c) What is Lenz's law? Deduce an expression for the emf induced in a straight conductor moving in a uniform magnetic field.

d) Define permeability and susceptibility of magnetic materials. Derive a relation between them.

6. Attempt **any three** questions. (3×4=12)

a) Describe the motion of electron in magnetic field. Also calculate time period.

b) What is nuclear fission? How energy is released in nuclear fission reaction?

c) Obtain $N = N_0 e^{-\lambda t}$ in radioactive decay law. Describe the significance of decay curve.

d) Using Bohr's Postulate, Calculate the energy of electron in n^{th} orbit of hydrogen atom.

7. Attempt **any one** questions. (1×4=4)

a) Distinguish between harmonics and overtones. Derive an expression for n^{th} overtones of an open organ pipe.

b) What is end correction? How can you determine end correction of a closed pipe by resonance method?

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

a) Describe Foucault's method to determine the velocity of light.

b) Explain young's double slit interference of light for the bright and dark fringes.

Group – C

9. Attempt **any two** questions. (2×4=8)

a) The value of dip at a place is 45^0. If the plane of the dip circle as turned through 60^0 from the meridian, what will be the apparent dip?

b) A 60cm long wire of mass 10gm is suspended horizontally in a transverse magnetic field of flux density 0.4T through two springs at its two ends. Calculate the current required to pass through the wire so that there is zero tension in the spring.

c) A tightly coiled spring having 75 coils, each 3.50cm in diameter is made of insulated metal wire 3.25mm in diameter. An ohm meter connected across its opposite ends reads 1.74Ω. What is the resistivity of metal?

10. Attempt **any two** questions. (2×4=8)

a) The energy liberated in the fission of single Uranium-235 atom is 3.2×10^{-11}J. Calculate the power production corresponding to the fission of 1gm of Uranium per day. Assume Avogadro constant as 6×10^{23}mol^{-1}.

b) A radioactive source which has the half life of 130 days contains initially 1×10^{20} radioactive atoms, and the energy released per disintegration is 8×10^{-13} J, Calculate the activity of the source after 260 days have elapsed and total energy released during this period.

c) An electron initially at rest is accelerated through a potential difference of 5000 V. Compute the momentum de Broglie's Wavelengths and the Wave number of electron wave.

11. A piano string 1.5m long is made of steels of density 7.7×10^3 Kgm^{-3} and young's Modulus of $2 \times 10^{11} Nm^{-2}$.It is maintained a tension which produces an electric strain of 1% in the string. What is the fundamental frequency of transverse vibration of the string? (4)

12. Newton's rings are observed in reflecting light of wavelength 5900A°. The diameter of 10^{th} dark ring is 0.50cm. Find the radius of curvature of the lens and the thickness of the oil film. (3)

Best of Luck