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 མུ་ཏིག་ཐང་འཕྲིན་རིམ་སློབ་གྲྭ་ཤོང་མ།



**MOTITHANG HIGHER SECONDARY SCHOOL
 THIMPHU THROMDE**

“Every child is **inspired** to learn and **empowered** with **wisdom** to excel in life”
TRIAL EXAMINATIONS, 2020

Physics Paper 1 (Theory)

Class: XII

Date:

Name:

Reading Time: 15 mins

Writing Time: 3 hours

Full marks: 100

Invigilator’s initial

Roll No. Class: Sec:

Question	For Teacher’s Use Only												Grand Total
	Section A(40)					Section B(60)							
	1a (15)	1b (5)	1c (5)	1d (5)	1e (10)	Q2 (10)	Q3 (10)	Q4 (10)	Q5 (10)	Q6 (10)	Q7 (10)	Q8 (10)	
Award													
Teacher’s initial													
Total Marks Awarded													

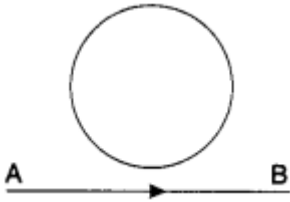
READ THE FOLLOWING DIRECTIONS CAREFULLY:

1. Do **not** write for the first **15 minutes**. This time is to be spent reading the questions
2. After having read the questions, you will be given **three hours** to answer all questions.
3. Answer **all** the questions in section A. answer any **six** questions from section B.
4. All workings, including rough work should be done on the same sheet and adjacent to the rest of the answer. The intended marks for the questions are given in brackets [].
5. A list of useful physical constants is given at the end of the question paper.
6. Remember to write **quickly** but **neatly**.

Section A (40 marks)
Answer **ALL** the questions

Question 1

(a) *Each question is followed by four possible choices of answers. Choose the correct alternative and circle it. Do not circle more than one alternative. If there are more than one choice circled, NO score will be awarded.* [15]

- (i) A particle executing S.H.M. has a maximum speed of 30 cm/s and a maximum acceleration of 60 cm/s^2 . The period of oscillation is
(a) π s. (c) 2π s.
(b) $(\pi/2)$ s. (d) (π/t) s.
- (ii) Electric conduction in a semiconductor occurs due to
(a) electrons only. (c) neither electrons nor holes.
(b) holes only. (d) both electrons and holes.
- (iii) A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then its focal length will
(a) become zero (c) become small, but non-zero
(b) become infinite (d) remain unchanged
- (iv) In the given figure current from A to B in the straight wire is decreasing. The direction of induced current in the loop is
(a) clockwise
(b) anticlockwise
(c) changing direction
(d) nothing can be said
- 
- (v) The rotation of earth about its axis is
(a) periodic motion. (c) damped motion.
(b) simple harmonic motion. (d) non-periodic motion.
- (vi) When a ray of light enters from one medium to another, then which of the following does not change?
(a) Frequency (c) Speed
(b) Wavelength (d) Amplitude
- (vii) What happens to the interference pattern when the two slits S_1 and S_2 in Young's double experiment are illuminated by two independent but identical sources?
(a) The intensity of the bright fringes doubled.
(b) The intensity of the bright fringes becomes four times.
(c) Two sets of interference fringes overlap.
(d) No interference pattern is observed.

(viii) The particle which is made up of 1 up quark and 2 down quark is

- (a) Electron. (c) Neutron.
 (b) Proton. (d) Positron.

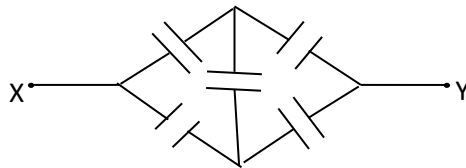
(ix) Donor impurity atoms in semiconducting material results a new

- (a) wide energy band (c) discrete energy level just below conduction band
 (b) narrow energy band (d) discrete energy level just above valance band

(x) If temperature increases, angle of contact

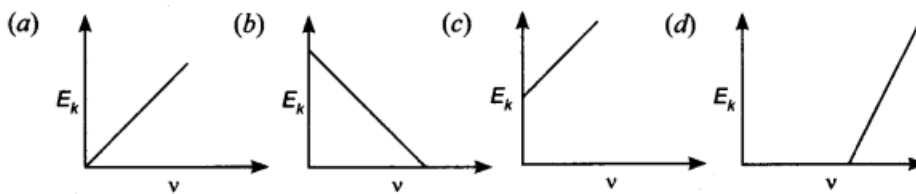
- (a) decreases. (c) increases.
 (b) remains constant. (d) fluctuates.

(xi) The capacitors in the given circuit diagram have equal capacitance of $10\mu\text{F}$ each. What is the equivalent capacitance between X and Y?



- (a) $50\mu\text{F}$. (c) $20\mu\text{F}$.
 (b) $40\mu\text{F}$. (d) $10\mu\text{F}$.

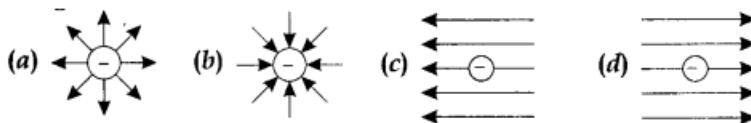
(xii) Maximum kinetic energy (E_k) of a photoelectron varies with frequency (ν) of the incident radiation as



(xiii) In the nuclear reaction ${}^{11}_6\text{C} \rightarrow {}^{11}_5\text{B} + \beta^+ + X$, what does X stand for?

- (a) Electron (c) Neutron
 (b) Proton (d) Neutrino

(xiv) Which of the following figures represent the electric field lines due to a single negative charge?



(xv) At resonance frequency the impedance in series LCR circuit is

- (a) maximum (c) zero
(b) minimum (d) infinity

(b) Fill in the blanks.

[5]

- (i) Simple harmonic motion is a _____ projection of uniform circular motion on the _____ of the circle in which the circular motion occurs.
- (ii) Whenever the amount of _____ linked with a circuit changes, an emf is induced in circuit and direction of current induced in a wire moving in a magnetic field is found using _____
- (iii) In a concave mirror, the virtual object and the _____ image combinations are not possible while in a convex mirror, a real object cannot form a _____ image.
- (iv) If liquid _____ in a tube, the angle of contact would be acute because the force of _____ is more.
- (v) In a single slit diffraction experiment, if a beam of red light is replaced by the blue light, the diffraction fringes become _____.
- (vi) Electric flux is a _____ quantity.

(c) Match each item of Column A with the most appropriate item of Column B. Rewrite the correct pairs by writing the number and the corresponding alphabet in your answer sheet.

[5]

Column A	Column B
i. Solar dynamo	a. Charge independent
ii. Photon absorption	b. Telescope
iii. Strong force	c. Sunglasses
iv. Quarks	d. Intensity
v. Convex mirror	e. Leptons
vi. Streamline	f. Frequency
vii. Fission	g. Hadrons
viii. Photoelectron emission rate	h. Tube of flow
ix. Control rods	i. Differential rotation
x. Coronagraph	j. Street lamp
	k. Neutrons
	l. Charge dependent
	m. Neutron transmutation doping

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ix. Control rods	
x. Coronagraph	

(d) Correct the following statements.

[5]

(i) Thermistors are generally made up of insulators.

.....

(ii) Sunspots are cooler because of intense magnetic field which allow the rise of the heat from the solar interior.

.....

(iii) The capacitance of a parallel plate capacitor increases K times if the space between the plates of the capacitor is completely filled with conducting material having dielectric constant k.

.....

(iv) $\phi = \frac{NI}{\mathfrak{R}}$ is called Ohm's law of electricity.

.....

(v) In diffraction pattern, all the bright and dark fringes are of equal width.

.....

(e) Answer the following questions:

[10]

(i) What will be the consequences if aircraft are manufactured in such a way that angular frequency of wings coincides with frequency of engine of aircraft? State one real-life example which is due to the same phenomenon. [2]

(ii) When two devices were given the same voltage and the surrounding temperature was gradually increased, device A showed increase in current and device B showed decrease in current. What conclusions can you draw about the nature of the wires used in the devices? Support your answers with reasons. [2]

(iii) Represent with an equation how quarks change during β – decay. [1]

(iv) In a single slit experiment, how will the angular width of central bright maximum fringe change if you decrease the slit width? Support your answers with equation. [1]

(v) Two neutral bodies A and B are rubbed together to charge them. If these charged bodies A and B are kept at a certain distance apart, draw the electric lines of force due to these two charged bodies. [1]

(vi) Do you believe that nuclear fusion reactor is the potential future energy source? Support your answer with suitable reasons. [1.5]

(vii) You are provided with two convex lenses A and B of focal lengths 10 cm and 60 cm respectively, and a concave lens C of focal length 50 cm. If you are asked to design a pair of spectacles of power +8D, which pair of lenses will you choose? Show your work. [1.5]

Section B (60 marks)
Answer *any SIX* questions

Question 2

(a) What will be the difference in the wavefronts if a point source of light is near and far away at infinity? [1]

(b) Imagine yourself falling vertically downwards. Represent graphically how your velocity changes as you fall in presence and in absence of drag force. [2]

(c) Using a mirror, you want to focus an upright image of double the size of the object on the screen. What type of mirror will you use? If your mirror has a focal length of 20 cm, at what distance will you place your object in front of the mirror for this situation? [3]

(d) Differentiate between interference and diffraction based on the fringe pattern. [2]

(e) (i) What would happen to time period of a swing if a girl swinging in sitting position stands? Why? [1]

(ii) What would happen to the time period if she swings in the same swing at higher altitude than before? Why? [1]

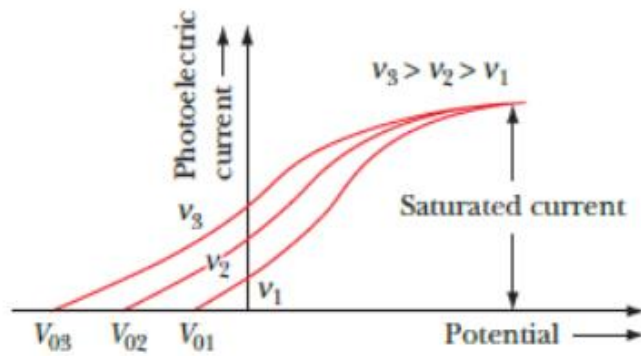
Question 3

(a) What is pair annihilation? [1]

(b) Derive expressions for velocity and acceleration for S. H. M. Also plot the graphs for the two. [3]

(c) A photoelectric experiment was conducted taking radiation of different frequencies (ν) but of same intensity, and the variation between photoelectric current and potential of plate A is

obtained and is shown in the graph. What conclusions can you draw from this experiment? [2]



(d) A particle called K^- anti-meson is made up of an anti-up and strange quarks. Based on this information, predict the charge and baryon number of the K^- . [2]

(e) Why do you think p-p cycle is not feasible on earth but on Sun?

[2]

Question 4

(a) A capacitor has no charge. Is its capacitance zero? Give one factor that determines the capacitance of the capacitor?

[1]

(b) Suppose sphere A has a charge of $-50e$ and sphere B has a charge of $+20e$. The spheres are made of conducting materials and are identical in size. If the spheres touch each other and then separated by distance of 2 mm, what is the resulting coulomb's force between them? [2]

(c) Derive lens equation with the help of a diagram.

[3]

(d) Do you think our Earth will experience “little ice age” ever again? Why?

[2]

- (e) Under what conditions does the Bernoulli's equation hold strictly? What happens if the liquid has viscosity? [2]

Question 5

- (a) What are the factors that influences the amount of insolation received on earth? [2]

- (b) You have designed a toy that undergoes SHM. Discuss the variation of kinetic energy and potential energy of the toy using a graph. [2]

- (c) Two coils are at fixed location. When coil 1 has no current and current in coil 2 increases at the rate of 15 A/s, the emf induced in coil 1 is 25 mV. (i) What is their mutual inductance?
(ii) When coil 2 has no current and coil 1 has a current of 3.6 A, what is the flux linkage in coil 2? [3]

- (d) Obtain the binding energy per nucleon of a nitrogen nucleus. Given mass of ${}_{7}\text{N}^{14} = 14.00307\text{u}$. [3]

Question 6

- (a) A step-up down transformer operated on a 2.5 kV line. It supplies a load with 20 A. The ratio of the primary winding to the secondary is 10 :1. If the transformer is 90% efficient, calculate
i. the power output
ii. the voltage and
iii. the current in the secondary coil. [3]

(b) Dawa charged a parallel plate capacitor with a battery and then disconnected it. He then decreased the distance between the plates. What changes he will observe in (i) capacitance (ii) charge on the plates and (iii) stored energy of the capacitor? Give reasons or supporting equations for your answer. [3]

(c) In LCR circuit, voltage leads the current. Do you agree with this statement? Support your judgement. Also draw phasor diagram. [2]

(d) In young's double slit experiment using monochromatic light of wavelength 600 nm, interference pattern was obtained on the screen kept at 1.5 m away from the two slits. Calculate the distance between the slits if the fringe width was found to be 1mm. [2]

Question 7

(a) Differentiate between periodic and oscillatory motion. Give an example for each. [2]

(b) Do you think adding solute in a liquid increases surface tension? Explain using an example. [2]

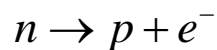
(c) In a photoelectric cell, a retarding potential of 0.5 V is required to block the moment of electrons from the cathode when monochromatic light of wavelength 400 nm is incident on the surface. Find the work function of the material of the cathode. [3]

- (d) A $50 \mu\text{F}$ capacitor, a 30Ω resistor and 0.7 H inductor are connected in series to an AC supply which generates a voltage V given by $V = 300 \sin 200t$ volt. Calculate peak value of the current flowing through the circuit. [3]

Question 8

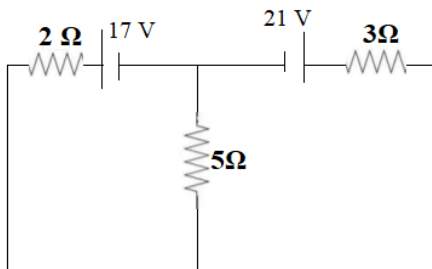
- (a) Which wave: radio wave or visible light wave will diffract more around the building? Why? [1]

- (b) Show if the lepton number is conserved in the following reaction. If it is not conserved what needs to be done to conserve the lepton number. [2]



(c) As a kid you must have rubbed a comb on your hair and tried to attract paper pieces. Do you think a metal spoon will do the same trick? Why? What relation does this experiment give between electrostatic force and gravitational force? [2]

(d) Determine the current through each resistor in the circuit given. [3]



(e) A capacitor blocks dc and allows ac. Why? How will inductor affect dc?

[2]

[PHYSICAL CONSTANTS]

Acceleration due to gravity	$g = 9.8 \text{ m/s}^2$
Avogadro's number	$N_A = 6.022 \times 10^{23}$
Boltzmann constant	$k = 1.38 \times 10^{-23} \text{ J/K}$
Density of water at 4°C	$\rho = 1000 \text{ kg/m}^3$
Electron charge	$e = 1.6 \times 10^{-19} \text{ C}$
Energy equivalent of	$1 \text{ u} = 931.5 \text{ MeV}$
Mass of an electron	$m_e = 9.1 \times 10^{-31} \text{ kg}$
Mass of a neutron	$m_n = 1.008665 \text{ u}$
Mass of a proton	$m_p = 1.007276 \text{ u}$
Permeability of free space	$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$
Permittivity of free space	$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$
Planck's constant	$h = 6.63 \times 10^{-34} \text{ J.s}$
Speed of electromagnetic wave	$c = 3 \times 10^8 \text{ ms}^{-1}$
Standard atmospheric pressure	$1 \text{ atm} = 101325 \text{ Pa}$
Universal gas constant	$R = 8.31 \text{ J/mol.K}$
1 electron volt	$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$
Planck's constant	$h = 6.63 \times 10^{-34} \text{ J.s}$
Energy equivalent of	$1 \text{ u} = 931.5 \text{ MeV}$
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