



ཤེས་རིག་རྒྱན་ལག།
ལུ་ཏིག་ཐང་འཐིང་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, 2019

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:

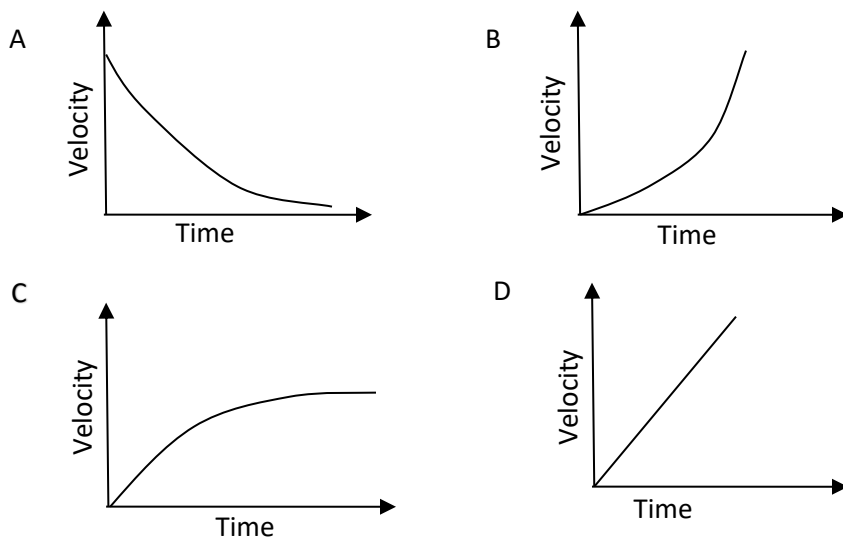
1. Do **not** write for the first **15 minutes**. This time is to be spent reading the questions
2. After having read the questions, you will be given **three hours** to answer all questions.
3. Answer **all** the questions in section A. answer any **six** questions from section B.
4. All workings, including 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 choices circled, NO score will be awarded. [15]
- (i) Oil spreads over the surface of water whereas water does not spread over the surface of the oil because
- A. Surface tension of oil is higher than that of water.
 - B. Surface tension of water is higher than that of oil.
 - C. They have almost equal surface tension.
 - D. Surface tension of water is very low.
- (ii) The indicator on the dashboard of a car glows when overheating of its engine takes place. Such indicator of the car is connected to
- A an ultrasonic sensor.
 - B a thermistor.
 - C an IR sensor.
 - D an LDR.
- (iii) A ray initially parallel to the principal axis of concave mirror reflects through
- A. the center of curvature of the mirror
 - B. the focus of the mirror
 - C. the optical center of the mirror
 - D. the radius of curvature of the mirror
- (iv) When you double the number of turns without changing the length of the solenoid, its self-inductance becomes
- A. Quadrupled.
 - B. Doubled.
 - C. Halved.
 - D. Tripled.
- (v) A SHM is represented by $x(t) = 10 \sin(20t - 0.5)$ meter. The amplitude and angular frequency are:
- A. $A = 10\text{m}; \omega = 20 \text{ rad/s.}$
 - B. $A = 20\text{m}; \omega = 10 \text{ rad/s.}$
 - C. $A = 10\text{m}; \omega = 20 \text{ rad/s.}$
 - D. $A = 0.5\text{m}; \omega = 10 \text{ rad/s.}$
- (vi) If you want to burn a piece of paper using sun light and a convex lens, you would place the piece of paper to be burnt
- A. At F
 - B. At 2F
 - C. Between F and 2F
 - D. Between F and optical centre.
- (vii) In young's double slit experiment, if blue light is replaced by red light, the fringe width will
- A. Increase.
 - B. Decrease.
 - C. Remain same.
 - D. Disappear
- (viii) A particle which is not composed of quarks and anti-quarks is
- A proton.
 - B neutron.
 - C meson.
 - D electron.
- (ix) The semiconductors having only a single type of atoms as their constituent particles are
- A. Extrinsic semiconductors.
 - B. Intrinsic semiconductors.
 - C. Compound semiconductors.
 - D. Impure semiconductors.

(x) The velocity versus time graph for a body falling in a viscous fluid is



(xi) The voltage in a capacitor during charging process

- A. increases exponentially.
- B. decreases exponentially.
- C. increases linearly.
- D. decreases linearly.

(xii) In a photoelectric experiment, the wavelength of the incident radiation is reduced from 6000 \AA to 4000 \AA , while the intensity of radiation remains same, then:

- A. the cut-off potential will decrease.
- B. the cut-off potential will increase.
- C. the photoelectric current will increase.
- D. the photoelectric current will decrease.

(xiii) The particle 'X' in the following nuclear reaction ${}_1\text{H}^1 + {}_1\text{H}^3 \rightarrow {}_2\text{H}^3 + \text{X}$ is

- A electron
- B proton
- C neutron
- D meson

(xiv) For a particle executing SHM, which of the following statements is **not** correct?

- A. The total energy of the particle always remains the same
- B. The restoring force is always directed towards an equilibrium position
- C. The restoring force is maximum at the extreme position
- D. The acceleration of the particle is maximum at the equilibrium position

(xv) For which of the following combinations, the LCR series circuit is in resonance?

- A $X_L = 50 \Omega$, $X_C = 100 \Omega$ and $R = 50 \Omega$
- B $X_L = 100 \Omega$, $X_C = 50 \Omega$ and $R = 50 \Omega$
- C $X_L = 50 \Omega$, $X_C = 100 \Omega$ and $R = 100 \Omega$
- D $X_L = 50 \Omega$, $X_C = 50 \Omega$ and $R = 100 \Omega$

(b) Fill-in-the-blanks with appropriate words.

[5]

- (i) At mean position, the total energy of a particle executing SHM is in the form of..... energy whereas at the extreme positions, the total energy of particle is in the form of energy.
- (ii) AC generator is based on the principle ofand the direction of induced emf is given by.....
- (iii) The lateral magnification of a spherical mirror is the ratio of height of the.....to the height of the.....
- (iv) When the angle of contact is acute, the force ofis greater than the force of
- (v) When the piston of the air pump is pushed in, the volume of air trapped under the piston decreases due to law.
- (vi) If the angle between the electric field vector and area vector is 90 degree, then the electric flux through this surface area is

(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 cycle	a. Concave mirror
ii. de-Broglie hypothesis	b. periodic
iii. Combination of three quarks	c. Conservation of mass
iv. Neutrino	d. oscillatory
v. Shaving mirror	e. Maximum kinetic energy
vi. Equation of continuity	f. MRI of a human brain
vii. Controlled chain reaction	g. Matter waves
viii. Stopping potential (V_0)	h. pores
ix. Resonance	i. Fusion reactor
x. Smaller sunspots	j. Fission reactor
	k. Lepton
	l. Baryon
	m. Convex mirror

Column A	Column B
i. solar cycle	
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viii. Stopping potential (V_0)	
ix. Resonance	
x. Smaller sunspots	

(d) Correct the following statements.

[5]

(i) In semiconductors, the valence band is completely filled, the conduction band is empty and the forbidden gap is quite large.

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(ii) Solar irradiance is the amount of solar energy available at a given location, per unit area and time.

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(iii) Two capacitors P and Q of capacitances $2C$ and $3C$ are connected in series. The ratio of charge on P and Q is 2:3.

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(iv) Step down transformer increases the voltage but decreases the current.

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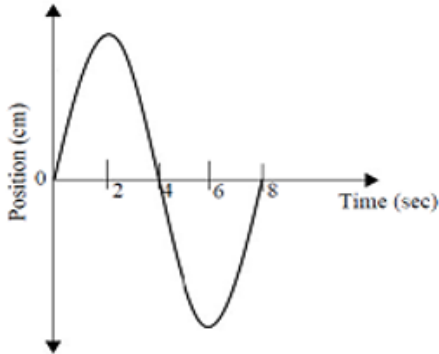
(v) Diffraction of sound waves is more pronounced because its amplitude is very large.

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(e) Answer the following questions:

[10]

- (i) The graph given represents the position of a ball attached to a spring oscillating in simple harmonic motion. When will the ball have maximum velocity and acceleration? [2]



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- (ii) Sonam designed two electrical circuits A and B using two different wires. Both the circuits were connected to same DC voltage of 12 V. In each circuit, he connected an ammeter. He kept both the circuits near a hot Bukhari. After sometimes, he noticed that the ammeter reading in circuit A was gradually increasing while in the ammeter in circuit B was gradually decreasing. What conclusions can you draw about the nature of the wires used in the circuits? Support your answers with reasons. [2]

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

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- (iv) Absolute temperature of gas is increased four times its original value. What will be the change in r.m.s. velocity of its molecules? [1]

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- (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 force due to these two charged bodies. [1]

(vi) Which one would you prefer: nuclear fission or nuclear fusion to generate electricity on earth? Support your answer with suitable reason. [1.5]

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(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 want to design a pair of spectacles of power +8D, which pair of lenses will you choose? Show your work. [1.5]

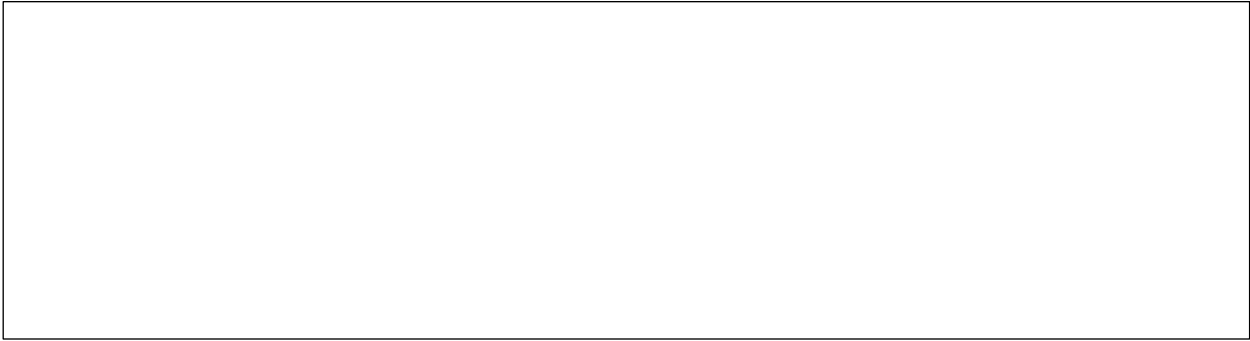
Section B (60 marks)
Answer *any SIX* questions

Question 2

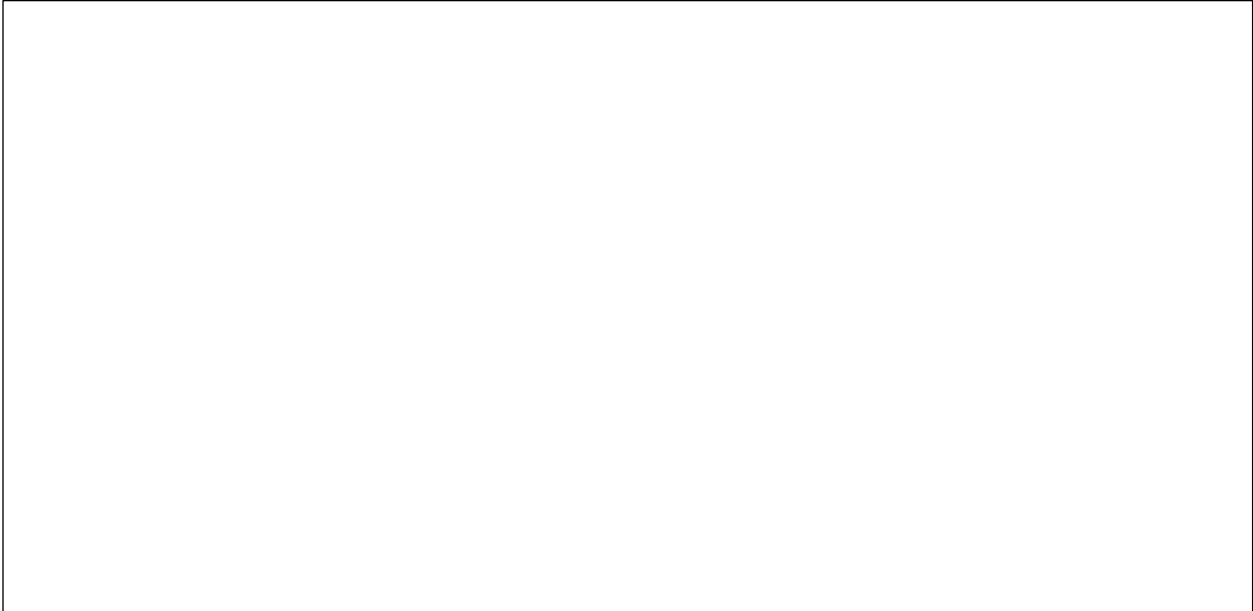
(a) State Dalton's law of partial pressure. [1]

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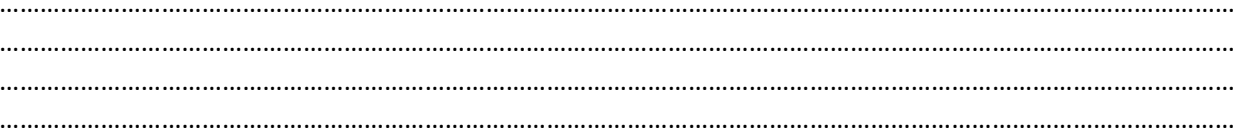
(b) Two metal spheres A and B of same material are dropped through a viscous fluid of viscosity η . If the radius of the sphere A is twice the radius of sphere B, find the ratio of terminal velocity of spheres A and B. [2]



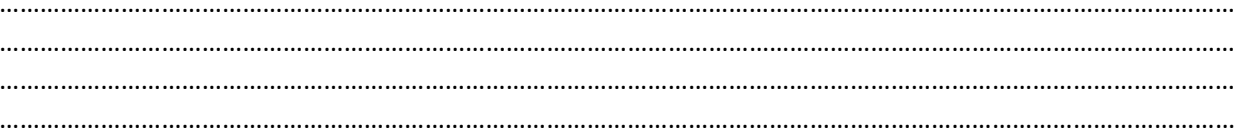
(c) Using a mirror, you want to focus an upright image of double the size of the object on the screen. What type of mirror will you use? If your mirror has a focal length of 20 cm, at what distance will you place your object in front of the mirror? [3]



(d) In a single slit experiment, how will the angular width of central bright maximum fringe change when (i) slit width is decreased and (ii) light of smaller wavelength is used? Support your answers with equations. [2]



(e) Will a pendulum clock gain or lose time, when taken to the top of a mountain? Justify your answer. [2]



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Question 3

(a) Write down any two properties of carbon nanotube. [1]

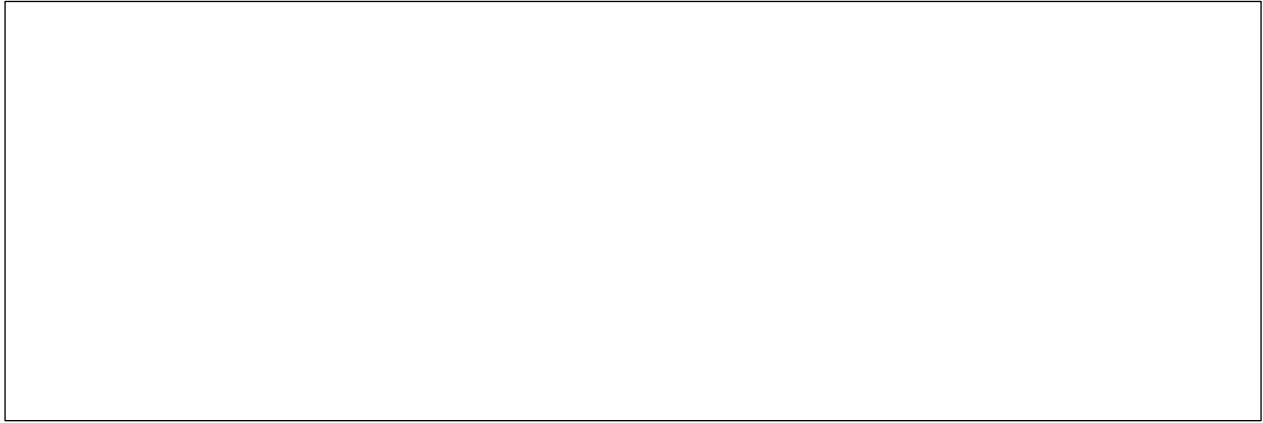
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(b) The displacement of S.H.M is given by $x(t) = A\cos 2\pi ft$. Deduce an expression for velocity and acceleration of S.H.M from above displacement equation. Also represent velocity and acceleration graphically. [3]

(c) In Davisson-Germer experiment, state the observations which led to (i) show the wave nature of the electron and (ii) confirm the de-Broglie relation. [2]

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(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) What do you think would happen if natural uranium is used instead of enriched uranium fuel in the nuclear reactor? Give reason for your answer. [2]

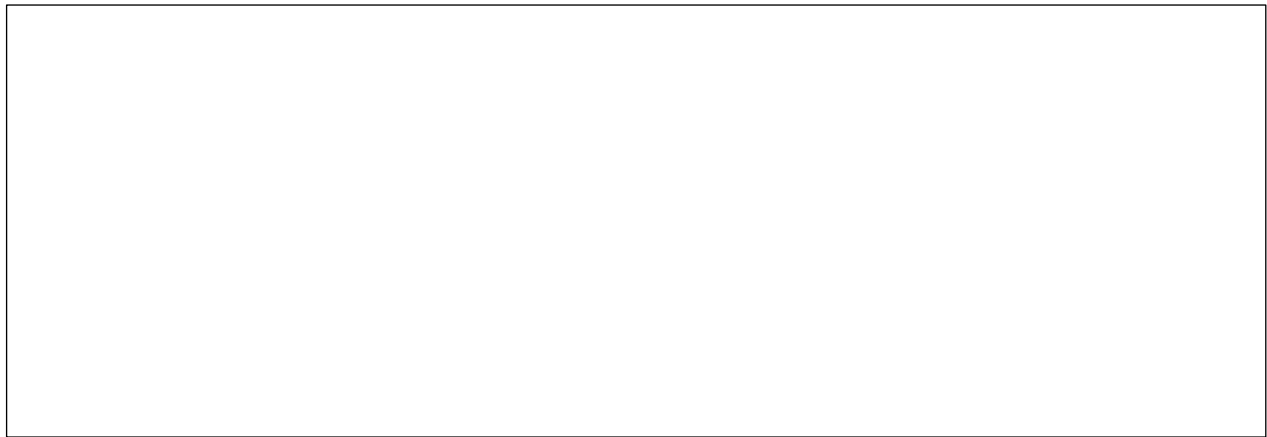
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Question 4

(a) A capacitor has no charge. Is its capacitance zero? Give one factor that determines the capacitance of the capacitor? [1]

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(b) The two point charges $+q$ and $+4q$ are separated by a distance of $6a$. Find the point joining the two charges where the electric field is zero. [2]



(c) Derive lens equation with the help of a diagram. [3]



(d) Do you believe that nuclear fusion reactor is the potential energy source in future? Support your answer with suitable reasons. [2]

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

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Question 5

(a) What are the conditions required for the solar dynamo to work? [2]

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(b) (i) Can periodic motion be considered as simple harmonic motion? Give an example to support your answer. [1]

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(ii) Why does the body of the bus begin to rattle sometimes, when the bus picks up the speed? [1]

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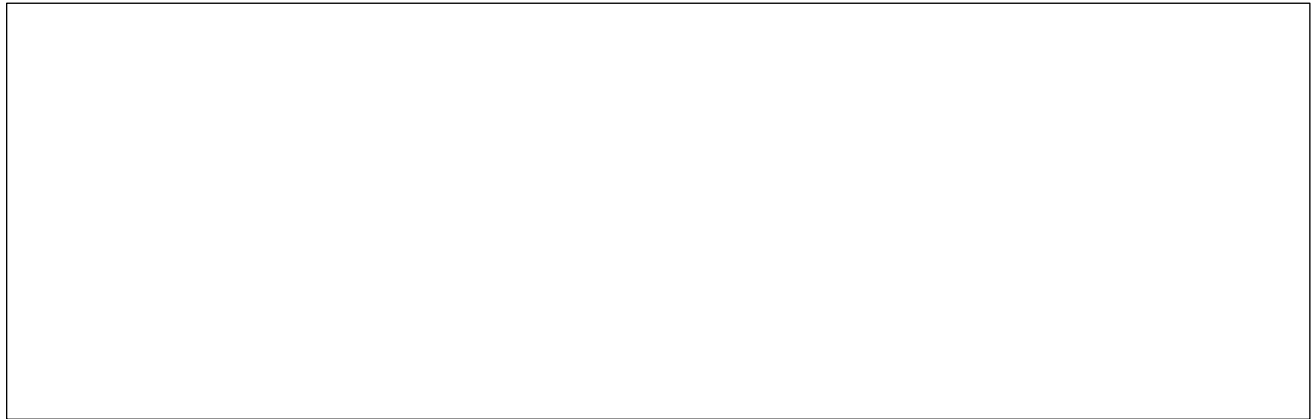
(c) Consider a coil of 600 turns, current of 1 A and reluctance of 1.657×10^5 AT/Wb. Find the (i) mmf and (ii) flux of the coil. [3]

(d) Using Maxwell's distribution curve of speed of gas molecules, explain how rain and sunshine is caused? [3]

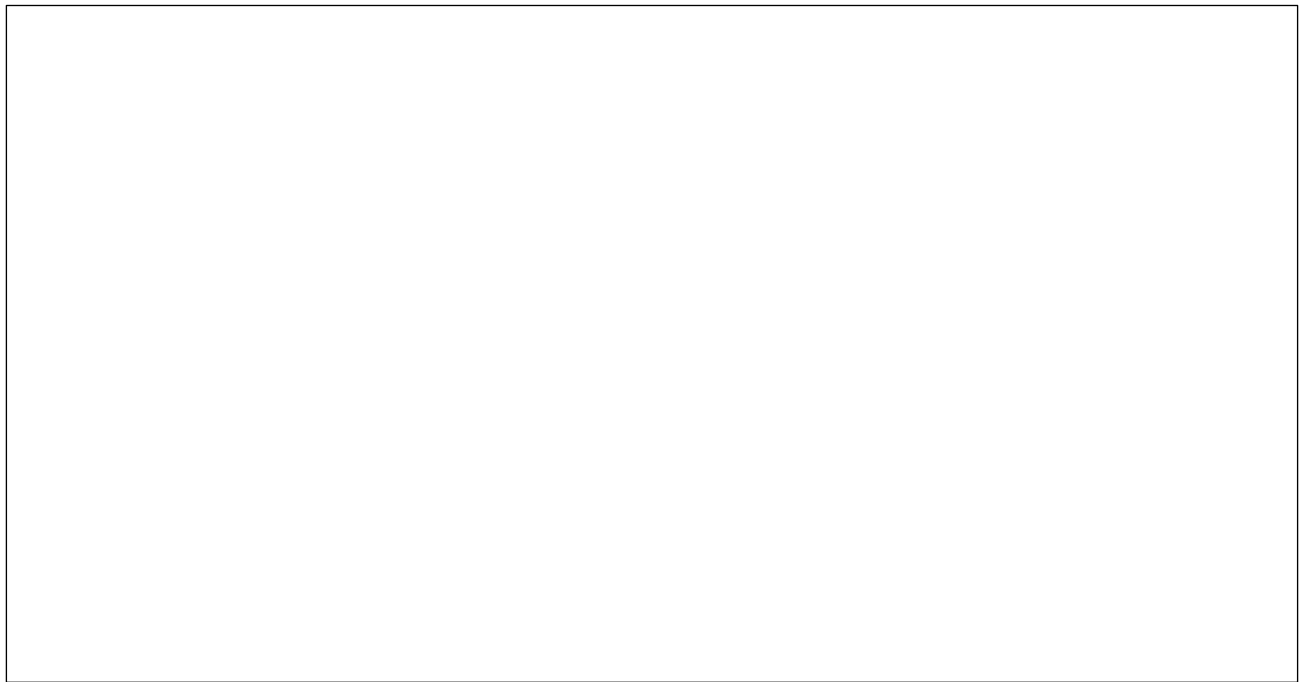
Question 6

- (a) The mutual inductance between two coils is 0.15 H. If a current of 20 A in the primary coil is cut off in 0.05 s, find the emf induced in the secondary coil. If the secondary coil has 60 turns, find the flux change in it. [3]

- (b) Derive the expression for instantaneous charge q during the discharging of the capacitor. [3]



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



(d) If you are making a spectrograph, what would you use it for? Would you use diffraction grating or prism in your spectrograph? Give one reason for your choice. [2]

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Question 7

(a) You amplitude in the swing slowly decreases. What is this oscillation called? How would you define this motion? Give the relation for the mechanical energy of a particle executing such kind of oscillation. [2]

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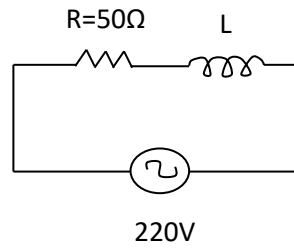
(b) Do you think adding solute in a liquid increases surface tension? Explain using an example.[2]

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(c) Determine the value of Planck’s constant using Einstein’s photoelectric equation. [3]

(d) In the circuit diagram given below, the current is found to lag behind the voltage by an angle 60° . Calculate the:

- (i) inductive reactance,
- (ii) impedance of the circuit and
- (iii) current flowing in the circuit.



[3]

Question 8

(a) Dorji sees a colourful pattern on a puddle. What are the two conditions required for this to happen? [1]

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(b) Calculate the binding energy per nucleon of the nuclei of ${}_{26}\text{Fe}^{56}$.
 [Given: Mass of ${}_{26}\text{Fe}^{56} = 55.934939 \text{ u.}$]

[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 attract the paper pieces if rubbed on hair and brought near by the paper pieces? Why? What relation does this experiment give between electrostatic force and gravitational force? [2]

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(d) Derive an expression for instantaneous current to determine whether current leads or lags in AC circuit containing only capacitor. Represent the phase difference graphically. [3]

(e) A capacitor blocks dc and allows ac. Why? How will inductor affect dc? [2]

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[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	$1\text{u} = 931.5 \text{ MeV}$
	$\epsilon_0 = 8.85 \times 10^{-12}\text{C}^2\text{N}^{-1}\text{m}^{-2}$
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