Roll Number SET A



INDIAN SCHOOL MUSCAT ANNUAL EXAMINATION PHYSICS

CLASS: XI 13.02.2020

Sub. Code: 042

Time Allotted: 3 Hrs.

Max. Marks: 70

General Instructions:

- All questions are compulsory. There are 37 questions in all.
- This question paper has four sections: section A, section B, section C and section D.
- Section A contains twenty questions of one mark each, Section B contains seven questions of two marks each, Section C contains seven questions of three marks each, Section D contains three questions of five marks each.
- There is no overall choice. However, an internal choice has been provided in two questions of one marks each, two questions of two marks, one question of three marks and in all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.
- You may use the following value of physical constant wherever necessary: $g = 9.8 \text{ m/s}^2$.

SECTION A

1	A particle projected at 60° to the horizontal with a kinetic energy K. The kinetic energy at the highest point is						
	(a) K/2	(b) K	(c) Zero	(d) K/4			
2	An object is proj	jected upwards w	vith a velocity	y of 100 m/s. It will s	trike the ground after	(1)	
	(a) 10 s	(b) 20 s	(c) 15 s	(d) 5 s			
3	· ·		•	the other, are releaseparation will be: (d) Zero	sed simultaneously and fall	(1)	
4	A particle is mo	ving along a stra	ight line with	constant speed, then		(1)	
	· ·	oarticle is constant of particle is nor		(b) acceleration of p(d) None of the abo			
5	_	of the resultant of the two	-	rectors is equal to the	magnitude of either vector.	(1)	
	(a) 150 degree	(b) 120 deg	gree	(c) 90 degree	(d) 60 degree		
6	Which of the fol angular speed?	llowing statemen	ts is false for	a particle moving in	a circular path with constant	(1)	
	 angular speed? (a) The velocity vector is tangent to the circle (b) The acceleration vector is tangent to the circle (c) The acceleration vector points to the center of the circle (d) The velocity and acceleration vectors are perpendicular to each other 						

7	What angle of projection would result in a ball travelling the maximum horizontal distance?								
	(a) 90^0	(b)	45 ⁰	(c) 60^0	(d) 30^0				
				OR					
	of these, the only	vector	quantities are		ectrical charg , energy and	e, temperature, area. Out			
	(a) force, temper			`	•				
8	` '	(c) momentum, electrical charge and area (d) force and momentum First law of thermodynamics corresponds to							
	(a) Law of conse	rvation	of energy	(b) Law o	of conservation	on of angular momentum			
9	` '		on of linear mon of mass 20 kg dec	` '	ewton's law to 5 m/s in a	of cooling distance of 100 m. Force	(1)		
	(a) -27.5 N	(b) -47.5 N	(c) -37.5 N	(d) -6	67.5 N			
10	For a wave propa	ıgating	in a medium, idea	ntify the property th	at is indepen	dent of the others.	(1)		
	(a) Velocity		(b) Wave length	n (c) Freque	ency	(d) All the above			
				OR					
	In the longitudina	al wave	es the direction of	vibration in mediu	m of particle	is			
	(a) Perpendicula	r to pro	pagation of wave	(b) Para	llel to propag	gation			
	(c) Different from	om ead	ch other	(d) Var	iable for tin	ne to time			
11	Materials that show very small plastic range beyond elastic limit are called								
	(a) Brittle materi	ials	(b) Elastomers	(c) Elastic	materials	(d) Ductile materials	(1)		
12	When the speed of a moving body is doubled								
	(a) Its acceleration	on is do	oubled	(b) Its moment	tum is double	ed			
	(c) Its kinetic e	nergy	is doubled	(d) Its potent	tial energy i	s doubled			
13	The S.I unit of to	orque is	S				(1)		
	(a) Nm		(b) Nm/s	(c) m/s^2	(d) k	gm/s			
14	If the temperatur	e of the	e source is increas	sed, the efficiency o	of a Carnot er	igine	(1)		
	(a) Increases		(b) Decr	eases					
	(c) Remains con	nstant	(d) First	increases then re	mains const	ant			
15	Write the four fu	ındame	ental forces in natu	are in the increasing	g order of the	ir magnitude.	(1)		
16	What is the angle rough surface?	e betwo	een frictional forc	e and instantaneous	velocity of a	a body moving over a	(1)		
17	Which physical	quantit	ies are expressed	by the following			(1)		
	(a) Rate of chan	ge of a	ngular momentun	n (b) Moment of lin	ear momentu	ım			
18	State Wien's dis	placen	nent law.				(1)		

(1) 19 Sound travels faster on a rainy day than on a dry day. Why? Which physical quantity is represented by the area under stress-strain graph? (1) 20 **SECTION B** (2) Can a body have energy without having momentum and have momentum without having energy? 21 Explain. (2) (a) Can a bomb initially at rest, explode into three pieces which fly in mutually perpendicular 22 direction. Justify? (1 mark) (b) A cricket player lowers his hands to catch the ball safely. Explain why?(1 mark) Using the expression for pressure exerted by a gas deduce the relation between kinetic energy and (2) 23 absolute temperature T of an ideal gas. OR Write any four postulates of kinetic theory of gases a) Show graphically how acceleration due to gravity varies as we move from the centre of the (2) 24 earth to great heights above the surface of the earth. (1) b) The potential energy of an artificial satellite is -30 x 10⁹ J. Calculate its kinetic energy and total energy. (1 m) A truck starts from rest and rolls down a hill with constant acceleration. It travels a distance of 400 25 m in 20 s. Calculate the acceleration of the truck and force acting on it, if its mass is 7 metric ton. OR A mass of 6 kg is suspended by a rope of 2m from a ceiling. A force of 50 N in the horizontal direction is applied at the midpoint of the rope. What is the angle the rope makes with the vertical in equilibrium (2)26 A physical quantity P is given by $P = \frac{a^3b^2}{(\sqrt{c}d)}$ The percentage errors in a, b, c and d are 1%, 3%, 4% and 3% respectively. Find the percentage error in P. (2) Explain how in a thermos flask the loss of heat due to three modes is minimized. 27 **SECTION C** (a) Is uniform circular motion an example of accelerated motion? Give reason. (3) 28 (b) Derive the expression for centripetal acceleration for an object under uniform circular motion, along a path of radius r with speed v. (a) Draw velocity-time graph for an object thrown vertically upwards returning to the point of (3) 29 projection. (1 mark) (b) Can a distance- time graph of an object be parallel to time axis? Give reason. (1 mark) Page 3 of 5

(c) Can an object's velocity change direction when its acceleration is constant? Support your answer with an example. (1 mark) Three bodies a ring, a solid cylinder and a solid sphere starting from rest roll down the same (3) 30 inclined plane without slipping. The radii of the bodies are identical. Which of the bodies reach the ground with maximum velocity? (3) (a) Define escape velocity of an object. (1) 31 (b) Derive the expression for the escape velocity of an object from the earth. (2) Derive an expression for acceleration due to gravity at a depth d below the surface of the earth of radius R in terms of acceleration due to gravity g on the surface of the earth. Assume the earth to be a perfect sphere of uniform density ρ . State law of equipartition of energy . For one mole of a diatomic gas derive the expression for C_p (3) 32 and C_v and calculate the ratio of C_p/C_v . Discuss about the harmonics formed in a stretched string and obtain the ratio of the frequencies of (3) 33 the harmonics in the string. (3) (a) State two difference between adiabatic and isothermal process. 34 (b) Why efficiency of a heat engine cannot be 100% or unity? (c) Calculate the coefficient of performance of a refrigerator working between -3 0 C and 27 0 C. **SECTION D** (a) Show that in case of one dimensional elastic collision of two bodies, the relative velocity of (5) 35 separation after collision is equal to the relative velocity of approach before collision. (b) In a ballistics demonstration a police officer fires a bullet of mass 50 g with speed 200 m/s on a soft plywood of thickness 2 cm. The bullet emerges with only 10 % of its KE. What is the emergent speed of the bullet? (2 marks) OR (a) State the law of conservation of mechanical energy. (b) Show that the total mechanical energy of a freely falling body under gravity is conserved. (c) .Show the variations in kinetic energy, potential energy and total energy graphically. (a) Show that the oscillations of a simple pendulum are simple harmonic and derive the (5) 36 expression for time period of the simple pendulum. (3 marks) (b) Why soldiers are asked not to march over old bridges. (1 mark) (c) Draw a graph showing the variation of energy with respect to time for a harmonic oscillator executing damped oscillations. (1 mark) OR (a) Define Simple harmonic motion. (b) Derive the differential equation for a simple harmonic motion. (c) The equation of a particle in SHM is as given as $Y = 0.05 \sin (50 \pi t + \pi/3)$, where y is in Page **4** of **5**

37 (a) State and prove Bernoulli's principle. (3 marks)

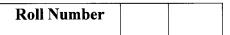
- (5)
- (b) When air is blown between two balls suspended close to each other, they are attracted towards each other. Why? (1 mark)
- (c) How does the ploughing of fields help in preservation of moisture in the soil? (1 mark)

OR

- (a) Define terminal velocity.
- (b) Derive an expression for the terminal velocity attained by a spherical body falling through a viscous medium.
- (c) A spherical rain drop of radius 0.2 mm has a terminal velocity in air 2 m/s. The viscosity of air is $18 \times 10^{-5} \text{ Nm}^{-2} \text{ s}$. Find the viscous force on the rain drop.

End of the Question Paper

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INDIAN SCHOOL MUSCAT ANNUAL EXAMINATION PHYSICS

CLASS: XI

Sub. Code: 042

Time Allotted: 3 Hrs.

13.02.2020

Max. Marks: 70

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- You may use the following value of physical constant wherever necessary: $g = 9.8 \text{ m/s}^2$.

SECTION A

1	An object is projected upwards with a velocity of 100 m/s. It will strike the ground after						
	(a) 10 s	(b) 20 s	(c) 15 s	(d) 5	5 s	(1)	
2	A particle is mov	ving along a str	aight line with c	onstant speed, th	en	(1)	
	(a) velocity of p	article is consta	ent ((b) acceleration of	of particle is zero		
3	(c) acceleration Which of the fol angular speed?	-	`	d) None of the particle moving	above in a circular path with constant	(1)	
	(a) The velocity(b) The accelera(c) The accelera(d) The velocity	tion vector is to tion vector point	angent to the circ	of the circle	ach other		
4	First law of ther	modynamics co	orresponds to			(1)	
	(a) Law of cons	ervation of ener	rgy	(b) Law of o	conservation of angular momentum		
	(c) Law of cons	servation of li	near momentu	m (d) Newton	n's law of cooling		
5	A particle project highest point is	eted at 60 0 to t	he horizontal wi	th a kinetic ener	gy K. The kinetic energy at the	(1)	
	(a) K/2	(b) K	(c) ZERO	(d) K/4			

6	Two bodies, one held 30 cm directly above the other, are released simultaneously and fall freely under gravity. After 2 sec their relative separation will be:							
	(a) 10 cm (b) 20 cm (c) 30 cm (d)	d) Zero						
7	If the temperature of the source is increased, the efficiency of a Carn	ot engine	(1)					
	(a) Increases (b) Decreases							
	(c) Remains constant (d) First increases then remains c	onstant						
8	The magnitude of the resultant of two equal vectors is equal to the m Then the angle between the two vectors is	agnitude of either vector.	(1)					
	(a) 150 degree (b) 120degree (c) 90degree	(d) 60 degree						
9	Materials that show very small plastic range beyond elastic limit are	called	(1)					
	(a) Brittle materials (b) Elastomers (c) Elastic materials	(d) Ductile materials						
10	When the speed of a moving body is doubled		(1)					
	(a) Its acceleration is doubled (b) Its momentum is doubled	1						
	(c) Its kinetic energy is doubled (d) Its potential energy is	doubled						
11	1 The S.I unit of torque is		(1)					
	(a) Nm (b) Nm/s (c) m/s2 (d) kgm	n/s						
12	2 For a wave propagating in a medium, identify the property that is inc	dependent of the others.	(1)					
	(a) Velocity (b) Wave length (c) Frequency	(d) All the above						
	OR In the longitudinal waves the direction of vibration in medium of particles.	rticle is						
	(a) Perpendicular to propagation of wave (b) Parallel to propagation							
	(c) Different from each other (d) Variable for							
13	The velocity of a body of mass 20 kg decreases from 20 m/s to 5 m/s on the body is	s in a distance of 100 m. Force	(1)					
	(a) -27.5 N (b) -47.5 N (c) -37.5 N (d) -6	57.5 N						
14	4 What angle of projection would result in a ball travelling the maxim	um horizontal distance?	(1)					
	(a) 90^0 (b) 45^0 (c) 60^0 (d) 30^0							
	OR	OR						
	Consider the quantities, force, power, energy, momentum, electrical of these, the only vector quantities are	charge, temperature, area. Ou	t ·					
	(a) force, temperature and area (b) power, energy	y and temperature						
	(c) momentum, electrical charge and area (d) force and m	omentum						
15	Which physical quantity is represented by the area under stress-strain	n graph?	(1)					
16	6 Which physical quantities are expressed by the following (i) Rate of	fichange of angular	(1)					

17	What is the angle between frictional force and instantaneous velocity of a body moving over a rough surface?	(1)
18	Sound travels faster on a rainy day than on a dry day. Why?	(1)
19	State Wien's displacement law.	(1)
20	Write the four fundamental forces in nature in the increasing order of their magnitude.	(1)
	SECTION B	
21	Using the expression for pressure exerted by a gas deduce the relation between kinetic energy and absolute temperature T of an ideal gas.	(2)
	OR	
	Write any four postulates of kinetic theory of gases.	
22	(a) Show graphically how acceleration due to gravity varies as we move from the centre of the earth to great heights above the surface of the earth. (1)	(2)
	(b) The potential energy of an artificial satellite is -30 x 10 ⁹ J. Calculate its kinetic energy and total energy. (1 m)	
23	Can a body have energy without having momentum and have momentum without having energy? Explain.	(2)
24	Give reason for the following	(2)
	(a) Chinaware is wrapped in straw paper before packing.	
	(b) Proper inflation of tyres of vehicles saves fuel.	
25	The percentage errors in the measurements of mass and speed are 2% and 3 % respectively. How much will be the maximum error in the estimate of kinetic energy obtained by measuring mass and speed.	(2)
26	Explain how in a thermos flask the loss of heat due to three modes is minimized.	(2)
27	A truck starts from rest and rolls down a hill with constant acceleration. It travels a distance of 400 m in 20 s. Calculate the acceleration of the truck and force acting on it, if its mass is 7 metric tons.	(2)
	OR	
	A mass of 6 kg is suspended by a rope of 2m from a ceiling. A force of 50 N in the horizontal direction is applied at the midpoint of the rope. What is the angle the rope makes with the vertical in equilibrium?	
	SECTION C	
28	(a) Is the rocket in flight, an example of projectile? Give reason.	(3)

Page 3 of 5

momentum (ii) Moment of linear momentum

	(b) Show that the path followed by a projectile is a parabola when it is projected at an angle θ with the horizontal.	
29	Three bodies a ring, a solid cylinder and a solid sphere starting from rest roll down the same inclined plane without slipping. The radii of the bodies are identical. Which of the bodies reach the ground with maximum velocity?	(3)
30	(a) Draw velocity-time graph for an object thrown vertically upwards returning to the point of projection. (1 mark)	(3)
	(b) Can a distance- time graph of an object be parallel to time axis? Give reason. (1 mark)	
	(c) Can an object's velocity change direction when its acceleration is constant? Support your answer with an example. (1 mark)	
31	Derive an expression for acceleration due to gravity at a height h above the surface of the earth of radius R in terms of acceleration due to gravity g on the surface of the earth. Assume the earth to be a perfect sphere of uniform density ρ .	(3)
	OR	
	State and prove law of periods for planetary motion.	
32	Define degrees of freedom. For one mole of a monoatomic gas derive the expression for Cp and Cv and calculate the ratio of Cp/Cv.	(3)
33	Discuss about the harmonics formed in an open organ pipe and show that the frequencies of the harmonics are in the ratio 1:2:3.	(3)
34	(a) State two difference between adiabatic and isothermal process.	(3)
	(b) Why efficiency of a heat engine cannot be 100% or unity?	
	(c) Calculate the coefficient of performance of a refrigerator working between -3 °C and 27 °C.	
	SECTION D	
35	(a) Show that the oscillations of a simple pendulum are simple harmonic and derive the expression for time period of the simple pendulum.	(5)
	(b) Why soldiers are asked not to march over old bridges.	
	(c) Draw a graph showing the variation of energy with respect to time for a harmonic oscillator executing damped oscillations.	
	OR	
	(a) Define Simple harmonic motion.	
	(b) Derive the differential equation for a simple harmonic motion.	
	(c) The equation of a particle in SHM is as given by $y = 0.05 \sin (50 \pi t + \pi/3)$, where y is in meter and t is in second. Calculate its (i) time period (ii) amplitude and (iii) velocity amplitude	
36	(a) State and prove Bernoulli's principle. (3 marks)	(5)
	(b) When air is blown between two balls suspended close to each other, they are attracted towards each other. Why?	
	(c) How does the ploughing of fields help in preservation of moisture in the soil?	
	Page 4 of 5	

- (a) Define terminal velocity.
- (b) Derive an expression for the terminal velocity attained by a spherical body falling through a viscous medium.
- (c) A spherical rain drop of radius 0.2 mm has a terminal velocity in air 2 m/s. The viscosity of air is 18×10^{-5} Nm⁻² s. Find the viscous force on the rain drop.
- 37 (a) Show that in case of one dimensional elastic collision of two bodies, the relative velocity of separation after collision is equal to the relative velocity of approach before collision. (5)
 - (b) In a ballistics demonstration a police officer fires a bullet of mass 50 g with speed 200 m/s on a soft plywood of thickness 2 cm. The bullet emerges with only 10 % of its KE. What is the emergent speed of the bullet? (2 marks)

OR

- (a) State the law of conservation of mechanical energy.
- (b) Show that the total mechanical energy of a freely falling body under gravity is conserved.
- (c) Show the variations in kinetic energy, potential energy and total energy graphically.

End of the Question Paper

Roll Number	

SET C



CLASS: XI

13.02.2020

INDIAN SCHOOL MUSCAT ANNUAL EXAMINATION **PHYSICS**

Sub. Code: 042

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- You may use the following value of physical constant wherever necessary: $g = 9.8 \text{ m/s}^2$.

SECTION A

1 What	What angle of projection would result in a ball travelling the maximum horizontal distance?								
(a) 90	0 (b)	45 ⁰	(c) 60^0	(d) 30^0					
			OR						
	Consider the quantities, force, power, energy, momentum, electrical charge, temperature, area. Out of these, the only vector quantities are								
(a) for	ce, temperature	e and area		(b) power,	energy and temperature				
` '	omentum, ele aw of thermody	O		(d) force a	nd momentum	(1)			
(a) La	(a) Law of conservation of energy (b) Law of conservation of angular momentum								
(c) La	w of conserva	ation of linear	momentum	(d) Newton	n's law of cooling				
(a) ve	ocity of particl	e is constant	t line with cons (b) acc ero (d) No	celeration of	particle is zero	(1)			
	icle projected a	at 60 0 to the ho	rizontal with a	kinetic energ	y K. The kinetic energy at the	(1)			
(a) K	2	(b) K	(c) ZER	O	(d) K/4				
5 An ob (a) 10		d upwards with (b) 20 s	a velocity of 1 (c) 15 s		ll strike the ground after (d) 5 s	(1)			

6	under gravity. At	fter 2 sec their re	elative separa	ation will be:		aneously and fall freely	(1)
	(a) 10 cm	(b) 20 cm	(c) 30 c	cm (d) I	Zero		
7	For a wave propa	agating in a med	ium, identify	the property tha	it is indepe	endent of the others	(1)
	(a) Velocity	(b) Wavel	length	(c) Frequency	y (d	l) All the above	
				OR			
	In the longitudina	al waves the dire	ection of vib	ration in medium	of particle	e is	
	(a) Perpendicula	r to propagation	of wave	(b) Parallel	to propaga	ution	
	(c) Different from	om each other		(d) Variabl	le for time	e to time	
8	-			ectors is equal to	o the magn	itude of either vector.	(1)
	Then the angle b (a)150 degree	(b) 120de		(c) 90degree	(6	l) 60 degree	
9	Which of the follangular speed?	lowing statemen	its is false for	r a particle movi	ng in a circ	cular path with constant	(1)
	(a) The velocity(b) The accelera(c) The accelera(d) The velocity	tion vector is tar	ngent to the c ts to the cent	circle er of the circle	each othe	r	
10	The velocity of a on the body is	ı body of mass 2	20 kg decreas	ses from 20 m/s t	to 5 m/s in	a distance of 100 m. Force	(1)
	(a) -27.5 N	(b) -47.5	N	(c) -37.5 N	(d)) -67.5 N	
11	When the speed	of a moving bo	dy is double	d			(1)
	(a) Its accelerati	on is doubled	(b) Its momentum	is doubled	l	
	(c) Its kinetic e	nergy is doub	led (d	d) Its potential	energy is	doubled	
12	Materials that sh	ow very small p	plastic range	beyond elastic li	mit are cal	led	(1)
	(a) Brittle mater	ials (b) El	lastomers	(c) Elastic n	naterials	(d) Ductile materials	
13	If the temperatur			the efficiency of	a Carnot	engine	(1)
	(a) Increases) Decreases				
1.4	(c) Remains co	` '	First increa	ases then remai	ns consta	nt.	
14	The S.I unit of to	•	(-) (-2	(4) 1	. In		(1)
	(a) Nm	(b) Nm/s	(c) m/s^2	(d) kgm	I/S		
15	Sound travels fa	ster on a rainy d	lay than on a	dry day. Why?			(1)
16	Which physical	quantity is repre	esented by th	e area under stre	ss-strain g	raph?	(1)
17	Write the four fo	undamental forc	es in nature i	in the increasing	order of th	neir magnitude.	(1)
18	What is the angl rough surface?	e between fricti	onal force an	nd instantaneous	velocity o	f a body moving over a	(1)

Which physical quantities are expressed by the following (a) Rate of change of angular (1) 19 momentum (b) Moment of linear momentum? State Wien's displacement law. (1) 20 **SECTION B** (a) Can a bomb initially at rest, explode into three pieces which fly in mutually perpendicular (2) 21 direction. Justify? (1 mark) (b) A cricket player lowers his hands to catch the ball safely. Explain why? (1 mark) A truck starts from rest and rolls down a hill with constant acceleration. It travels a distance of 400 (2) 22 m in 20 s. Calculate the acceleration of the truck and force acting on it, if its mass is 7 metric tons. OR A mass of 6 kg is suspended by a rope of 2m from a ceiling. A force of 50 N in the horizontal direction is applied at the midpoint of the rope. What is the angle the rope makes with the vertical in equilibrium? Using the expression for pressure exerted by a gas deduce the relation between kinetic energy and (2) 23 absolute temperature T of an ideal gas. OR Write any four postulates of kinetic theory of gases. (a) Show graphically how acceleration due to gravity varies as we move from the centre of the (2)24 earth to great heights above the surface of the earth. (1) (b) The potential energy of an artificial satellite is -30 x 10⁹ J. Calculate its kinetic energy and total energy. (1 m) Can a body have energy without having momentum and have momentum without having energy? (2)25 Explain. Explain how in a thermos flask the loss of heat due to three modes is minimized. (2) 26 (2) 27 A physical quantity P is given by $P = \frac{a^3b^2}{(\sqrt{c}d)}$ The percentage errors in a, b, c and d are 1%, 3%, 4% and 3% respectively. Find the percentage error in P. **SECTION C** 28 Three bodies a ring, a solid cylinder and a solid sphere starting from rest roll down the same (3) inclined plane without slipping. The radii of the bodies are identical. Which of the bodies reach the ground with maximum velocity? Derive an expression for acceleration due to gravity at a height h above the surface of the earth of 29 (3) radius R in terms of acceleration due to gravity g on the surface of the earth. Assume the earth to Page 3 of 5

OR

State and prove law of periods for planetary motion.

- 30 (a) Is the rocket in flight, an example of projectile? Give reason. (3)
 - (b) Show that the path followed by a projectile is a parabola when it is projected at an angle θ with the horizontal.
- 31 (a) Draw velocity-time graph for an object thrown vertically upwards returning to the point of projection. (1 mark)
 - (b) Can a distance- time graph of an object be parallel to time axis? Give reason. (1 mark)
 - (c) Can an object's velocity change direction when its acceleration is constant? Support your answer with an example. (1 mark)
- 32 (a) State two difference between adiabatic and isothermal process. (3)
 - (b) Why efficiency of a heat engine cannot be 100% or unity?
 - (c) Calculate the coefficient of performance of a refrigerator working between -3 0 C and 27 0 C.
- Discuss about the harmonics formed in a stretched string and obtain the ratio of the frequencies of the harmonics in the string.
- Define degrees of freedom. For one mole of a monoatomic gas derive the expression for C_p and C_v (3) and calculate the ratio of C_p/C_v .

SECTION D

(5)

- 35 (a) State and prove Bernoulli's principle. (3 marks)
 - (b) When air is blown between two balls suspended close to each other, they are attracted towards each other. Why?
 - (c) How does the ploughing of fields help in preservation of moisture in the soil?

OR

- (a) Define terminal velocity.
- (b) Derive an expression for the terminal velocity attained by a spherical body falling through a viscous medium.
- (c) A spherical rain drop of radius 0.2 mm has a terminal velocity in air 2 m/s. The viscosity of air is 18 x 10⁻⁵ Nm⁻² s. Find the viscous force on the rain drop.
- 36 (a) Show that the oscillations of a simple pendulum are simple harmonic and derive the expression for time period of the simple pendulum. (3 marks)
 - (b) Why soldiers are asked not to march over old bridges. (1 mark)
 - (c) Draw a graph showing the variation of energy with respect to time for a harmonic oscillator executing damped oscillations. (1 mark)

OR

- (a) Define Simple harmonic motion.
- (b) Derive the differential equation for a simple harmonic motion.
- (b) The equation of a particle in SHM is as $y = 0.05 \sin (50 \pi t + \pi/3)$, where y is in meter and t is in second. Calculate its (i) time period (ii) amplitude and (iii) velocity amplitude.
- 37 (a) Show that in case of one dimensional elastic collision of two bodies, the relative velocity of separation after collision is equal to the relative velocity of approach before collision. (5)
 - (b) In a ballistics demonstration a police officer fires a bullet of mass 50 g with speed 200 m/s on a soft plywood of thickness 2 cm. The bullet emerges with only 10 % of its KE. What is the emergent speed of the bullet? (2 marks)

OR

- (a) State the law of conservation of mechanical energy.
- (b) Show that the total mechanical energy of a freely falling body under gravity is conserved.
- (c) Show the variations in kinetic energy, potential energy and total energy graphically.

End of the Question Paper