Version No.				
3	0	0	4	1

ROLL NUMBER						

PHYSICS HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed.

Do not use lead pencil.

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دیے گئے نمبر مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Answer Sheet No. _____

ہر سوال کے سامنے دیے گئے، کریکولم کے مطابق درست دائرہ کو پر کریں۔ **Invigilator Sign.** _____

Fill the relevant bubble against each question according to curriculum: **Candidate Sign.** _____

	Question	A	B	C	D	A	B	C	D
1.	The dimensions $[ML^2T^{-2}]$ show:	Power	Work	Velocity	Acceleration	○	○	○	○
2.	If $r = 2.25 \pm 0.01cm$ then percentage uncertainty in "r" will be:	0.2%	0.3%	0.4%	0.5%	○	○	○	○
3.	$\hat{j}.(\hat{i} \times \hat{k}) =$	0	–1	1	2	○	○	○	○
4.	Magnitude of centripetal force $F_c =$	$mr\omega^2$	$mr\omega$	$n\omega^2$	mv^2	○	○	○	○
5.	If the length of blade of a fan is increased, then its rotational speed (at same voltage and current):	Will increase	Will decrease	Will become infinite	Remains constant	○	○	○	○
6.	Two bodies A and B of same masses have velocities in the ratio 2:1, their kinetic energies are in the ratio:	2:1	1:2	4:1	1:4	○	○	○	○
7.	Maximum drag force on a 1kg falling sphere is:	9.8 N	1 N	98 N	4.9 N	○	○	○	○
8.	Young's Modulus, Y=	$\frac{\Delta L / L}{F / A}$	$\frac{FA}{\Delta L.L}$	$\frac{\Delta L.L}{FA}$	$\frac{F / A}{\Delta L / L}$	○	○	○	○
9.	In an adiabatic process which quantity remains constant?	Internal energy	Volume	Temperature	Mass	○	○	○	○
10.	Location of a submarine in deep sea can be detected by:	Doppler effect	Compton's effect	Faraday's Law	Bernoulli principle	○	○	○	○
11.	An electron is placed in a uniform electric field directed from south to north. In which direction will electron move after it is released?	East	South	North	West	○	○	○	○
12.	In order to achieve high accuracy, the slide wire of a potentiometer should be:	As long as possible	As short as possible	Very thick	Neither too small, nor too large	○	○	○	○
13.	Two closely placed parallel wires are carrying current in opposite direction, the wires will:	Repel each other	Attract each other	Not affect each other	Rotate each other	○	○	○	○
14.	One weber is equal to:	NA^{-1}	$Nm\,A^{-1}$	$Nm^{-1}A$	$Nm^{-1}A^{-1}$	○	○	○	○
15.	When an object moves with a very high speed its length _____ in the direction of its motion.	Contracts	Expands	Remains same	Becomes zero	○	○	○	○
16.	Relativistic mass is always:	Less than rest mass	Greater than rest mass	Equal to rest mass	Zero	○	○	○	○
17.	A hadron may either be a Baryon or a:	Lepton	Gluon	Photon	Meson	○	○	○	○

$\vec{A}.\vec{B} = AB\cos\theta \quad L = I\omega \quad K.E = \frac{1}{2}mv^2 \quad W = mg \quad g = 9.8ms^{-2} \quad v = r\omega \quad \vec{A} \times \vec{B} = AB\sin\theta \quad \varphi_B = \vec{B}.\vec{A}$ uncertainty = $\frac{\text{Absolute uncertainty}}{\text{No. of vibrations}}$

PHYSICS HSSC–I

20

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

SECTION – B (Marks 42)

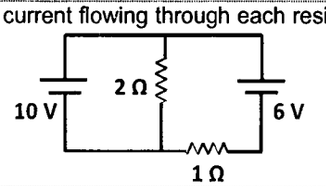
Q. 2 Answers the following parts briefly. **(14 x 3 = 42)**

(i)	Briefly explain 'precision' and 'accuracy' with a diagram.	1x3	OR	How can ordinary light be polarized using polarizers?	03
(ii)	The velocity of a missile traveling at 1500 ms^{-1} increases to 5000 ms^{-1} after moving through a distance of 70 km. Calculate the time for the missile to reach this velocity.	03	OR	A body at 200°C undergoes a reversible isothermal process. The heat energy removed in this process is 7300 J. Calculate the entropy change and discuss entropy sign.	03
(iii)	What is meant by 'conservative' and Non–conservative' forces? Give one example each.	03	OR	What is meant by Magnus effect? Explain with the help of an example.	03
(iv)	Differentiate between crystalline solids and amorphous solids. (Give at least three differences.)	03	OR	Earth completes its one rotation about its axis in 24 hours. Calculate angular velocity of earth about its axis in radian per second.	1+2
(v)	The Doppler's effect is used in radar system. Briefly explain the working of radar system.	03	OR	Verify that: $(\vec{A}.\vec{B})^2+(\vec{A}\times\vec{B})^2=(AB)^2$	03
(vi)	Calculate KE in electron volt and joules gained by an electron moving through a potential difference of 2 volts.	03	OR	What happens to the density of an object as it moves in a direction with very high speed relative to speed of light? Justify.	03
(vii)	Why does the resistance of LDR decrease with increase in intensity of light on it?	03	OR	State Faraday's law of electromagnetic induction. Give its mathematical form.	2+1
(viii)	Does the induced emf in a circuit depend on the resistance of the circuit? Does the induced current depend on the resistance of the circuit? Justify.	1.5 + 1.5	OR	At what speed would the mass of proton be doubled? The rest mass of proton is $1.673\times10^{-27}\ kg$.	03
(ix)	The Kinetic energy of a charged particle moving in a uniform magnetic field does not change. Why? Explain briefly.	03	OR	If $^{233}_{92}U$ decays twice by alpha particle emission, what is the resulting isotope? Show by equation.	03
(x)	What is Faraday's cage? Briefly explain its working.	03	OR	Compare gluons and photons.	03
(xi)	What is meant by annihilation? Give one annihilation reaction.	03	OR	To increase the intensity of wave by a factor of 10, calculate the required increase in amplitude of wave.	03
(xii)	How will the radius of a flexible ring change if it is given negative charge?	03	OR	What is the difference between inertial and non-inertial frame of reference?	03
(xiii)	Use dimensional analysis to prove the equation $P=\rho gh$ is dimensionally homogeneous.	03	OR	Write three statements of second law of thermodynamic. (one in terms of entropy)	03
(xiv)	Derive the relation between torque, moment of inertia and angular acceleration.	1x3	OR	What is meant by interference? Give conditions for interference.	1+2

SECTION – C (Marks 26)

Attempt the following questions.

(Use of graph paper is not necessary. Candidates can make their own grid on answer book if required)

Q.3	State and explain vector product with an example. Also show that $\vec{A}\times\vec{B}\neq\vec{B}\times\vec{A}$	3+4	OR	What is meant by projectile? Derive the mathematical expressions of following for projectile motion: i) Time of flight ii) Range and maximum range of projectile	1+2 +4
Q.4	Explain the working of refrigerator. Also explain the coefficient of performance of refrigerator.	4+2	OR	State work-energy theorem. Explain this theorem for resistive medium.	06
Q.5	State the equation of continuity and derive its mathematical form. On what basis is the equation of continuity derived?	1+5 +1	OR	What is meant by elastic potential energy? Find a relation for the elastic potential energy of a material.	1+6
Q.6	Why does an astronaut feel weightless in space? How can artificial gravity be produced in a satellite? For a satellite derive expression for angular velocity, time period and frequency of satellite.	1+1 +4	OR	Find the current flowing through each resistor of the circuit. 	06

- $\sin^2\theta+\cos^2\theta=1$
- $\omega=\frac{\theta}{t}$
- $S=\frac{\Delta Q}{T}$
- $1eV=1.6\times10^{-19}J$
- $\vec{A}.\vec{B}=AB\cos\theta$
- $\sum\varepsilon=0$
- $\omega=\frac{2\pi}{T}$
- $\vec{A}\times\vec{B}=AB\sin\theta$
- $E=qv$
- $I=\frac{\varepsilon}{R}$
- $v_f=v_i+at$
- $v_f^2-v_i^2=2aS$
- $F_c=\frac{mv^2}{r}$
- $\varepsilon=\frac{\Delta\phi}{\Delta t}$
- $I\propto A^2$
- $\sum I=0$
- $m=\frac{m_o}{\sqrt{1-\frac{v^2}{c^2}}}$

21

Version No.				
3	2	0	4	1

ROLL NUMBER						

PHYSICS HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed.

Do not use lead pencil.

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دے کر نگرانِ مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال منوع ہے۔

Answer Sheet No. _____

ہر سوال کے سامنے دیے گئے، کریکولم کے مطابق درست دائرہ کو پر کریں۔ **Invigilator Sign.** _____

Fill the relevant bubble against each question according to curriculum: **Candidate Sign.** _____

	Question	A	B	C	D	A	B	C	D
1.	In a simple pendulum experiment, percentage errors (uncertainty) in "L" and "T" are 0.1% and 2% respectively. Maximum percentage error (uncertainty) in "LT^2" is:	4.1%	3%	2.1%	3.2	○	○	○	○
2.	If $\bar{A}.\bar{B} = \lvert\bar{A}\times\bar{B}\rvert$ then angle "θ" between vectors $\bar{A}$ and $\bar{B}$ is:	0	$\pi/4$	$\pi/2$	π	○	○	○	○
3.	When a massive body of mass M_1 is moving with velocity V_1 collides with lighter stationary body of mass m_2, the velocity of massive body after collision will be:	$V_1' = 2V_1$	$V_2' = V_1$	$V_1' = V_1$	$V_2' = 2V_2$	○	○	○	○
4.	Moment of inertia of a body spinning about its axis **DOES NOT** depend on the:	Angular velocity of body	Mass of body	Orientation of the axis	Distribution of mass around axis	○	○	○	○
5.	The bodies A and B of equal masses have velocities ratio in 2:1 their K.E are in the ratio of:	2:1	1:2	4:1	1:4	○	○	○	○
6.	The fluid is said to be incompressible, if its density is:	Constant	Very high	Very small	Zero	○	○	○	○
7.	Equation of continuity is based upon law of conservation of:	Momentum	Energy	Mass	Charge	○	○	○	○
8.	Glass is an example of _____ solid.	Crystalline	Amorphous	Poly-crystalline	Ductile	○	○	○	○
9.	Young's Modulus, Y=	$\frac{\Delta L/L}{F/A}$	$\frac{FA}{\Delta L.L}$	$\frac{\Delta L.L}{FA}$	$\frac{F/A}{\Delta L/L}$	○	○	○	○
10.	A Carnot engine undergoes _____ processes in one cycle.	Two	Three	Four	Six	○	○	○	○
11.	Stars moving away from the earth show:	Red shift	Blue shift	Black shift	Yellow shift	○	○	○	○
12.	A negatively charged particle is placed in a uniform electric field directed from south to north. In which direction will the particle move after being released?	North	South	East	West	○	○	○	○
13.	A 100 ohm resistor is connected across the terminals of a 10V battery. The power dissipation of the resistor is:	1 watt	10 watts	100 watts	1000 watts	○	○	○	○
14.	The SI unit of magnetic induction is:	Nm	Gauss	Weber	Tesla	○	○	○	○
15.	Relativistic mass is always:	Less than rest mass	Greater than rest mass	Equal to rest mass	Zero	○	○	○	○
16.	Inertial frame of reference is a frame in which _____ law of motion holds.	1st	2nd	3rd	4th	○	○	○	○
17.	Two up quarks and one down quark make a:	Meson	Photon	Neutron	Proton	○	○	○	○

- $(K.E)_{trans} = \frac{1}{2}mv^2$
- $I = mr^2$
- $P = VI$
- $P = \frac{V^2}{R}$
- $\bar{A}.\bar{B} = AB\cos\theta$
- $\bar{A}\times\bar{B} = AB\sin\theta$
- $L = I\omega$
- $v = r\omega$

PHYSICS HSSC–I

Time allowed: 2;35 Hours **Total Marks Sections B and C: 68**

SECTION – B (Marks 42)

Q. 2 Answers the following parts briefly. **(14 x 3 = 42)**

(Use of graph paper is not necessary. Candidates can make their own grid on answer book if required)

(i)	Show that the equation $P = \rho gh$ is dimensionally homogeneous.	03	OR	Explain that increase in entropy means degradation of energy.	03
(ii)	Time for 10 vibrations of a simple pendulum is 17.6s. Least count of stop watch is 0.1s. Find time period of simple pendulum. Also determine uncertainty in it.	03	OR	When water falls from a tap, its cross-sectional area decreases as it comes down. Explain why? 	03
(iii)	Under what condition the rectangular (perpendicular) components of a vector have same magnitude?	03	OR	Discuss the motion of two bodies after collision when $m_1 << m_2$ and $V_2 = 0$.	03
(iv)	What is meant by Gyroscope? Explain briefly.	03	OR	What is meant by work? How can work done be calculated graphically by a variable force?	03
(v)	A space ship has diameter of **8m** rotates about its axis to produce artificial gravity of magnitude **17.47ms^{-2}** in it. Calculate with which angular speed the satellite rotates?	03	OR	Differentiate between conservative and non-conservative forces. Give examples.	03
(vi)	Derive the relation between torque, moment of inertia and angular acceleration.	03	OR	Derive the formula for Kinetic Energy [using the equations of motion]	03
(vii)	What is meant by Magnus effect? Give its causes and effects.	03	OR	Differentiate between reversible and irreversible processes. Also give examples.	03
(viii)	Show that: $\frac{Volt}{meter} = \frac{Newton}{Coulomb}$	03	OR	Find the power delivered by an engine for attaining velocity= $(4\hat{i} + 5\hat{j})$ m/s while it exerts a force= $(8\hat{i} - 2\hat{j})$ N.	03
(ix)	What is meant by null method of measurement? Enlist two applications.	03	OR	Briefly describe the terms, *stress*, *strain* and *Young's modulus*.	03
(x)	Why are the suspension bridges written with their period of use? Why after that period it is dangerous to use the bridge? (Elastic potential)	03	OR	What is meant by magnetic flux linkage? Explain briefly.	03
(xi)	State three statements of second law of thermodynamics.(one in terms of entropy)	03	OR	How is Doppler's effect helpful in diagnosis of cardiac diseases? Explain briefly.	03
(xii)	Calculate entropy change when 800g of ice melts at $0°C$, latent heat of fusion for ice is $3.36\times10^5 J/kg$. Also discuss sign of entropy.	03	OR	Can sound waves be polarized? Explain briefly.	03
(xiii)	To increase intensity of waves by a factor of 25, calculate the required increase in amplitude of wave.	03	OR	What is super fluidity? Give some of its applications.	2+1
(xiv)	Under what conditions can the terminal potential differences of a battery exceed its emf?	03	OR	State the characteristics of vector product.	03

SECTION – C (Marks 26)

Attempt the following questions.

(Use of graph paper is not necessary. Candidates can make their own grid on answer book if required)

Q.3	What is meant by projectile? Determine the expressions for velocity and displacement of a projectile thrown horizontally from a certain height.	1+4 +2	OR	What is meant by electric field strength? Show that: $E = \frac{-\Delta V}{\Delta r}$	07
Q.4	State and explain terminal velocity. Derive its equation by using stoke's law.	1+2 +3	OR	What is meant by quark? Explain the quark family of particles.	2+4
Q.5	What are stationary waves? Discuss the formation of harmonics in stationary waves in an open organ pipe.	1+6	OR	What is centripetal acceleration? Derive an expression for centripetal acceleration in terms of angular velocity "ω".	1+6
Q.6	Discuss and derive an expression for magnetic force acting per unit length of conductor, when current is passing through two parallel straight conductors in upward direction.	06	OR	Discuss the following consequences of special theory of relativity: i) Time dilation ii) Length contraction iii) Mass increase	2x3

- $\Delta S = \frac{\Delta Q}{T}$
- $v_2' = \left(\frac{2m_1}{m_1 + m_2}\right) v_1$
- $T = \frac{Total\ time}{No.of\ vibrations}$
- $P = \vec{F}.\vec{v}$
- $I \propto A^2$
- $\omega = \sqrt{\frac{g_e}{R}}$
- $\text{uncertainty} = \frac{\text{Absolute uncertainty}}{\text{No. of vibrations}}$
- $\Delta Q = mL_f$
- $v_1' = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) v_1$
- $W = KE = F.\Delta d$
- $F_{drag} = 6\pi\eta rv$
- $P_1 + \frac{1}{2}\rho v_1^2 + \rho g h_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g h_2$

Version No.				
9	0	0	4	1

ROLL NUMBER						

PHYSICS HSSC–I
(Old Curriculum 2006)
SECTION – A (Marks 17)

Time allowed: 25 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed.

Do not use lead pencil.

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دے کر ناظم مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Answer Sheet No. _____

ہر سوال کے سامنے دیے گئے، کریکولم کے مطابق درست دائرہ کو پر کریں۔ **Invigilator Sign.** _____

Fill the relevant bubble against each question according to curriculum: **Candidate Sign.** _____

	Question	A	B	C	D	A	B	C	D
1.	Which pair has the same dimension?	Work and power	Force and torque	Torque and power	Work and energy	○	○	○	○
2.	The length of body is measured as 3.51m, if the accuracy is 0.01m, then the percentage uncertainty in the measurement is:	3.51%	0.35%	0.28%	28.65%	○	○	○	○
3.	A force of 10 N makes an angle of 30° with x- axis. The magnitude of x- component is:	5 N	8.66 N	10 N	Zero N	○	○	○	○
4.	Resultant of two forces 20N and 50N acting simultaneously on a body **CANNOT** be:	20 N	30 N	40 N	70 N	○	○	○	○
5.	A 7 kg bowling ball experiences a net force of 5.0 N. What will be its acceleration?	35 ms^{-2}	7.0 ms^{-2}	5.0 ms^{-2}	0.71 ms^{-2}	○	○	○	○
6.	A ball with original momentum $+4.0\ kgms^{-1}$ hits a wall and bounces straight back without losing any kinetic energy. The change in momentum of the ball is:	$+4\ Ns$	$-4\ Ns$	$+8\ Ns$	$-8\ Ns$	○	○	○	○
7.	Two bodies with kinetic energies in the ratio of 4 : 1, are moving with equal linear momentum, the ratio of their masses is:	1 : 2	1 : 1	4 : 1	1 : 4	○	○	○	○
8.	The relation between the escape velocity v_{esc} and orbital velocity v_o is:	$v_{esc} = 1/2\ v_o$	$v_{esc} = \sqrt{2}\ v_o$	$v_{esc} = v_o$	$v_{esc} = 2\ v_o$	○	○	○	○
9.	Weight of 60 kg man in a downward moving lift with constant acceleration of $1/2g$ is:	Zero N	300 N	600 N	200 N	○	○	○	○
10.	A sphere is rolling without slipping on a horizontal plane. Ratio of its rotational kinetic energy and translational kinetic energy is:	2 : 3	2 : 5	2 : 7	2 : 9	○	○	○	○
11.	Drag force $F_d =$	$6\eta v$	$6rv$	$6\pi\eta rv$	$6\pi rv$	○	○	○	○
12.	Water level in a tank is 10m above leak point. Speed with which water emerges from leak is:	10 ms^{-1}	14.14 ms^{-1}	194.14 ms^{-1}	0.1 ms^{-1}	○	○	○	○
13.	If the period of oscillation of mass M suspended form a spring is 2 seconds, then period of mass 4M will be:	1 second	2 second	3 second	4 second	○	○	○	○
14.	A wave is reflected from the boundary of a denser to a rarer medium, it undergoes a phase change of:	0°	$\frac{\pi}{2}$	π	2π	○	○	○	○
15.	The fundamental frequency of closed organ pipe is f. If both ends are open then its fundamental frequency will be:	f	0.5 f	2 f	4 f	○	○	○	○
16.	Colored fringes observed in soap bubbles are the example of:	Interference	Refraction	Polarization	Diffraction	○	○	○	○
17.	For an ideal gas the internal energy is directly proportional to:	Pressure	Volume	Mass	Temperature	○	○	○	○

- $F_x = F\cos\theta$
- $F = ma$
- $\Delta p = p_f - p_i$
- $v_{esc} = \sqrt{2gR_e}$
- $v_o = \sqrt{gR_e}$
- $F_y = F\sin\theta$
- $T = m(g-a)$
- $K.E = \frac{p^2}{2m}$
- $(K.E)_{tran} = \frac{1}{2}mv^2$
- $(K.E)_{rot} = \frac{1}{2}I\omega^2$
- $v = \sqrt{2g(h_1 - h_2)} = \sqrt{2gh}$
- $f_{1(open)} = \frac{v}{2l}$
- $v = r\omega$
- $I = \frac{2}{5}mr^2$
- $T = 2\pi\sqrt{\frac{m}{k}}$
- $g = 10ms^{-2}$
- $\%Uncertainity = \left(\frac{LC}{Measured\ value}\right)\times 100\%$
- $f_{1(close)} = \frac{v}{4l}$

PHYSICS HSSC–I
(Old Curriculum 2006)

24

Time allowed: 2:35 Hours **Total Marks Sections B and C: 68**

SECTION – B (Marks 42)

Q. 2 Answers the following parts briefly. **(14 x 3 = 42)**

(i)	How many radians account for circumference of a circle? How many steradians account for circumference of a sphere?	03	OR	What will be the frequency of a simple pendulum if its length is 1 m?	03
(ii)	Show that: $\left\|\vec{A}\times\vec{B}\right\|^2+\left\|\vec{A}.\vec{B}\right\|^2=A^2B^2$	03	OR	The engine of a JF Thunder fighter develops a thrust of 3000 N. What horse power does it have at a velocity of $600 ms^{-1}$?	03
(iii)	Can the velocity of a body reverse the direction when acceleration is constant? If you think so, give an example.	03	OR	A string 1 m long is used to whirl a 100 g stone in a horizontal circle at a speed of $2\ ms^{-1}$. Find the tension in the string.	03
(iv)	Calculate the angle of projection for which kinetic energy at summit is equal to one fourth of its kinetic energy at point of projection.	03	OR	Show that the relation between maximum height and time of flight of projectile is $H=\left(\frac{gT^2}{8}\right)$.	03
(v)	A body of mass 2.0 kg is dropped from rest position 5 m above the ground. What is its velocity at height of 3.0 m above the ground?	03	OR	The magnitude of dot and cross product of two vectors are $6\sqrt{3}$ and 6 respectively. Find the angle between two vectors?	03
(vi)	The mass of moon is 1/80 of the mass of earth and the corresponding radius is 1/4 of the earth. Calculate escape velocity at surface of the moon.	03	OR	Is it possible for a person to distinguish between a raw egg and a hard boiled one by spinning each on a table? Explain briefly.	03
(vii)	Determine orbital speed of International Space Station (ISS), if its orbit is $4\times10^2\ km$ above surface of earth.	03	OR	To what height can a 400 W engine lift a 100 kg mass in 3s?	03
(viii)	The moon revolves around the earth in almost a circle of radius 382400 km in 27.3 days. What is the centripetal acceleration?	03	OR	The deviation of the second order diffracted image formed by an optical grating having 5000 lines per centimeter is $32°$. Calculate the wavelength of the light used.	03
(ix)	Radius of small fog droplet in air is found to be $5.1x10^{-6}m$. Coefficient of viscosity of air is $1.9x10^{-5}kgm^{-1}s^{-1}$. Find settling speed of droplet in air.	03	OR	Modern cars are not rigid but are designed to have "crumple zones" (irregular fold) that collapse upon impact. What is the advantage of this design?	03
(x)	From the top of a tall building, two tennis balls are dropped, one filled with air and the other with water. Which ball reaches terminal velocity first and why?	03	OR	A cricket ball moves past an observer from left to right, spinning counter clockwise, in which direction the ball tend to deflect?	03
(xi)	A spider swings in the breeze from a silk thread with a period of 0.6s. How long is the spider's strand of silk?	03	OR	If an equation is dimensionally correct, is that equation a right equation?	03
(xii)	The speed of sound in air at $0°C$ is $332\ ms^{-1}$. What will be speed of sound at $22°C$?	03	OR	Can specific heat of a gas be zero or infinity? Can specific heat be negative?	03
(xiii)	X-rays of wavelength 3nm are incident on a crystal for which the lattice spacing is 5nm. Calculate the angle at which the first Bragg's diffraction is observed.	03	OR	Water is flowing smoothly through a closed pipe system. At one point, the speed of water is $3ms^{-1}$, while another point 3m higher, the speed is $4ms^{-1}$. At lower point the pressure is 80kPa. Find the pressure at the upper point.	03
(xiv)	What happens to the temperature of room in which an air conditioner is left running on a table in the middle of a room?	03	OR	A source of sound vibrates at 200 Hz and is receding from a stationary observer at $18\ ms^{-1}$. If the speed of sound is $331ms^{-1}$ then what frequency does the observer hear?	03

SECTION – C (Marks 26)

Attempt the following questions.

Q.3	Explain scalar or dot product of two vectors with at least two examples and four properties.	07	OR	How can resultant of two or more vectors be obtained by their rectangular components?	07
Q.4	The length of a pendulum is $(1.5\pm0.01)m$ and the acceleration due to gravity is taken into account as $(9.8\pm0.01)ms^{-2}$. Calculate the time period of the pendulum with uncertainty in it.	06	OR	What is Doppler effect? Explain it for the cases when: i) Both listener and source of sound move towards each other. ii) Both listener and source of sound move away from each other.	06
Q.5	What is Carnot's engine? Explain its working and calculate its efficiency. Also state Carnot's theorem.	07	OR	A block weighing 4.0 kg extends a spring by 0.16 m from its un–stretched position. The block is removed and a 0.50 kg body is hung from the same spring. If the spring is now stretched and then released, what is its period of vibration?	07
Q.6	Explain Brewster law of polarization with a diagram.	06	OR	Prove that: $C_p-C_v=R$	06

- $R=\frac{v_i^2\,\mathrm{Sin}\,2\theta}{g}$
- $H=\frac{v_i^2\,\mathrm{Sin}^2\theta}{2g}$
- $T=\frac{2v_i\ \mathrm{Sin}\ \theta}{g}$
- $f'=(\frac{v}{v+a})f$
- $f=\frac{1}{2\pi}\sqrt{\frac{g}{l}}$
- $P=\frac{mgh}{t}$
- $\vec{A}\times\vec{B}=AB\,\mathrm{Sin}\,\theta\,\hat{n}$
- $v_t=\frac{2\rho gr^2}{9\eta}$
- $a_c=\frac{v^2}{r}=\frac{v^2}{R}$
- $F_c=\frac{mv^2}{r}$
- $T=2\pi\sqrt{\frac{l}{g}}$
- $v_o=\sqrt{\frac{GM}{R+h}}$
- $\vec{A}.\vec{B}=AB\,\mathrm{Cos}\,\theta$
- $T=2\pi\sqrt{\frac{m}{k}}$
- $f'=\left(\frac{v-b}{v+a}\right)f$
- $\mathrm{d}=\frac{1}{\mathrm{N}}$
- $V_{esc}=\sqrt{2gR}$
- $P=Fv$
- $K.E=\frac{1}{2}mv^2$
- $d\,\mathrm{Sin}\,\theta=n\lambda$
- $f'=\left(\frac{v+b}{v-a}\right)f$
- $v_t=v_0+(0.61)t$
- $2d\,\mathrm{Sin}\,\theta=m\lambda$
- $R_e=6.4\times10^6\,m$
- $P_1+\frac{1}{2}\rho v_1^2+\rho gh_1=P_2+\frac{1}{2}\rho v_2^2+\rho gh_2$
- $\mathrm{Sin}^2\theta+\mathrm{Cos}^2\theta=1$
- $M_e=6\times10^{24}kg$
- $G=6.673\times10^{-11}Nm^2kg^{-2}$