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PHYSICS

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Latest Syllabus
(Issued by Department of PUE, Karnataka)
BLOW UP SYLLABUS
I PUC MATHEMATICS - Code No. 35

Column1	Column2	Column3	Column4	Column42	Column5	Column6
SUBJECT	**CLASS**	**CODE**	**DEPARTMENT OF P U EDUCATION**		**ACADEMIC PROGRAM FOR THE YEAR 2018-19**	
MATHE-MATICS	**I PUC**	**35**	*PUC (4 THEORY + 2 PROBLEM CLASSES A WEEK)*	***PRACTICE/PROBLEM SESSIONS***		
DAY	DATE	DAY				
DAY 1	14-May-18	MONDAY	REVISION ON REAL NUMBER SYSTEM			
DAY 2	15-May-18	TUESDAY	**CHAPTER 1: SETS :** Sets and their representations: Definitions, examples, Methods of Representation in roster and rule form, examples			
DAY 3	16-May-18	WEDNESDAY	TYPES OF SETS, EMPTY, FINITE, INFINITE, EQUAL SETS, SUBSETS			
DAY 4	17-May-18	THURSDAY	**Subsets of the set of real numbers** especially intervals (with notations). Power set. Number of elements in power set. Universal set. Examples			
DAY 5	18-May-18	FRIDAY	Operation on sets: Union and intersection of sets. Difference of sets. Complement of a set, Properties of Complement sets.			
DAY 6	19-May-18	SATURDAY		Practice session on Problems on sets		
	20-May-18	SUNDAY				
DAY 7	21-May-18	MONDAY	**Venn diagrams :** simple problems on Venn diagram representation of operation on sets			
DAY 8	22-May-18	TUESDAY		PRACTICAL PROBLEMS ON VENN DIAGRAMS		

DAY 9	23-May-18	WEDNESDAY	**Chapter 2: Relation and function :** Ordered pairs, Cartesian product of sets. Number of elements in the Cartesian product of two finite sets. Cartesian product of the reals with itself (upto $R \times R \times R$).			
DAY 10	24-May-18	THURSDAY	**Relation :** Definition of relation, pictorial diagrams, domain, co-domain and range of a relation and examples			
DAY 11	25-May-18	FRIDAY	**Function :** Function as a special kind of relation from one set to another. Pictorial representation of a function, domain, co-domain and range of a function. Real valued function of the real variable			
DAY 12	26-May-18	SATURDAY		Problem on Relation, Examples of functions		
	27-May-18	SUNDAY				
DAY 13	28-May-18	MONDAY	constant, identity, polynomial, rational function with their domain and range. Discussion on graphs of parabola $y = x^2$ and $y = x^3$, their domain and range.			
DAY 14	29-May-18	TUESDAY	modulus, signum and greatest integer functions with their graphs.			
DAY 15	30-May-18	WEDNESDAY	**Algebra of real valued functions :** Sum, difference, product and quotients of functions with examples.			
DAY 16	31-May-18	THURSDAY	Solving problems of Miscellaneous examples on Relation and functions			
DAY 17	01-Jun-18	FRIDAY		INTERACTIVE PRACTICE SESSION ON FINDING DOMAIN AND RANGE OF FUNCTIONS BY TAKING CERTAIN /ADDITIONAL EXAMPLES IN TEXT BOOK		
DAY 18	2-Jun-18	SATURDAY		SESSION MAY BE TAKEN FOR SOLVING PROBLEMS OF MISCELLANEOUS EXAMPLES GIVEN IN TEXT BOOK ON RELATION AND FUNCTIONS		

	03-Jun-18	SUNDAY				
DAY 19	4-Jun-18	MONDAY	**Chapter 3: TRIGONOMETRY:** **Angle :** Positive and negative angles. Degree Measure, Radian Measure, Getting expression for length of arc of circle. relationship between degree and radians, relationship between radian Measuring angles in radians and in degrees and conversion from one measure to another. Listing standard angles in radians and degrees.			
DAY 20	05-Jun-18	TUESDAY	Problems on conversion of radians and degrees and length of arc of circle			
DAY 21	6-Jun-18	WEDNESDAY	Definition of trigonometric functions with the help of unit circle. Truth of the identity $\sin^2 x + \cos^2 x = 1$ and Revision on Trigonometric identities. Defining other trigonometric functions in terms of sine and cosine functions, getting other trigonometric identities from $\sin^2 x + \cos^2 x = 1$			
DAY 22	07-Jun-18	THURSDAY	Trigonometric ratios of Quadrantal angles, 0°, 180°, 270°, 360° degrees. Deducting results for $\sin x=0$, $\cos x=0$, $\tan x=0$, $\sin(2n\pi+x) = \sin x$, $\cos(2n\pi+x)=\cos x$, concluding $\sin x$ and $\cos x$ repeats after interval of 2π			
DAY 23	8-Jun-18	FRIDAY		REVISION /PROBLEMS ON TRIGONOMETRY		
DAY 24	09-Jun-18	SATURDAY		REVISION /PROBLEMS ON TRIGONOMETRY		
	10-Jun-18	SUNDAY				
DAY 25	11-Jun-18	MONDAY	Revision on Trigonometric ratios of certain standard angles, Sign of Trigonometric functions,			
DAY 26	12-Jun-18	TUESDAY	Domain and range of trigonometric functions and their graphs			
DAY 27	13-Jun-18	WEDNESDAY	Given one trigonometric functions and expressing other trigonometric function in terms of it using right angled triangle.			

DAY 28	14-Jun-18	THURSDAY	**Trigonometric functions of sum and difference of two angles :** Deducing the formula for cos(x + y) using unit circle . Expressing sin (x + y) and cos (x + y) in terms of sin x, sin y, cos x and cos y. Deducing the identities like following and problems tan (x ± y) = (tan x ± tan y) / (1 tan$x$. tan y) cot (x ± y) = (cot x cot y 1) / (cot y ± cot x)			
DAY 29	15-Jun-18	FRIDAY		Practice session on Exercise 3.2 and Highligting the importance of drawing graphs of trigonometric functions		
	16-Jun-18	SATURDAY	RAMZAN			
	17-Jun-18	SUNDAY				
DAY 30	18-Jun-18	MONDAY	Getting the trigonometric functions of cos(π/2 – x), sin(π/2 – x), Definition of allied angles and obtaining their trigonometric ratios using compound angle formulae. Deducting trigonometric functions of allied angles cos(π/2+x) = –sin x, sin(π/2+x) = cos x etc , General rule to remember t ratios of allied angles			
DAY 31	19-Jun-18	TUESDAY	Trigonometric ratios of multiple angles : Identities related to sin2x, cos2x, tan2x, sin3x, cos3x and tan3x Deducting trigonometric ratios of half angles from above formulae			
DAY 32	20-Jun-18	WEDNESDAY	Deducing results of TRANSFORMATION FORMULAE, converting sum of t, functions into Product and product into sum sin$x$ +sin$y$ = 2 sin (x+y)/2 cos(x – y)/2; sin$x$ – sin$y$ = 2 cos (x+y)/2 sin (x – y)/2 cos$x$ + cos$y$ = 2 cos (x+y)/2 cos(x – y)/2; cos$x$ – cos$y$ = – 2 sin (x+y)/2 sin(x – y)/2 Deducting results of 2 cos$x$ cos$y$ = cos(x + y)+cos(x – y) etc			

DAY 33	21-Jun-18	THURSDAY	**Trigonometric Equations :** General Solution of trigonometric equations of the type $\sin\theta = \sin\alpha$, $\cos\theta = \cos\alpha$ and $\tan\theta = \tan\alpha$ and problems			
DAY 34	22-Jun-18	FRIDAY		PROBLEMS ON TRIGONOMETRY		
DAY 35	23-Jun-18	SATURDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
	24-Jun-18	SUNDAY				
DAY 36	25-Jun-18	MONDAY	Proofs and simple applications of sine and cosine rule. Problems			
DAY 37	26-Jun-18	TUESDAY		Problems on Sine and cosine rule		
DAY 38	27-Jun-18	WEDNESDAY	**CHAPTER 4: Principle of Mathematical Induction:** Principle of mathematical Induction proofs of (a) $\Sigma \cong [n = (n(n+1)/2]$ (b) $\Sigma \cong [n^\wedge 2 = (n(n+1)(2n+1))/6]$ (c) $\Sigma \cong [n^\wedge 3 = (n^\wedge 2(n+1)^\wedge 2)/4]$ (d) $\Sigma \cong [2n - 1 = n^\wedge 2]$ by mathematical induction			
DAY 39	28-Jun-18	THURSDAY	Sample problems on mathematical induction			
DAY 40	29-Jun-18	FRIDAY	PROBLEMS ON MATHEMATICAL INDUCTION			
DAY 41	30-Jun-18	SATURDAY		5 Mark questions covered in Question bank		
	01-Jul-18	SUNDAY				
DAY 42	2-Jul-18	MONDAY	**CHAPTER 5 : Complex Numbers and Quadratic Equations:** Introducing complex numbers using $x^2+1=0$, Introducing symbol "I", Deducting the result for $I^{4n} = 1$, Solving problems of Exercise 5.1 , 1, 2 and 3			

DAY 43	03-Jul-18	TUESDAY	Algebraic properties of complex numbers and solving problems related			
DAY 44	4-Jul-18	WEDNESDAY	Square roots of negative real number, Identities,			
DAY 45	05-Jul-18	THURSDAY	Modulus and the conjugate of complex number and problems, Argand plane and polar representation of complex numbers and problems			
DAY 46	6-Jul-18	FRIDAY		Practice session on finding Modulus and conjugate of complex number		
DAY 47	07-Jul-18	SATURDAY		Problems on complex numbers		
	8-Jul-18	SUNDAY				
DAY 48	09-Jul-18	MONDAY	Finding argument and modulus of complex number and representing complex number into polar form,			
DAY 49	10-Jul-18	TUESDAY	solution of quadratic equations in the complex number system, Square-root of a Complex number given in supplement and problems.			
DAY 50	11-Jul-18	WEDNESDAY		Practice session on solving Miscellaneous problems / questions from question bank		
DAY 51	12-Jul-18	THURSDAY	**CHAPTER 6: LINEAR INEQUALITIES :** Rules related to linear inequalities and types of inequalities. , Algebraic solutions of linear inequalities in one variable and their representation on the number line and examples.			
DAY 52	13-Jul-18	FRIDAY	Solving problems related to Exercise 6.1			
DAY 53	14-Jul-18	SATURDAY		Practice session on word problems on Linear inequalties.		
	15-Jul-18	SUNDAY				
DAY 54	16-Jul-18	MONDAY	Graphical solution of linear inequalities in two variables and examples			

DAY 55	17-Jul-18	TUESDAY	Solution of system of linear inequalities in two variables -graphically and examples			
DAY 56	18-Jul-18	WEDNESDAY	problems from Miscelleneous exercises			
DAY 57	19-Jul-18	THURSDAY	1st test			
DAY 58	20-Jul-18	FRIDAY	1st test			1 TEST
DAY 59	21-Jul-18	SATURDAY	1st test			
	22-Jul-18	SUNDAY				
DAY 60	23-Jul-18	MONDAY	**CHAPTER 10: STRAIGHT LINES:** Brief recall of 2-D from earlier classes: mentioning formulae .			
DAY 61	24-Jul-18	TUESDAY	Inclination of a line, concept of slope, slope of line joining points			
DAY 62	25-Jul-18	WEDNESDAY	Problems on slope, Slope of parallel and perpendicular lines, collinearity of three points, problems			
DAY 63	26-Jul-18	THURSDAY	Angle between two lines: problems.			
DAY 64	27-Jul-18	FRIDAY		PROBLEMS OF STRAIGHT LINES		
DAY 65	28-Jul-18	SATURDAY		PROBLEMS OF EXERCISE 10.1		
	29-Jul-18	SUNDAY				
DAY 66	30-Jul-18	MONDAY	**Various forms of equations of a line:** Derivation of equation of lines parallel to axes, point-slope form, slope-intercept form, two-point form,			
DAY 67	31-Jul-18	TUESDAY	Various forms of equations of a line: Derivation of intercepts form and normal form and problems.			
DAY 68	1-Aug-18	WEDNESDAY	General equation of a line. Reducing $ax+by+c=0$ into other forms of equation of straight lines. Getting expression for slope, x intercept, y intercept of $ax+by+c=0$, sample problems			
DAY 69	02-Aug-18	THURSDAY	Condition for the two lines in general form to be parallel and perpendicular, Equation of family of lines passing through the point of intersection of two lines and problems			

DAY 70	3-Aug-18	FRIDAY		Practice session on Derivation of various forms of straight lines		
DAY 71	04-Aug-18	SATURDAY		Problems on straight lines		
	5-Aug-18	SUNDAY				
DAY 72	06-Aug-18	MONDAY	Distance of a point from a line , distance between two parallel lines and problems.			
DAY 73	7-Aug-18	TUESDAY	concurrent lines , Equation of line passing through point of intersection of two lines(given in supplement), problems , Solving Miscellaneous problems on straight lines.			
DAY 74	08-Aug-18	WEDNESDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 75	9-Aug-18	THURSDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 76	10-Aug-18	FRIDAY		REVISION TEST/SOLVING MISCELLANEOUS PROBLEMS ON STRAIGHT LINES		
DAY 77	11-Aug-18	SATURDAY	**CONIC SECTION :** Introduction, section of cone, degenerated conic sections,			
	12-Aug-18	SUNDAY				
DAY 78	13-Aug-18	MONDAY	**CIRCLE :** Definition, standard form of equation of circle, General form of equation of circle $x^2+y^2+2gx+2fy+c=0$, center and radius of circle, problems			
DAY 79	14-Aug-18	TUESDAY	problems on circles continued, **Parabola :** Definition, Derivation of standard equation of parabola, other forms of parabola, Latus rectum,			
	15-Aug-18	WEDNESDAY	INDEPENDENCE DAY			
DAY 80	16-Aug-18	THURSDAY	Problems on parabola			

DAY 81	17-Aug-18	FRIDAY	**Ellipse :** Definition, relationship between semi major axis, semi minor axis and distance of focus from the center of the ellipse. Special cases of an ellipse, eccentricity, Deriving standard equation of ellipse			
DAY 82	18-Aug-18	SATURDAY		PRACTICE SESSION ON DERIVATION OF ELLIPSE, PARABOLA		
	19-Aug-18	SUNDAY				
DAY 83	20-Aug-18	MONDAY	Properties of standard form of Ellipse, other form of ellipse having center at origin, Finding length of latus rectum of parabola, eccentricity, Problems			
DAY 84	21-Aug-18	TUESDAY	**Hyperbola:** Definition, Derivation, other form, properties			
	22-Aug-18	WEDNESDAY	BAKRID			
DAY 85	23-Aug-18	THURSDAY	Problems on Hyperbola			
DAY 86	24-Aug-18	FRIDAY		Solving Miscellaneous examples and problems		
DAY 87	25-Aug-18	SATURDAY		Practice session on Problems on conics		
	26-Aug-18	SUNDAY				
DAY 88	27-Aug-18	MONDAY	**LIMITS AND DERIVATIVES:** Limits: Indeterminate forms, existence of functional value, Meaning of $x \to a$, idea of limit, Left hand limit, Right hand limit, Existence of limit, definition of limit,			
DAY 89	28-Aug-18	TUESDAY	Algebra of limits , Proof of $\lim\limits_{x \to a} f(x)$ for positive integers only, PROBLEMS			
DAY 90	29-Aug-18	WEDNESDAY	**Limits of Trigonometric functions:** Sandwich theorem, Proof $\lim\limits_{x \to a} f(x)$ getting result for $\lim\limits_{x \to a} f(x)$ and problems			

DAY 91	30-Aug-18	THURSDAY	PROBLEMS ON LIMITS			
DAY 92	31-Aug-18	FRIDAY		PROBLEMS ON FINDING LEFT HAND LIMIT AND RIGHT HAND LIMIT FOR A FUNCTION		
DAY 93	01-Sep-18	SATURDAY		Conducting Test/MCQ/practice session on Miscellaneous problems		
	2-Sep-18	SUNDAY				
DAY 94	03-Sep-18	MONDAY	**Derivative :** Definition and geometrical meaning of derivative *i.e.*, definition of derivative related to slope of tangent of the curve, Mentioning of Rules of differentiation , problems			
DAY 95	4-Sep-18	TUESDAY	Derivative of x^n, sin$x$, cos$x$, tan$x$, constant functions from first principles problems			
DAY 96	05-Sep-18	WEDNESDAY	Problems on Limits and derivatives			
DAY 97	6-Sep-18	THURSDAY	Limits involving exponential and logarithmic functions, Mentioning of standard limits $\lim_{x\to 0}\left[\frac{\log(f+x)}{x}\right]$ $\lim_{x\to 0}\left[\frac{e^x-1}{x}\right]$			
DAY 98	07-Sep-18	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 99	8-Sep-18	SATURDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
	09-Sep-18	SUNDAY				
DAY 100	10-Sep-18	MONDAY	MID TERM EXAMINATION			
DAY 101	11-Sep-18	TUESDAY	MID TERM EXAMINATION			
DAY 102	12-Sep-18	WEDNESDAY	MID TERM EXAMINATION			
	13-Sep-18	THURSDAY	GANESH CHATURTHI			

DAY 103	14-Sep-18	FRIDAY	MID TERM EXAMINATION			
DAY 104	15-Sep-18	SATURDAY	MID TERM EXAMINATION			MID TERM
	16-Sep-18	SUNDAY				
DAY 105	17-Sep-18	MONDAY	MID TERM EXAMINATION			
DAY 106	18-Sep-18	TUESDAY	MID TERM EXAMINATION			
DAY 107	19-Sep-18	WEDNESDAY	MID TERM EXAMINATION			
DAY 108	20-Sep-18	THURSDAY	MID TERM EXAMINATION			
	21-Sep-18	FRIDAY	LAST DAY OF MOHARRUM			
DAY 109	22-Sep-18	SATURDAY	REVISION			
	23-Sep-18	SUNDAY				
DAY 110	24-Sep-18	MONDAY	**PERMUTATION AND COMBINATION** : Fundamental principle of counting. Factorial n , PROBLEMS			
DAY 111	25-Sep-18	TUESDAY	Permulations : Definition, examples, derivation of formulae ^nP_r. Permutation when all the objects are not distinct, problems			
DAY 112	26-Sep-18	WEDNESDAY	Problems on Permutations			
DAY 113	27-Sep-18	THURSDAY	Problems on Permutations			
DAY 114	28-Sep-18	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 115	29-Sep-18	SATURDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
	30-Sep-18	SUNDAY				
DAY 116	01-Oct-18	MONDAY	Combination: Definition, examples Proving $^nC_r={}^nC_r r!$, $^nC_r = {}^nC_{n-r}$ Problems based on above formulae.			
	2-Oct-18	TUESDAY	MAHATHMA GANDHI JAYANTHI			
DAY 117	03-Oct-18	WEDNESDAY	Problems on Combination			
DAY 118	4-Oct-18	THURSDAY	Problems on Combination			
DAY 119	05-Oct-18	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		

DAY 120	6-Oct-18	SATURDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
	07-Oct-18	SUNDAY				
	8-Oct-18	MONDAY	MAHALAYA AMMAVASYA			
DAY 121	09-Oct-18	TUESDAY	Three dimensional Co ordinate goemetry: Introduction, Idea of co-ordinates, Octants etc			
DAY 122	10-Oct-18	WEDNESDAY	Distance formula, problems			
DAY 123	11-Oct-18	THURSDAY	Section formula ,Mid point formula, problems			
DAY 124	12-Oct-18	FRIDAY		PRACTICE SESSION ON DERIVATIONS ON 3D GEOMETRY		
DAY 125	13-Oct-18	SATURDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
	14-Oct-18	SUNDAY				
	15-Oct-18	MONDAY				
	16-Oct-18	TUESDAY				
	17-Oct-18	WEDNESDAY				
	18-Oct-18	THURSDAY	MAHANAVAMI			
	19-Oct-18	FRIDAY	VIJAYADASHMI			
	20-Oct-18	SATURDAY				
	21-Oct-18	SUNDAY				MID TERM
	22-Oct-18	MONDAY				
	23-Oct-18	TUESDAY				VACATION
	24-Oct-18	WEDNESDAY	VALMIKI JAYANTHI			
	25-Oct-18	THURSDAY				
	26-Oct-18	FRIDAY				
	27-Oct-18	SATURDAY				
	28-Oct-18	SUNDAY				
DAY 126	29-Oct-18	MONDAY	Recapitulation of concepts of permutation and combination, formula			

DAY 127	30-Oct-18	TUESDAY	**BINOMIAL THEOREM:** History, statement and proof of the binomial theorem for positive integral indices Pascal's triangle,			
DAY 128	31-Oct-18	WEDNESDAY	Statement and Proof of Binomial theorem, general and middle term in binomial expansion, some special cases of Binomial theorem			
	1-Nov-18	THURSDAY	KANNADA RAJYOTHSAVA			
DAY 129	02-Nov-18	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 130	3-Nov-18	SATURDAY		PRACTICE SESSION ON DERIVATIONS		
	04-Nov-18	SUNDAY				
DAY 131	5-Nov-18	MONDAY	Using binomial theorem , evaluating 98^5 etc, Problems			
	06-Nov-18	TUESDAY	NARAKA CHATURDASHI			
DAY 132	7-Nov-18	WEDNESDAY	Problems on Binomial theorem			
	08-Nov-18	THURSDAY	BALIPADYAMI DEEPAWALI			
DAY 133	9-Nov-18	FRIDAY	Problems on Binomial theorem			
DAY 134	10-Nov-18	SATURDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
	11-Nov-18	SUNDAY				
DAY 135	12-Nov-18	MONDAY	Recapitulation of Sequence and series			
DAY 136	13-Nov-18	TUESDAY	**Sequence and Series:** Definitions, Problems Arithmetic Progression (A.P.): Definition, examples, general term of AP, nth term of AP, sum to n term of AP, Problems			
DAY 137	14-Nov-18	WEDNESDAY	Problems on AP			
DAY 138	15-Nov-18	THURSDAY	Arithmetic Mean (A.M.) and problems. Geometric Progression (G.P.) : General term of a G.P., n^{th} term of GP, sum of n terms of a G.P. , and problems			

DAY 139	16-Nov-18	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 140	17-Nov-18	SATURDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
	18-Nov-18	SUNDAY				
DAY 141	19-Nov-18	MONDAY	Problems on GP,Infinite G.P and its sum, geometric mean (G.M.).			
DAY 142	20-Nov-18	TUESDAY	Problems on nth term and sum to n term of series			
	21-Nov-18	WEDNESDAY	EID MILAD			
DAY 143	22-Nov-18	THURSDAY	Relation between A.M. and G.M. and problems. Sum to n terms of the special series : Σn, Σn^2 and Σn^3			
DAY 144	23-Nov-18	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 145	24-Nov-18	SATURDAY		Solving Miscellaneous examples and problems		
	25-Nov-18	SUNDAY				
	26-Nov-18	MONDAY	KANAKADASA JAYANTHI			
DAY 146	27-Nov-18	TUESDAY	**Probability :** Random experiments: outcomes, sample spaces (set representation).			
DAY 147	28-Nov-18	WEDNESDAY	Problems on describing sample space for indicated experiment			
DAY 148	29-Nov-18	THURSDAY	**Types of Events :** Occurrence of events, simple event, compound event, impossible event, sure event, complimentary event, 'not', 'and' & 'or' events			
DAY 149	30-Nov-18	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 150	1-Dec-18	SATURDAY		REVISION ON PROBABILITY		

	02-Dec-18	SUNDAY				
DAY 151	3-Dec-18	MONDAY	Exhaustive events, mutually exclusive events. Problems			
DAY 152	04-Dec-18	TUESDAY	Problems on Mutually exclusive and Exhaustive events			
DAY 153	5-Dec-18	WEDNESDAY	Axiomatic (set theoretic) probability, examples			
DAY 154	06-Dec-18	THURSDAY	2nd test			
DAY 155	7-Dec-18	FRIDAY	2nd test			2 TEST
DAY 156	08-Dec-18	SATURDAY	2nd test			
	9-Dec-18	SUNDAY				
DAY 157	10-Dec-18	MONDAY	**Probability of an event**, Probability of equally likely outcomes, Probability of Event A or B, problems			
DAY 158	11-Dec-18	TUESDAY	Probability of event 'not A" problems, problems on probability			
DAY 159	12-Dec-18	WEDNESDAY	**STATISTICS :** Measures of dispersion, Mean deviation of ungrouped data and grouped data, Discrete frequency distribution,			
DAY 160	13-Dec-18	THURSDAY	Mean deviation about Mean, short cut method, Problems			
DAY 161	14-Dec-18	FRIDAY		SOLVING MISCELLANEOUS PROBLEMS ON PROBABILITY		
DAY 162	15-Dec-18	SATURDAY		MCQ/TEST/PRACTICE SESSIONS		
	16-Dec-18	SUNDAY				
DAY 163	17-Dec-18	MONDAY	Mean deviation about Median , problems			
DAY 164	18-Dec-18	TUESDAY	Variance and standard deviation			
DAY 164	19-Dec-18	WEDNESDAY	standard deviation of discrete frequency distribution, problems, Standard deviation of continuous frequency distribution , problems			
DAY 165	20-Dec-18	THURSDAY	short cut method to find variance and standard deviation, problems			

DAY 166	21-Dec-18	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 167	22-Dec-18	SATURDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
	23-Dec-18	SUNDAY				
DAY 168	24-Dec-18	MONDAY	Analysis of frequency distribution, comparision of two frequency distribution with same mean but different variances, problems			
	25-Dec-18	TUESDAY	CHRISTMAS			
DAY 169	26-Dec-18	WEDNESDAY	Miscellaneous examples and problems			
DAY 170	27-Dec-18	THURSDAY		REVISION ON STATISTICS		
DAY 171	28-Dec-18	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 172	29-Dec-18	SATURDAY		Practice session on Miscellaneous examples and problems		
	30-Dec-18	SUNDAY				
DAY 173	31-Dec-18	MONDAY	**CHAPTER 14: MATHEMATICAL REASONING:** Definition of statement, examples, Negation of statement , examples			
DAY 174	01-Jan-19	TUESDAY	compound statement,Logical connectives " and", "OR",, problems,			
DAY 175	2-Jan-19	WEDNESDAY	Implication, converse and contrapostive of implication, problems			
DAY 176	03-Jan-19	THURSDAY	validating statements, Miscellaneous examples			
DAY 177	4-Jan-19	FRIDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		
DAY 178	05-Jan-19	SATURDAY		Selected questions of 1M, 2M, 3M & 5M of topics covered this week from question bank		

	6-Jan-19	SUNDAY				
DAY 179	07-Jan-19	MONDAY	REVISION CLASS / REMEDIAL GUIDANCE			
DAY 180	8-Jan-19	TUESDAY	REVISION CLASS / REMEDIAL GUIDANCE			
DAY 181	09-Jan-19	WEDNESDAY	REVISION CLASS / REMEDIAL GUIDANCE			
DAY 182	10-Jan-19	THURSDAY	REVISION CLASS / REMEDIAL GUIDANCE			2ND PUC PREPARA-TORY
DAY 183	11-Jan-19	FRIDAY	REVISION CLASS / REMEDIAL GUIDANCE			EXAM
DAY 184	12-Jan-19	SATURDAY	REVISION CLASS / REMEDIAL GUIDANCE			
	13-Jan-19	SUNDAY				
DAY 185	14-Jan-19	MONDAY	REVISION CLASS / REMEDIAL GUIDANCE			
	15-Jan-19	TUESDAY	MAKARASANKRANTI			
DAY 186	16-Jan-19	WEDNESDAY	REVISION CLASS / REMEDIAL GUIDANCE			
DAY 187	17-Jan-19	THURSDAY	REVISION CLASS / REMEDIAL GUIDANCE			
DAY 188	18-Jan-19	FRIDAY	REVISION CLASS / REMEDIAL GUIDANCE			
DAY 189	19-Jan-19	SATURDAY	REVISION CLASS / REMEDIAL GUIDANCE			

DESIGN OF THE QUESTION PAPER

Time: 3 Hours 15 Minutes *(of which 15 minuts for reading the question paper).* **Maximum Marks: 100**

The weightage of the distribution of marks over different dimensions of the question paper shall be as follows :

A. WEIGHTAGE TO OBJECTIVES

Objective	Weightage	Marks
Knowledge	40%	43/105
Understanding	30%	31/105
Application	20%	21/105
Skill	10%	10/105

B. WEIGHTAGE TO CONTENT/SUBJECT UNITS:

Unit No.	Chapter No.	Topic	No. of Hours	Weightage Marks
I	1	Physical world	2	2
	2	Unit and measurement	4	3
II	3	Motion in a straight line	8	7
	4	Motion in a plane	12	11
III	5	Laws of motion	11	10
IV	6	Work energy and power	11	10
V	7	System of particles and rigid body	12	10
VI	8	Gravitation	9	8
VII	9	Mechanical properties of solids	5	4
	10	Mechanical properties of fluids	5	4
	11	Thermal properties of matter	10	9
VIII	12	Thermodynamics	8	7
IX	13	Kinetic theory	5	4
X	14	Oscillations	8	7
	15	Waves	10	9
		Total	**120**	**105**

Note: *Variation of 1 Mark per chapter is allowed, however the total marks should not exceed 105.*

C. WEIGHTAGE TO FORMS OF QUESTIONS:

Part	Question Main	Type of Questions	Marks	Number of questions to be set	Number of questions to be answered
A	I	Very short answer (VSA)	1	10	10
B	II	short answer (SA 1)	2	8	5
C	III	short answer (SA 2)	3	8	5
D	IV	Long answer (LA)	5	3	2
	V	Long answer (LA)	5	3	2
	VI	Numerical Problems (NP)	5	5	3

Note:

1. L A Questions in IV and V mains should not be split in to SA and VSA type Questions.

2. L A Questions in IV Main must be set from Unit I to V.

3. L A Questions in V Main must be set from Unit VI to X.

4. N P Questions in VI Main must be set such that one Numerical Problem is from every 2 successive units.

D. WEIGHTAGE TO LEVEL OF DIFFICULTY:

Level	Weightage	Marks
Easy	40%	43/105
Average	40%	42/105
Difficult	20%	20/105

GENERAL INSTRUCTIONS :

- Questions should be clear, unambiguous, understandable and free from grammatical errors.
- Questions which are based on same concept, law, fact etc. and which generate the same answer should not be repeated under different forms (VSA, SA, LA and NP).
- Questions must be set based on the blow up syllabus only.

SAMPLE BLUE PRINT

PUC-I : PHYSICS (33)

Unit	Chapter	Topic	Teaching Hours	Marks allotted	1 mark (VSA)	2 marks (SA1)	3 marks (SA2)	5 marks (LA)	5 marks (NP)
I	1.	Physical world	2	2		✓			
	2.	Units and measurement	4	3	✓	✓			
II	3.	Motion in a straight line	8	7		✓		✓	
	4.	Motion in a plane	12	11	✓	✓	✓		✓
III	5.	Lows of motion	11	10		✓	✓	✓	
IV	6.	Work energy and power	11	9	✓		✓		✓
V	7.	System of particles and rigid body	12	11	✓	✓	✓	✓	
VI	8.	Gravitation	9	8			✓		✓
VII	9.	Mechanical properties of solids	5	4	✓		✓		
	10.	Mechanical properties of fluids	5	4	✓	✓			
	11.	Thermal properties of matter	10	9	✓		✓		✓
VIII	12.	Thermodynamics	8	6	✓			✓	
IX	13.	Kinetic theory	5	4	✓		✓		
X	14.	Oscillations	8	7		✓		✓	
	15.	Waves	10	10				✓	✓
		Total	**120**	**105**	**10**	**16**	**24**	**30**	**25**

SOLVED PAPER	I PUC Annual Examination 2018	Physics Subject Code 33 (N)

Time : 3 Hours 15 Min. **Max. Marks : 70**

General Instructions :

1. *All parts are compulsory.*
2. *Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.*
3. *Numerical problems should be solved with relevant formulae.*

PART-A

I. Answer ALL the following questions : **$10 \times 1 = 10$**

1. What are fundamental units ?
2. Define centripetal acceleration.
3. When is work done by the force positive ?
4. Express torque in vector form.
5. Give the relation between stress and strain.
6. State Pascal's Law.
7. What is magnus effect ?
8. Define heat capacity.
9. Mention the formulae for coefficient of performance of a refrigerator.
10. Define mean free path.

PART-B

II. Answer any FIVE of the following questions : **$5 \times 2 = 10$**

11. Mention two fundamental forces in nature.
12. Write the dimensional formulae for
(a) Force (b) Pressure
13. Define displacement and acceleration.
14. Give the representation for Scalar product and Vector product of two vectors.
15. Mention any two methods of reducing friction.
16. Write the general conditions for equilibrium of a rigid body.
17. Explain the application of surface tension idea in case of action of detergents.
18. What is simple harmonic motion ? Give one example.

PART-C

III. Answer any FIVE of the following questions : **$5 \times 3 = 15$**

19. Derive an expression for maximum height of a projectile.
20. What is angle of banking ? Mention an expression for maximum safe speed of a vehicle on a level road and express the symbols.
21. Distinguish between conservative and non conservative forces.
22. Compare the equations of linear motion with rotational motion.
23. State Kepler's laws of planetary motion.
24. Derive an expression for Young's modulus of a wire in terms of its radius.
25. Prove that $\alpha_v = \frac{1}{T}$ for ideal gas.
26. Mention three assumptions of Kinetic theory of gases.

PART-D

IV. Answer any TWO of the following questions : **2 × 5 = 10**

27. What is velocity-time graph ? Derive the equation $x = v_0t + \frac{1}{2}at^2$ by graphical method.

28. State and prove law of conservation of linear momentum.

29. Define Torque and angular momentum.
Derive the relation between torque and angular momentum.

V. Answer any TWO of the following questions : **2 × 5 = 10**

30. Explain different stages of Carnot's cycle with P-V diagram.

31. Derive an expression for time period of oscillating bob of simple pendulum.

32. Mention the differences between progressive and stationary waves.

VI. Answer any THREE of the following questions : **3 × 5 = 15**

33. An aircraft executes a horizontal loop of radius 1 km with a steady speed of 900 kmph. Compare its centripetal acceleration with acceleration due to gravity.

34. A man weighing 49 kg carries a bag of 2 kg. He climbs to the top of a building 100 m tall in 5 minutes. Calculate the work done by the man and the power he develops.

35. Calculate 'g' at the bottom of a mine 8 km deep and at an altitude 32 km above the earth's surface. Radius of earth = 6.4×10^6 m and g on earth's surface = 9.8 m/s^2.

36. A cubical ice box of thermocol has each side 30 cm and thickness 5 cm. 4 kg of ice is put in the box, if outside temperature is 45°C and coefficient of thermal conductivity is 0.01 Js^{-1} m^{-1} K^{-1}. Calculate the mass of ice left after 6 hrs. Take latent heat of fusion of ice is 335×10^3 J Kg^{-1}

37. The apparent frequency of a note when an observer moves towards a stationary source with a velocity 20 m/s is 200 Hz. Calculate the actual frequency of a note. Also, calculate wavelength if velocity of sound in air is 350 m/s.

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SOLUTIONS
As Per Scheme of Valuation
(Issued by Department of PUE, Karnataka)

PART - A

I. **1.** These are the units of fundamental physical quantities. **[Scheme of Valuation 2018] 1**

Detailed Answer :

Meter, Kilogram, Second, Kelvin, Ampere, Candela and mole are the fundamental units of physical quantities.

2. It is the acceleration along the radial line and always directed towards the center of the circular path. **1**

3. If the applied force and displacement are in the same direction. **[Scheme of Valuation 2018] 1**

Detailed Answer :

$$W = \vec{F}\cdot\vec{s} = Fs\cos\theta$$

for $\cos\theta$ to be positive ($\theta < 90°$).

$\therefore$ Work done is positive.

4. $\vec{\tau} = \vec{r}\times\vec{F}$. **1**

5. Directly proportional. **[Scheme of Valuation 2018] 1**

Detailed Answer :

Stress $\propto$ Strain (within elastic limit).

6. The pressure applied to any part of enclosed liquid is transmitted undiminished equally in all directions. **1**

7. It is the dynamic lift due to spinning of ball. **[Scheme of Valuation 2018] 1**

Detailed Answer :

The thrust on a cylinder rotating about its axis while in motion in a fluid, the thrust being perpendicular to the relative motion of the cylinder in the fluid.

8. It is the quantity of heat required to raise the temperature of whole substance through 1 K. **1**

9. $\alpha = \dfrac{Q_2}{W}$ or $\alpha = \dfrac{Q_2}{Q_1 - Q_2}$. **[Scheme of Valuation 2018] 1**

Detailed Answer :

Coefficient of performance

$$\beta = \frac{Q_2}{Q_1 - Q_2} \text{ or } \frac{T_2}{T_1 - T_2}$$

Q_1 — amount of heat released to the source

Q_2 — amount of heat extracted from cold reservoir

T_1 — surrounding air, high temp.

T_2 — Cold reservoir, low temp.

10. It is the average distance covered by the molecule between two successive collisions. **1**

PART - B

II. **11.** Gravitational force, Electromagnetic force, Strong nuclear force, Weak nuclear force. **(Any two) 2**

12. Force = $L^1M^1T^{-2}$, Pressure = $L^{-1}M^1T^{-2}$. **1+1**

13. It is the shortest distance between the initial and final positions of the body. **1**

It is the rate of change of velocity. **1**

14. $\vec{a}.\vec{b} = |\vec{a}|.|\vec{b}|\cos\theta$ **1**

$\vec{a}\times\vec{b} = |\vec{a}||\vec{b}|\sin\theta$ **1**

15. Polishing, lubrication, streamlining, using ball bearings. **(Any two) 2**

16. A body is said to be in translation equilibrium, if vector sum of external forces acting on the body is zero.

$\sum\vec{F_i} = 0$ **1**

A body is said to be in rotational equilibrium if the vector sum of external torques acting on the body is zero.

$\sum\vec{\tau_i} = 0$ **1**

17. When detergents are added to water, surface tension decreases, detergents pull out oil and grease and clean dirty clothes. **2**

18. It is an oscillatory motion in which the acceleration of particle is directly proportional to its displacement and is always directed towards its mean position. **1**

Oscillations of the bob of a simple pendulum. **1**

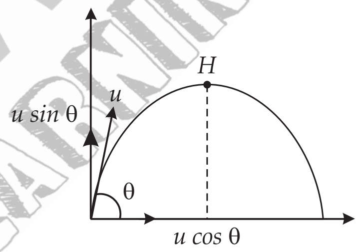
PART - C

III. 19. For vertical upward motion, $v^2 = u^2 - 2gh$ **1**

At highest position $v = 0$, $u = u\sin\theta$, $h = H$ **1**

$H = \dfrac{u^2\sin^2\theta}{2g}$ **[Scheme of Valuation 2018] 1**

Detailed Answer :



At maximum height

$$u_y = u\sin\theta\ ;\ t = \frac{T}{2} = \frac{u\sin\theta}{g}$$

$$h = ut + \frac{1}{2}gt^2$$

$$h = u\sin\theta.\frac{u\sin\theta}{g} + \frac{1}{2}(-g)\frac{u^2\sin^2\theta}{g^2}$$

$$h = \frac{u^2\sin^2\theta}{2g}$$

20. It is the angle between the inclined surface of the road and the horizontal. **1**

$v_{max} = \sqrt{u_s rg}$ **1**

$v_{max} \rightarrow$ safe speed, $u_s \rightarrow$ Coefficient of static friction, $r \rightarrow$ radius, $g \rightarrow$ acceleration due to gravity. **1**

21.

Conservative	Non Conservative
Work done by this force depends on initial and final position of the body.	Work done by this force depends on the path followed by body.
Work done in a round trip is zero.	Work done in a round trip is not zero.
Work done is completely recoverable.	Work done is not completely recoverable.
It is central in nature.	It is retarding in nature.

(Any three differences) **1 + 1 + 1**

22.

Linear motion	Rotational motion	
$v = u + at$	$w_f = w_i + \alpha t$	**1**
$v^2 = u^2 + 2ax$	$w_f^2 = w_i^2 + 2\alpha\theta$	**1**
$x = ut + \frac{1}{2}at^2$	$\theta = w_i t + \frac{1}{2}\alpha t^2$	**1**

23. All planets move around the sun in elliptical orbits with the sun at one of the foci. **1**

An imaginary line that joins the planet and the planet sweeps out equal areas in equal interval of time. **1**

Square of the period of revolution of the planet around the sun is directly proportional to the cube of the length of the semi major axis of ellipse. **1**

24.

$$y = \frac{\text{longitudinal stress}}{\text{longitudinal strain}} \quad \mathbf{1}$$

$$y = \frac{F/A}{dl/l} \quad \mathbf{1}$$

$$y = \frac{Fl}{\pi r^2 dl} \quad \mathbf{1}$$

25.

$$PV = RT \quad \mathbf{1}$$

$$PdV = RdT \quad \mathbf{1}$$

$$\alpha = \frac{1}{T}$$

[Scheme of Valuation 2018] 1

Detailed Answer :

From Gibbs Free Energy, α is defined as

$$\alpha = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P \quad \ldots(i)$$

Now, from Ideal Gas Equation

$$PV = nRT \quad \ldots(ii)$$

Now, doing partial differential in equation (ii)

$$P\left(\frac{\partial V}{\partial T}\right)_P = nR$$

or

$$\left(\frac{\partial V}{\partial T}\right)_P = \frac{nR}{P} \quad \ldots(iii)$$

Now, from equation (i), (ii) and (iii)

$$\alpha = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P = \frac{nR}{VP} = \frac{1}{T}$$

$$\alpha_v = \frac{1}{T}$$

This is the required relation.

26. Given amount of gas is collection of large number of molecules. **1**

All molecules are in incessant random motion **1**

Molecular collisions are elastic **1**

Molecular collisions are instantaneous. **(Any three) [Scheme of Valuation 2018]**

Detailed Answer :

(i) A gas consists of large number of perfect elastic sphere molecules.

(ii) Molecules are in state of random motion.

(iii) Size of the gas molecules is very small compared to the distance between them.

(iv) No force of attraction or repulsion between molecules.

(v) The collisions of the molecules are perfectly elastic.

(vi) Molecular density is uniform throughout the gas.

(vii) The collisions are instantaneous. **(Any three)**

PART - D

IV 27. It is the graph obtained by plotting instantaneous velocities of a body *Vs* time. **1**

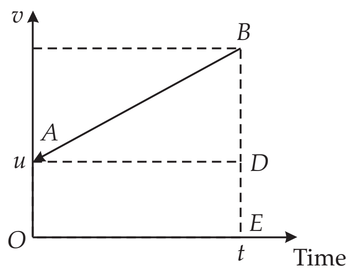
x = area of rectangle OACD + area of triangle ACB **1**

$v = u + at$ **1**

$x = u_0 t + \frac{1}{2}at^2$ **[Scheme of Valuation 2018]**

Detailed Answer :

A graph plotted between velocity on y-axis to the time on x-axis is called velocity-time graph.



Area under velocity-time graph represents distance covered from graph

$$\text{acceleration } a = \frac{DB}{AD} = \frac{DB}{t}$$

$\therefore$ $DB = at$

Distance travelled = area of ΔADB + area of rectangle OADE

To know about more useful books for 1-PUC [click here]

$$S = \frac{1}{2}DB \times AD + OA \times OE$$

$$= \frac{1}{2}at \times t + u \times t$$

$$S = ut + \frac{1}{2}at^2$$

28. Statement 1

$$\text{Impulse} = \text{change in moment} \quad 1$$

$$F_{AB} = -F_{BA} \text{ from Newton's third law} \quad 1$$

$$P'_A - P_A = -(P'_B - P_B) \quad 1$$

$$P_A + P_B = P'_A + P'_B$$

[Scheme of Valuation 2018]

Detailed Answer :

In an isolated system, the vector sum of the linear momentum of all the bodies of the system is conserved and is not affected due to their mutual action and reaction.

Let two bodies A and B have initial momentum P_A and P_B.

During collision,

$F_{AB} \rightarrow$ force on A by B and

$F_{BA} \rightarrow$ force on B by A

From Newton's 2nd law

$$F_{AB} \times t = \text{change in linear momentum of A} = P'_A - P_A$$

$$\text{and } F_{BA} \times t = P'_B - P_B$$

As per Newton's 3rd law

$$F_{AB} = -F_{BA}$$

$$P'_A - P_A = -(P'_B - P_B)$$

or

$$P'_A + P'_B = P_A + P_B$$

i.e., Total final momentum = Total initial momentum.

29. Torque is the product of magnitude of force acting on a particle and perpendicular distance between the lines of action of forces and axis of rotation. 1

Angular momentum is the product of linear momentum and perpendicular distance of the particle from axis of rotation. 1

$$\vec{L} = \vec{P} \times \vec{r} \quad 1$$

On differentiating

$$\frac{d\vec{L}}{dt} = m.\vec{v} \times \vec{v} + \vec{r} \times \vec{F} \quad 1$$

$$\vec{\tau} = \frac{d\vec{L}}{dt}$$

V. 30 P. V. Diagram 1

Stage 1 : Gas absorbs an amount of heat Q_1 from the source at constant temperature T_1 K. 1

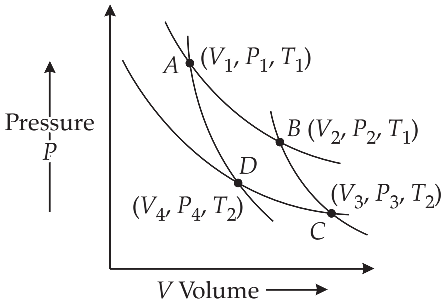
Stage 2 : Gas is allowed to expand adiabatically till temperature falls from T_1 to T_2. 1

Stage 3 : Gas is compressed isothermally, an amount of heat Q_2 is rejected into the sink. 1

Stage 4 : Gas is compressed adiabatically till it returns to its initial state. **[Scheme of Valuation 2018]** 1

Detailed Answer :

P – V diagram



31. Force that accelerates the bob = component of weight towards mean position **1**

$$m(-w^2y) = -mg\sin\theta$$ **1**

For small angular displacement $\sin\theta \approx \theta$, $\theta = \frac{y}{l}$ (fig) **1**

$$T = 2\pi\sqrt{\frac{l}{g}}$$ **[Scheme of Valuation 2018] 1**

Detailed Answer :

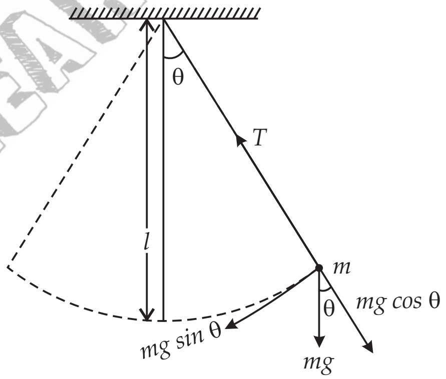
The tangential component of force mg is $mg\sin\theta$

$$\text{Torque} : -L(mg\sin\theta) = I\alpha$$

$$\text{Angular acceleration } \alpha = \frac{-mg\,L\sin\theta}{I}$$

For smaller displacement $\sin\theta° = \theta(\text{rad})$

i.e., $$\alpha = \frac{-mgL\theta}{I} \text{ but } \alpha = -\omega^2\theta$$



hence, $$\omega^2 = \frac{mgL}{I} \text{ or } \omega = \sqrt{\frac{mgL}{I}} \text{ but } \omega = \frac{2\pi}{T} \text{ and } I = mL^2$$

$$\frac{2\pi}{T} = \sqrt{\frac{mgL}{mL^2}} \quad \therefore T = 2\pi\sqrt{\frac{L}{g}}.$$

To know about more useful books for 1-PUC [click here]

32.

Progressive wave	Stationary wave
It is due to continuous vibration of particles in medium.	It is due to the superposition of two identical waves in opposite direction.
It transports energy.	It does not transport energy.
It travels with definite velocity. Amplitude of vibrating particles is same.	It is localised. Amplitude is different for different particles
No particles are permanently at rest.	Particles at nodes are permanently at rest.
It is represented by $y = a \sin(\omega t - kx)$	It is represented by $y = 2a \cos kx \sin \omega t$.

5

VI 33. $$a_c = \frac{v^2}{r}$$ **1**

$r = 1$ km, $v = 900$ kmph $= 250$ m/s, $g = 9.8$ m/s^2 **1**

$$a_c = 62.5 \text{ m/s}^2$$ **1**

$$\frac{a_c}{g} = 6.38$$ **1**

$$a_c = 6.38 \text{ g}$$ **1**

34. $$W = mgh$$ **1**

$$W = 4.9 \times 10^4 \text{ J}$$ **1**

$$P = \frac{W}{t}$$ **1**

$$P = 163.3 \text{ W}$$ **1**

Unit of work and power **[Scheme of Valuation 2018] 1**

Detailed Answer :

$$m = 49 + 2 = 51 \text{ kg}$$

$$W = m.g.h = 51 \times 9.8 \times 100$$

$$= 49980 \text{ J}$$

$$P = \frac{W}{t} = \frac{49980}{5 \times 60} = 166.6 \text{ W}$$

35. $$g' = \left[1 - \frac{2h}{R}\right]$$ **1**

$$g' = 9.702 \text{ m/s}^2$$ **1**

$$g' = g\left[1 - \frac{d}{R}\right]$$ **1**

$$g' = 9.78 \text{ m/s}^2$$ **1**

Unit **[Scheme of Valuation 2018] 1**

Detailed Answer :

(i) Value of g at 32 km above the earth

$$g' = g\left(1 - \frac{2h}{R}\right)$$

$$= 9.8\left(1-\frac{2\times 32000}{6.4\times 10^6}\right)$$

$$g' = 9.7 \text{ m/s}^2$$

(ii) At a depth of 8 km

$$g' = g\left(1-\frac{d}{R}\right)$$

$$= 9.8\left(1-\frac{8000}{6.4\times 10^6}\right)$$

$$= 9.79 \text{ m/s}^2$$

36. $dQ = K.A.\frac{dT}{dx}.dt$ **1**

Heat absorbed = mass × latent heat **1**

$m = 0.313$ kg **1**

mass of ice left = 4 – 0.313 = 3.687 kg **1**

Amount of ice remaining after 6 hrs is 3.687 kg with unit **[Scheme of Valuation 2018] 1**

Detailed Answer :

Thickness $\Delta x = 5 \text{ cm} = 5 \times 10^{-2}$ m

Area (Total) inside = 6 surfaces

$= 6 \times 30 \times 30 = 5400 \text{ cm}^2 = 0.54 \text{ m}^2$

$\Delta T = 45°C - 0 = 45$ K

$K = 0.01 \text{ Js}^{-1} m^{-1} k^{-1}$; $L = 335 \times 10^3 \text{ J kg}^{-1}$

m is the mass of ice melted per second

$$\frac{dQ}{dt} = mL = KA\frac{\Delta T}{\Delta x}$$

$$m = \frac{KA}{L}\frac{\Delta T}{\Delta x}$$

$$= \frac{0.01\times 0.54\times 45}{335\times 10^3\times 5\times 10^{-2}}$$

$$= \frac{54\times 45\times 10^{-4}}{335\times 5\times 10}$$

Ice melted in 6 hrs = 6 × 3600 sec $= \frac{54\times 45\times 10^{-4}\times 3600\times 6}{335\times 5\times 10} = 313$ g

Ice left = 4 kg – 313 g

= 3.687 kg

37. Observer moving towards a stationary source is $f' = f\left(\frac{v - v_0}{v}\right)$ **1**

$$f = 212\text{ Hz}$$ **1**

$$\lambda = \frac{v}{f}$$ **1**

$$\lambda = 1.65\text{ m}$$ **1**

Unit of f and λ **[Scheme of Valuation 2018] 1**

Detailed Answer :

Source is at rest, observer moving towards source

$$v' = \frac{v-(-v_L)}{v}\nu$$

$$= \left(\frac{v+v_L}{v}\right)\nu$$

$$= \left(\frac{350+20}{350}\right)200 = \frac{370}{350}\times 200 = 211.4\text{ Hz}$$

$$\lambda = \frac{v}{\nu} = \frac{350}{211.4} = 1.66\text{ m}$$

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SOLVED PAPER	I PUC Annual Examination 2018	Physics Subject Code 33 (S)

Time : 3 Hours 15 Min. **Max. Marks : 70**

General Instructions :

1. *All parts are compulsory.*
2. *Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.*
3. *Numerical problems solved without writing the relevant formulae carry no marks.*

PART-A

I. Answer ALL the following questions : **10 × 1 = 10**

1. What is the basis of cesium atomic clock ?

2. Which component of velocity is constant in a Projectile motion ?

3. Define inertia.

4. State Work - Energy theorem.

5. Mention the relation between Torque and Angular momentum of a particle.

6. What are Elastomers ?

7. State Bernoulli's principle.

8. How does viscosity of a liquid changes with rise in temperature ?

9. Mention the significance of zeroth law of thermodynamics.

10. How does an average Kinetic Energy of gas molecules depend on the absolute temperature ?

PART-B

II. Answer any FIVE of the following questions **5 × 2 = 10**

11. Write any two fundamental forces in nature.

12. Mention any two sources of systematic errors.

13. Distinguish between path length and displacement.

14. Define the terms

(i) Null vector or Zero vector (ii) Unit vector

15. Classify the nature of flow of liquid on the basis of Reynold's number.

16. Give Kelvin-plank statement and Clausius statement.

17. What are free oscillations and forced oscillations ?

18. What are Longitudinal waves and Transverse waves ?

PART-C

III. Answer any FIVE of the following questions : **5 × 3 = 15**

19. Obtain an expression of time of flight of a projectile.

20. What is friction ? Write any two advantages of friction.

21. What is collision ? Distinguish between Elastic collision and Inelastic collision.

22. State Kepler's law of planetary motion.

23. Draw a typical Stress-Strain curve for a metal. Mention yield point and fracture point.

24. Show that volume coefficient of thermal expansion $\alpha_v = \frac{1}{T}$ for ideal gas at constant pressure.

25. Mention any three assumptions of kinetic theory of gases.

26. Discuss modes of vibration of air column in a closed pipe.

PART-D

IV. Answer any TWO of the following questions : **$2 \times 5 = 10$**

27. What is Uniform Circular Motion ? Obtain an expression for centripetal acceleration.

28. Obtain an expression for maximum safe speed of a vehicle on a banked road in circular motion.

29. State and explain parallel axes theorem and perpendicular axes theorem.

V. Answer any TWO of the following questions : **$2 \times 5 = 10$**

30. Obtain an expression for total energy of a satellite revolving in circular orbit around a planet.

31. Explain different stages of Carnot's cycle with P-V-diagram.

32. Derive an expression of time period of oscillating bob of simple pendulum.

VI. Answer any THREE of the following questions : **$3 \times 5 = 15$**

33. From a balloon ascending with a velocity of 9.8 ms^{-1}, a stone was dropped and it reached the ground in 11 sec. How high was the balloon ? When the stone was dropped and with what velocity did it hit the ground ? (g = 9.8 ms^{-2}).

34. A pump on the ground floor of a building can pump up water to fill a tank of volume $30m^3$ in 15 min. If the tank is 40m above the ground and efficiency of the pump is 30%. How much power is consumed by the pump? (Density of water $10^3 kgm^{-3}$, g = $9.8ms^{-2}$).

35. A dental drill accelerates from rest to 900 rpm in 2 sec. What is the angular acceleration ? How many revolutions does it make in coming to full speed ?

36. Find the time for which a layer of ice 5 cm thick on the surface of a pond will increase its thickness by 0.1 cm when temperature of the surrounding air is – 20°C.

Thermal conductivity of ice = 2.1 $Wm^{-1}K^{-1}$

Density of ice = 900 Kg m^{-3}

Latent heat of ice = 3.36×10^5 J Kg^{-1}.

37. Two cars are approaching each other on a straight road and moving with a velocity 60 kmph. If the sound produced in one car is of frequency 500Hz. What will be the frequency of sound as heard by a person sitting in another car ? When the car has crossed and moving away from each other, what will be the frequency of sound as heard by the same person ? (speed of sound in air is 332 ms^{-1}).

❑❑❑

SOLUTIONS
As Per Scheme of Valuation
(Issued by Department of PUE, Karnataka)

PART - A

I. 1. Periodic vibrations produced in a cesium atom is the basis of cesium atomic clock. In other words, it uses as reference the frequency of microwave spectral lines produced by cesium atoms.

2. The horizontal component of velocity is constant in a projectile motion.

3. Inertia is the property of the body by which the body does not change its state of rest or uniform motion unless an external force acts on it.

4. Work- Energy Theorem states that the work done by all the forces (net force) acting on a particle is equal to the change in the kinetic energy of the particle.

5. $\vec{\tau} = \dfrac{d\vec{L}}{dt}$ where $\vec{\tau}$ is the torque and $\vec{L}$ is the angular momentum

Rate of change of angular momentum is defined as torque.

6. The substances which can be stretched to cause large strain are called elastomers.

7. Bernoulli's Principle :

It states that the total mechanical energy of an ideal fluid comprising of the kinetic energy of the fluid motion, gravitational potential energy of elevation and the pressure energy per unit mass in streamline motion is constant.

8. The viscosity of a liquid decreases with an increase in temperature.

9. Significance of zeroth law of thermodynamics.

It tells about the state of thermal equilibrium of the system. It defines the exchange of heat and also defines the temperature of the system.

10. Average kinetic energy is directly proportional to the absolute temperature

$$\text{Average K.E.} = \frac{3}{2}kT \text{ for a three dimensional system}$$

$$\text{and Average K.E.} = \frac{1}{2}kT \text{ for one dimensional system.}$$

PART - B

II. 11. (i) Gravitational Force.

(ii) Electromagnetic Force.

12. Sources of systematic errors :

(i) Imperfect calibration of instruments – Instrumental error.

(ii) Impact method of observation (percentage error).

13. Any two Differences. **[Scheme of Valuation 2018]**

Detailed Answer :

Path Length	Displacement
(i) The distance travelled by the body is called path length	(i) The difference between the initial and the final positions of a body is called its displacement.
(ii) It is a scalar quantity.	(ii) It is a vector quantity.
(iii) It can never be 0 or negative.	(iii) It can be 0 or negative.

14. (i) Null vector or zero vector :

A vector with zero magnitude and arbitrary direction.

(ii) Unit vector :

A vector which has magnitude as one [or a vector divided by its magnitude example, unit vector $= \dfrac{\vec{r}}{|\vec{r}|}$]

15. If Reynold's number Re < 2000, then the flow is streamline flow.

It Re > 2000, the flow is turbulent flow.

16. **Kelvin-Planck Statement :** No process exists whose sole result is the absorption of heat from a reservoir and its complete conversion into work.

Clausius Statement : No process is possible whose result is the transfer of heat from a colder object to a hotter object without any external work being done on the object.

17. **Free Oscillations :** The oscillations of a body when it oscillates with its own frequency are called free oscillations.

Forced Oscillations : When a body is subjected to periodic force, it oscillates with the frequency of the periodic force. Such oscillations are called forced oscillation.

18. **Longitudinal waves :** A wave in which the particles of the medium vibrates along the direction of propagation of wave is called a Longitudinal wave. For example, sound waves.

Transverse waves : A wave in which the particles of the medium vibrates in a direction perpendicular to the direction of wave. For example, light waves.

PART - C

III. 19. **Expression for time of flight of a projectile.**

The time of flight is just double the time projectile takes to reach the maximum height.

For vertical motion.

$$v_y = u_y + a_y t$$

$$\because a_y = -g$$

$$\therefore \quad v_y = u_y - gt$$

Initial velocity $u_y = u \sin\theta$

At highest point (maximum height) $v_y = 0$

$\therefore \quad 0 = u\sin\theta - gT$, T is the time to reach maximum height.

$$\therefore \quad T = \frac{u\sin\theta}{g}$$

Time of flight $T_f = 2T$

$$T_f = \frac{2u\sin\theta}{g}.$$

20. It is the force which opposes the relative motion between two surfaces of bodies in contact.

Any two advantages. **[Scheme of Valuation 2018]**

Detailed Answer :

Friction is the force which opposes the relative motion between the surfaces of the bodies in contact.

Advantages :

(i) Brakes on a car uses friction to stop.

(ii) It makes many types of motion possible.

21. Collision is physical striking between the bodies

Any two Differences **[Scheme of Valuation 2018]**

Detailed Answer :

Collision is violent physical striking of bodies against each other.

Elastic collision	Inelastic collision
(i) There is no loss of kinetic energy	**(i)** Some loss of kinetic energy occurs.
(ii) Forces involved are conserved in nature	**(ii)** Forces may be non-conservative in nature.
(iii) E.g., collision between glass balls etc.	**(iii)** E.g. collision between two vehicles.

22. Statement of I Law (Law of orbits)

Statement of II Law (Law of area)

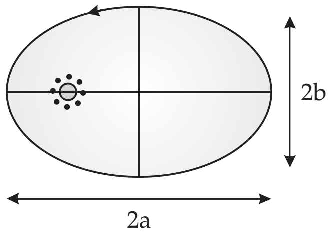
Statement of III Law (Law of period) **[Scheme of Valuation 2018]**

Detailed Answer :

Kepler's laws of Planetary Motion.

I Law — Law of Orbits : According to this law, all planets move in elliptical orbits with the sun situated at one of the foci of the ellipse.

For I Law :

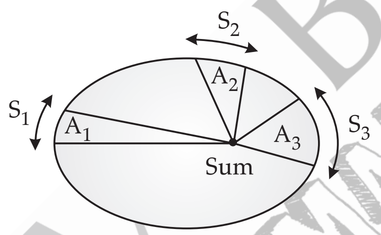


a : semi-major axis

b : semi-minor axis

II Law—Law of Areas : The speed of planet varies in such a way that the radius vector drawn from the sun to a planet sweeps out equal areas in equal intervals of time *i.e.*, the areal velocity of the planet around the sun is constant.

For II Law :



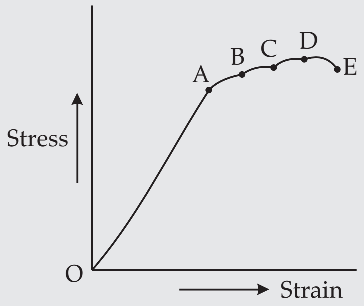
The areas A_1, A_2, A_3 are swept by the radius vector in equal intervals of time.

So, $A_1 = A_2 = A_3$

III Law—Law of Periods : The square of the time period of revolution of a planet around the sun is proportional to the cube of semi-major axis of its elliptical orbits.

For III Law : If 'T' is the time period of revolution of a planet and '*a*' be the semi-major axis, then $T^2 \alpha a^3$.

23.

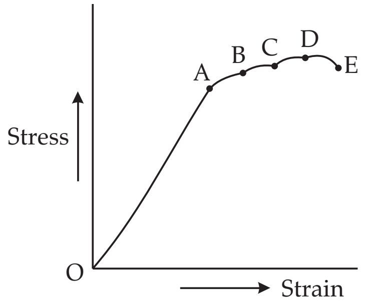


B Yield point

E Fracture Point

[Scheme of Valuation 2018]

Detailed Answer :



- The stress is proportional to strain upto point, where, Hooke's law is fully obeyed. Point A is known as proportional unit.

- When stress is increased beyond A, then for a small stress there in large strain in the wire upto B. When the load is reduced between points O and B, then the wire comes back to its original position.
- The wire regains its original position only when load applied is less than or equal to certain limit. This limit is called elastic limit. The point B on the curve is known as elastic limit or yield point.
- But, if the stress is increased beyond B, the strain further increases and the wire does not come back to its original position after removing load. It is deformed permanently.
- As the stress in further increased beyond C, there is a large strain in the body and the wire breaks at point E called fracture point.

24. Volume coefficient of thermal expansion $\alpha_v = \left(\frac{\Delta V}{V}\right)\frac{1}{\Delta T}$

Ideal gas equation

$$PV = nRT$$

$$P\,\Delta V = nR\Delta T$$

$$\therefore \quad \frac{\Delta V}{V} = \frac{\Delta T}{T}$$

$$\text{or} \quad \left(\frac{\Delta V}{V}\right)\frac{1}{\Delta T} = \frac{1}{T} = \alpha.$$

25. Any three assumptions **[Scheme of Valuation 2018]**

Detailed Answer :

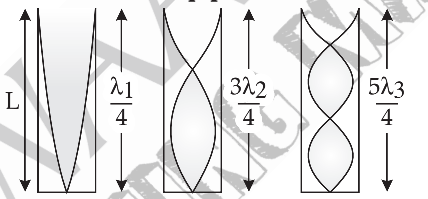
Kinetic Theory of gases :

(i) A given amount of gas consists of a very large number of molecules.

(ii) The size of a molecule is much smaller than the average distance of separation between the molecules.

(iii) There are no intermolecular forces between molecules of a gas. [except during collision]

26. Modes of vibrations of air column in a closed pipe.



- The air at the closed end is not free to vibrate so a node is formed at the closed end.
- While the air at the open end is free to vibrate with maximum amplitude so an antinode is formed at this end.
- This is the simplest mode of vibration and is called fundamental mode.

$$L = \frac{\lambda}{4} \text{ or } \lambda = 4L$$

$$\text{Frequency } f_1 = \frac{v}{\lambda} = \frac{v}{4L}$$

where,
v is the velocity of sound in air,
L is the length of the vibrating column,
λ is the wavelength.

Second mode : or first overtone — [Figure (2)]

$$L = \frac{3}{4}\lambda \text{ or } = \frac{4L}{3}$$

$$\therefore \quad f_1 = \frac{v}{\lambda} = \frac{3v}{4l}$$

Similarly for third mode or second overtone [figure (3)]

$$L = \frac{5\lambda}{4} \text{ or } \lambda = \frac{4}{5}L$$

$$f_3 = \frac{v}{\lambda} = \frac{5v}{4L}$$

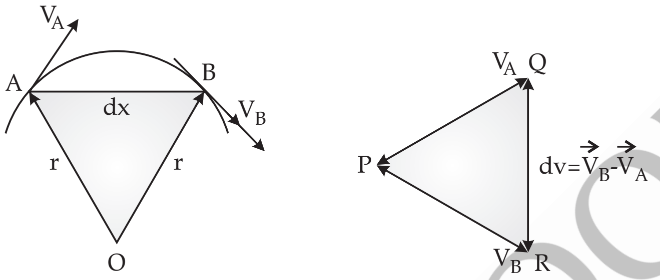
$$\therefore \quad f_1 : f_2 : f_3 = 1 : 3 : 5.$$

PART - D

IV. 27. Uniform Circular Motion can be defined as the motion of an object in is circle at a constant speed while the object a constantly changing its direction.

Expression for centripetal acceleration :

Let v be the velocity of the body (with mass m) is moving in a circular motion of radius r



Angular Speed $$w = \frac{\Delta\theta}{\Delta t}$$

$$|\vec{v}_1| = |\vec{v}_2|$$

Second figure is formed by joining the tails of the two vectors $\vec{v}_1$ and $\vec{v}_2$.

From fig (1) $$\frac{AB}{AO} = \frac{PQ}{PR}$$

$$\frac{\Delta v}{v} = \frac{\Delta x}{r}$$

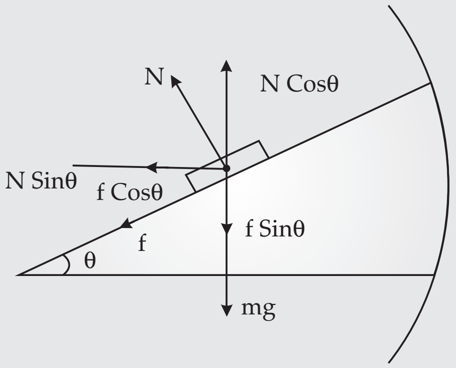
$$\therefore \Delta v = \frac{\Delta x v}{r}$$

$$\text{Acceleration} = \lim \Delta t \to 0 \ \frac{\Delta v}{\Delta t} = \frac{dv}{dt} = \frac{v}{r}\frac{dx}{dt}$$

$$= \frac{v^2}{r}$$

$$\therefore a = \frac{v^2}{r}.$$

28.



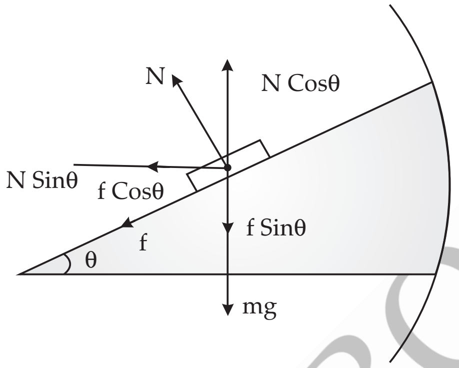
From Figure $$N \cos\theta = mg + f \sin\theta$$

$$N \sin\theta + f \cos\theta = \frac{mv^2}{R}$$

Taking $f = \mu_s N$ for Maximum speed and getting $N = \dfrac{mg}{\cos\theta - \mu s \sin\theta}$

Arriving at $$V_{max} = Rg\left(\frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta}\right)^{\frac{1}{2}}$$ **[Scheme of Valuation 2018]**

Detailed Answer :



$f \rightarrow$ force of friction

$N \rightarrow$ reaction force which will provide centripetal force.

Resolve it into two components – $N\cos\theta$ and $N\sin\theta$

Also resolve friction force f into $f\sin\theta$ and $f\cos\theta$.

(centripetal force) $\dfrac{mv^2}{R} = f\cos\theta + N\sin\theta$ (1) (acting towards centre)

$N\cos\theta = mg + f\sin\theta$ or $mg = N\cos\theta - f\sin\theta$

Dividing eq. (1) by (2) ...(2)

$$\frac{\frac{mv^2}{R}}{mg} = \frac{N\sin\theta + f\cos\theta}{N\cos\theta - f\sin\theta}$$

$$\frac{v^2}{Rg} = \frac{N\sin\theta + f\cos\theta}{N\cos\theta - f\sin\theta}$$

$$= \frac{\frac{N\sin\theta}{N\cos\theta} + \frac{f\cos\theta}{N\cos\theta}}{1 - \frac{f\sin\theta}{N\cos\theta}} = \frac{\tan\theta + \frac{f}{N}}{1 - \frac{f}{N}\tan\theta}$$

For maximum speed

$$f = \mu_s N$$

$\therefore$
$$\frac{v^2_{max}}{Rg} = \frac{\tan\theta + \frac{\mu_s N}{N}}{1 - \frac{\mu_s N}{N}\tan\theta}$$

$$= \frac{\tan\theta + \mu_s}{1 - \mu_s \tan\theta}$$

$$v^2_{max} = Rg\left[\frac{\tan\theta + \mu_s}{1 - \mu_s \tan\theta}\right]$$

or
$$v_{max} = (Rg)^{\frac{1}{2}}\left[\frac{\tan\theta + \mu_s}{1 - \mu_s \tan\theta}\right]^{\frac{1}{2}}.$$

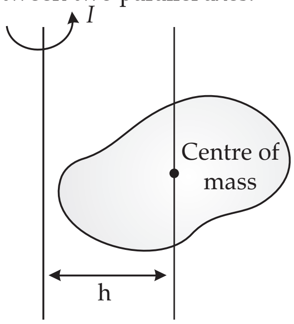
29. Statement of parallel axes theorem.

Statement of perpendicular axes theorem.

Explanation of parallel axes and perpendicular axes theorem. **[Scheme of Valuation 2018]**

Detailed Answer :

Theorem of parallel axes : It states that the moment of inertia of a body about an axis is equal to the sum of moments of inertia of the body about a parallel axes passing through its centre of mass and the product of mass and the square of distance between two parallel axes.



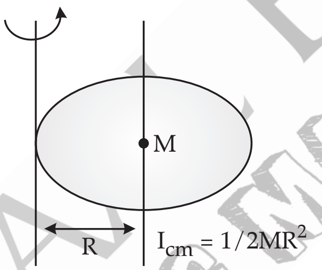
$$I = I_{cm} + Mh^2$$

M = mass of the lamina

h = distance between two parallel axes

For eg. Moment of inertia of disc about an axis perpendicular to the plane of disc and through its centre

$$I_{cm} = \frac{1}{2} MR^2$$



Then, moment of inertia about an axis

$$I = I_{cm} + Mh^2$$

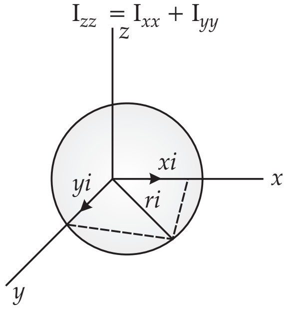
$$= \frac{1}{2} MR^2 + MR^2$$

as $h = R$

$\therefore$ $I = \frac{3}{2} MR^2$ according to theorem of parallel axes.

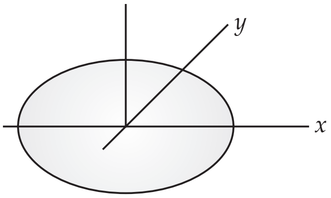
Theorem of Perpendicular axes : It states that the moment of inertia of a planar body (Lamina) about an axis perpendicular to its plane is equal to the sum of its moment of inertia about two perpendicular axes and lying in the plane of the body.

$$I_{zz} = I_{xx} + I_{yy}$$



eg. Moment of inertia of a disc about an axis through its centre of mass and perpendicular to its plane is—

$$I_{zz} = \frac{1}{2} MR^2.$$



If I_D = Moment of inertia of disc about one of its diameter (along *yy* axis car along *xx* axis)

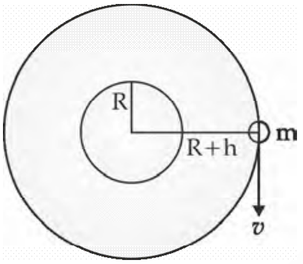
By perpendicular axis theorem, $I_{zz} = I_{xx} + I_{yy}$

$I_{xx} = I_{yy}$, mass distribution being identical in both the cases

$\therefore \quad I_{zz} = 2I_{xx} = 2I_D$

or $\quad I_D = \frac{I_{zz}}{2} = \frac{1}{4} MR^2.$

V. 30. Total energy of a satellite revolving in circular orbit around a planet.



For a satellite orbiting around a planet, the tangential/orbital velocity will be.

$$v = \sqrt{\frac{GM}{(R+h)}}$$

[as gravitational force on a satellite equals the centripetal force]

where R is radius of the planet and h is the height from the surface of the planet.

So, kinetic energy of the satellite $\quad KE = \frac{1}{2} mv^2 = \frac{1}{2}\frac{GmM}{(R+h)}$, m is the mass of the satellite

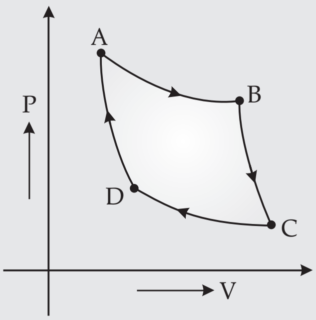
The gravitational P. E at infinity is considered to be zero, so the P. E at distance (R + h) from the centre of the planet will be :

$$PE = \frac{-GmM}{R+h}$$

Total energy E = K.E + P. E

$$= \frac{GmM}{2(R+h)} - \frac{GmM}{(R+h)} = \frac{-1}{2}\frac{GmM}{(R+h)}.$$

31.



Explanation isothermal expansion (curve AB)

Explanation adiabatic expansion (curve BC)

Explanation isothermal compression (curve CD)

Explanation adiabatic compression (curve DA) **[Scheme of Valuation 2018]**

Detailed Answer :

Carnot cycle : A carnot engine consists of

(i) A source of heat at temperature T_1

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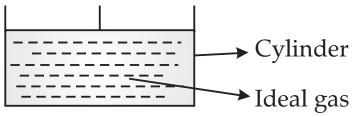
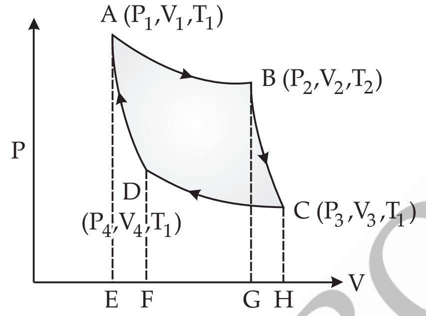
(ii) A sink at temperature T_2 such that $T_1 > T_2$.

(iii) A cylinder with conducting base with ideal gas as a working substance.

(iv) In insulating stand,



As the engine works, the working substance of the engine undergoes a cycle known as Carnot cycle.



(i) **First Step :** Isothermal expansion curve AB. The cylinder with gas is allowed to expand slowly at constant temperature T_1 by putting in on the source.

Work done = heat absorbed by the system.

$$W_1 = Q_1 = \int_{V_1}^{V_2} P\,dV$$

$$= RT_1 \log \frac{V_2}{V_1} = \text{ar (ABGEA)}$$

(ii) **Second Step :** Adiabatic expansion the cylinder is kept on the insulating stand while still expanding the gas (adiabatic) till the temperature falls to 7.

$$W_2 = \int_{V_1}^{V_2} P\,dV$$

$$PV^{\gamma} = \text{constant}$$

$$= \frac{R}{\gamma - 1}(T_1 - T_2) = \text{ar (BCHGB)}$$

(iii) **Third Step :** Isothermal compression, the cylinder is placed on the sink and the gas is compressed at constant temperature T_2

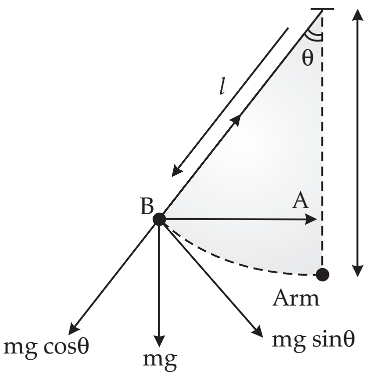
$$W_3 = \text{heat rejected by the system}$$

$$= Q_2$$

$$= -\int_{V_3}^{V_4} P\,dV = -RT_2 \log \frac{V_4}{V_3}$$

$$= RT_2 \log \frac{V_3}{V_4} = \text{ar (CDFH)}$$

32.



Consider a simple pendulum of length l and a bob with mass m.

Force that accelerates the bob is being provided by the component of weight (mg) towards the mean position.

i.e., $$ma = -mg \sin\theta$$

The oscillation being simple harmonic

$$a = -w^2 y$$

$$-mw^2 y = -mg \sin\theta$$

For small amplitude $\sin\theta \approx \theta$

$\therefore$ $$w^2 y = g\theta$$

$$\theta = \frac{y}{e} \qquad \left(\sin\theta = \frac{y}{e} \approx \theta\right)$$

$\therefore$ $$w^2 y = \frac{gy}{e} \text{ or } w = \sqrt{\frac{g}{l}}$$

$$w = \frac{2\pi}{T} \quad \therefore T = 2\pi\sqrt{\frac{g}{l}}$$ where, w is the angular frequency

T is the time period of oscillation.

VI. 33. $$h = ut + \frac{1}{2}gt^2.$$ **[Scheme of Valuation 2018]**

Detailed Answer :

Let u be the initial velocity of the stone = 9.8 cm/s^2

h = height of the balloon when the stone was thrown

t = time in which the stone reaches the ground.

$$h = ut + \frac{1}{2}gt^2$$

$$h = -9.8 \times 11 + \frac{1}{2} \times 9.8 \times (11)^2 = (-107.8 + 592.9)\ m.$$

$$= 485.1\ m$$

$\therefore$ $$v^2 = u^2 + 2gh$$

$$= (-9.8)^2 + 2 \times (9.8)(485.1)$$

$$v = 98 \text{ m/s}^2.$$

34. Volume of the tank = 30 m^3

Time to fill the tank = 15 minutes = 900 s.

Height of the tank above the ground = 40 m.

Efficiency of the pump is 30%

Power required to lift the water

$$P_r = \frac{w\,(\text{workdone})}{t\quad \text{time}} = \frac{mgh}{t}$$

$$\text{mass} = \rho V, \rho \text{ is density}$$

* $$P_r = \frac{\rho Vgh}{t} = \frac{10^3 \times 30 \times 9.8 \times 40}{900(\text{seconds})}$$

$$P_r = 13066.6 \text{ Watt.}$$

Let P be the power consumed. Only 30% of the power is utilized in lifting the water (efficiency is 30%)

i.e., $$\frac{30}{100}P = P_r \text{ or } P = \frac{100}{30} \times P_r = 43.6 \text{ kw.}$$

35. $$w_i = 0 \text{ as the drill is initially at rest}$$

$$w_f = 900 \text{ rpm} = 30 \times \pi \text{ radians/s}$$

Angular acceleration α, $= \dfrac{w_f - w_c}{t}$

$= \dfrac{30\pi}{2s}$ radians/s

$\therefore \quad \alpha = 15\,\pi$ radians/s.

$\dfrac{\text{distance travelled}}{2\pi} =$ no. of revolutions

$\therefore \quad \theta = w_i t + \dfrac{1}{2}\alpha t^2$

$= 0 + \dfrac{1}{2} \times 15 \times \pi \times (2)^2$

$\theta = 30\pi$ radians $= 2\pi n$

$\therefore \quad n = 15.$

36. Thickness of ice slab $= 5$ cm $= 0.05$ m

Increase in the thickness $= 0.1$ cm

K for ice $= 2.1\ \text{W}m^{-1}\,\text{K}^{-1}$

ρ ice $= 900$ kg m^{-3} latent heat of ice $= 3.36 \times 10^5\ \text{JKg}^{-1}$

T of the surroundings $= -20°$C

V of extra thickness, $\quad V = (A \times 0.001)\ m^3$

Mass of ice formed

$M = \rho V = 900 \times A \times 0.001$

$\therefore$ Heat transferred to change the temperature

$$Q = \frac{KA(T_2 - T_1)t}{d}$$

But $Q = m$L (Latent heat)

$$\therefore \quad t = \frac{mLd}{KA(T_2 - T_1)} = \frac{900 \times A \times 3.36 \times 10^5 \times 0.001 \times 0.05m}{2.1 \times 20}$$

$t = 360$ seconds.

37. Two cars are moving with velocities 60 km/h.

$v_1 = 60$ kmph $= 16.66$ m/s

$v_2 = 60$ kmph $= 16.66$ m/s

Sound produced in one car of frequency $= 500$ Hz.

When two cars are approaching

$$f' = \left(\frac{v + v_1}{v - v_2}\right) f \quad \text{(Doppler's effect)}$$

$$= \left(\frac{332 + 16.66}{332 - 16.66}\right) 500 = 552.83 \text{ Hz.}$$

But when the two cars have crossed each other

$$f' = \left(\frac{v - v_1}{v + v_2}\right) f$$

$$= \left(\frac{332 + 16.66}{332 - 16.66}\right) 500 = 452.21 \text{ Hz.}$$

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