MARKING SCHEME PHYSICS MODEL PAPER CLASS 9

RUBRICS

Section-B

Item no	Question(Description)	Reference
i	Differentiate between base and derived physical quantities by giving one example of each. **Possible answer:** **Base Physical Quantities:** Minimum number of physical quantities in terms of which all other physical quantities can be expressed are called base quantities. **Examples:** Any one of these (length, mass, time, electric current, thermodynamic temperature, amount of substance, luminous intensity) **Derived Physical Quantities:** The physical quantities defined in terms of base quantities are called derived physical quantities. **Examples:** Any one example (area, volume, speed, velocity, acceleration, density, force, pressure, energy)	KPTBB Grade 9^{th} Page#7,8
Marking	1+1+1+1	4
ii	Write four steps to calculate the slope of graph in Cartesian coordinate system. **Possible answer:** The slope of the graph means vertical coordinate difference divided by horizontal coordinate difference. The slope of the graph in Cartesian coordinate system can be calculated as: 1. Pick two points e.g., P_1 and P_2. 2. Determine the coordinates $P_1(X_1, Y1)$ and $P_2(X_2, Y2)$, by drawing perpendicular on X and Y-axis from both points. 3. Determine the difference between X-coordinates ($\Delta X=X_2 - X_1$) and Y coordinates ($\Delta Y=Y_2 - Y_1$). 4. Dividing the difference in Y-coordinates by difference in X-coordinates gives slope.	KPTBB Grade 9^{th} Page#43
Marking	1 mark for each point 1+1+1+1	4
iii	A body of mass 6kg is moving with an acceleration of $5m/sec^2$. Find its change in momentum in 10 sec. Possible answer: Given data: m= 6kg a= $5m/s^2$ t= 10sec To find: $\Delta P=?$ (1 mark) Formula: $F = \frac{\Delta P}{\Delta t}$ (1 mark)	KPTBB Grade 9^{th} Page#70

	$\Delta P = F \times \Delta t$ Solution: $\Delta P = ma \times \Delta t$ $\Delta P = 6x5x10$ (1 mark) Answer: $\Delta P = 300$kgm/s. (0.5+0.5) Answer+Unit	
Marking	1+1+1+1	4
iv	Prove that K.E = $\frac{1}{2}mv^2$ Possible answer: Consider a body which is initially at rest. A horizontal force F is applied to it comes it to move through a displacement 'S' and achieve final velocity v_f=v. The work done W appears as the K.E. Such that W=K.E= F x S--------(1) (1 mark) By Newton's Second law of motion F = ma --------(2) By 3rd equation of motion $2aS= {V_f}^2 - {V_i}^2$ Rearranging $S= \frac{{V_f}^2-{V_i}^2}{2a}$---------(3) (1 mark) Putting 2 and 3 in 1 K.E= ma x $\frac{{V_f}^2-{V_i}^2}{2a}$ K.E= m x $\frac{{V_f}^2-{V_i}^2}{2}$ (1 mark) As the object started from rest therefore, V_i=0 and V_f= V K.E = $\frac{1}{2}mv^2$ (1 mark)	KPTBB Grade 9th Page#153
Marking	1+1+1+1	4
v	Write any two advantages and disadvantages of friction. Possible answer: Advantages of friction: i) Our ability to walk depends on friction between the soles of our shoes (or feet) and the ground. ii) Friction holds the screw and nails in wood. Disadvantages of friction: i) It slows down moving object and causes heating of moving parts in machinery. ii) Energy is wasted to overcome friction in machinery.	KPTBB Grade 9th Page#81,82
Marking	2+2	4
vi	Define torque, what happens to the magnitude of torque when moment arm is doubled? Possible answer: Torque: "Turning effect produced in a body about a	KPTBB Grade 9th Page#112

	fixed point due to applied force is called torque or moment of force". Mathematical form: $\vec{\tau} = \vec{F} \times \vec{d}$ (2) As torques depends directly on moment arm, when the moment is doubled, the magnitude of torque will also be doubled. (2)	
Marking	2+2	4
vii	Differentiate between static and dynamic equilibrium by giving one example of each. Static equilibrium: When a body is at rest under the action of several forces acting together and several torques acting on the body is said to be in static equilibrium.(1 mark) Example: A book resting on the table is in static equilibrium, the weight of book is balanced by a normal reaction force from the table. (1 mark)Any one example Dynamic equilibrium: When a body is moving at uniform velocity under the action of several forces acting together the body is said to be in dynamic equilibrium.(1 mark) Example: A paratrooper falling with constant velocity. (1 mark)Any one example	KPTBB Grade 9th Page#120
Marking	1+1+1+1	4
viii	Derive mathematical form of Newton's law of universal gravitation. Possible answer: Statement: "Everybody in the universe attracts every other body with a force which is directly proportional to the product of their masses and inversely proportional to the square of distance between their centers". (1 mark) Explanation: Consider two bodies of masses 'm_1' and 'm_2' separated by distance 'r'. By definition of Newton's law of universal gravitation, the force of gravity F_g is $\propto {}_2m_1m$ _____(1) (1 mark) F_g $\propto \frac{1}{r^2}$_____(2) (1 mark)F_g Combining equation 1 and 2 we get $\propto \frac{{}_2m_1m}{{}_2r}$______(3)$F_g$ $=G\frac{m_1m_2}{r^2}$______(4) (1 mark)F_g	KPTBB Grade 9th Page#130
Marking	1+1+1+1	4
ix	If 0.02 kg of mass is completely converted into energy, what is the total energy produced? Given data:	KPTBB Grade 9th Page#157

	m=0.02kg c =3 x $10^8 m/s$ To Find: Energy=? (1 mark) Formula: From Einstein's equation (1 mark) $E = mc^2$ Solution: Putting the values $E = 0.02 \times (3 \times 10^8)^2$ $E = 0.02 \times 9 \times 10^{16}$ (1 mark)$E = 0.18 \times 10^{16}$ Answer: (1 mark)$E = 1.8 \times 10^{15} J$	
Marking	1+1+1+1	4
x	Define pressure, derive its formula and unit Possible answer: Pressure: Pressure is defined as force per unit area.(1 mark) Formula: Pressure is represented by letter 'P', if force 'F' is applied on area 'A', the pressure is P=$\frac{F}{A}$ (1 mark) Unit: The SI unit of pressure is the newton per square meter (N/m^2), which is given a special name, the pascal(Pa). 1 Pa = $1N/1m^2$ (2 marks)	KPTBB Grade 9^{th} Page#174
Marking	1+1+2	4
xi	Define thermal conductivity, write any three factors which affect the rate of flow of heat. Possible answer: Thermal conductivity: The quantity of heat which flows through one square meter of area of substance in one second when a temperature difference of 1K is maintained across a thickness of one meter. (1 mark) Factors: (Any three) The rate of heat flow depends on: The difference of temperature between the two faces or ends of conductor. Length of conductor	KPTBB Grade 9^{th} Page#238

	Cross sectional area of conductor Nature of material	
Marking	1+1+1+1	4

Section-C

Item no	Question(Description)	Reference
2.(a)	Explain three types of motion with one example of each. Possible answer: Translatory Motion: In Translatory motion body changes its position as a whole. The line or path of motion could be straight or curved. (0.5) Example: Any one example of Translatory motion like motion of car, ball, falling bodies, rowing boats and flying birds. (0.5) Rotatory Motion: Rotation of a body as a whole around a fixed axis is called rotatory motion. (0.5) Example: Any one example of rotatory motion like, motion of wheel, hands of clock, blades or wings of turning fan.(0.5) Vibratory Motion: The repeated forward and backward motion/to and fro motion of an object about its mean position is called vibratory motion. (0.5) Example: Any one example of vibratory motion like motion of mass attached to an elastic spring, motion of swing or motion of plucked violin string. (0.5)	KPTBB Grade 9th Page#31
Marking	0.5+0.5+0.5+0.5+0.5+0.5	3
2(b)	A bullet accelerates the length of the barrel of a gun 0.8m long with a magnitude of 5.35 x 10^5 m/s^2 .Find the speed of bullet when it exit the barrel. **Given data:** S=0.8m a= 5.35 x 10^5 m/s^2 $v_i = 0$ **To find:** $v_f = ?$ (1 mark) **Formula:** $2aS = {v_f}^2 - {v_i}^2$ (1 mark) **Solution:**	KPTBB Grade 9th Page#59

	$2x\ 5.35 \times 10^5 x0.8 = v_f{}^2 - 0$ $v_f{}^2 = 85.6 \times 10^4$ (1 mark) $v_f = 9.25 \times 10^2$ m/s. **Answer**: $v_f = 925$ m/s (1 mark)	
Marking	1+1+1+1	4
3(a)	Determine the mass of earth by applying law of universal gravitation. Possible answer: Let an object of mass 'm_o' be placed on the surface of earth. The distance between the centre of the body and earth is nearly equal to radius of earth 'r_E'. If the mass of earth is 'm_E' then the force 'F_g' with which earth attracts the body is given by law of gravitation. $F_g = \frac{m_o m_E}{r_E{}^2}$ ------------(1)(1 mark) We know that the force of gravity is equal to the weight of the body $F_g = W = m_o g$ --------(2) (1 mark) Comparing equation 1 and 2 we get $m_o g = \frac{m_o m_E}{r_E{}^2}$ $g = G\frac{m_E}{r_E{}^2}$ ----------(3) Re-arranging $m_E = g\frac{r_E{}^2}{G}$-----------(4) (1 mark) By putting values of 'G', 'g' and 'r_E' we get $m_E = 6 \times 10^{24}$ kg. (1 mark)	KPTBB Grade 9th Page#134
Marking	1+1+1+1	4
3(b)	At which altitude above earth's surface would the gravitational accelerations be $4.9 m/s^2$? **Given data** $g_h = 4.9 m/s^2$ $g = 9.8 m/s^2$ Radius of Earth, $r_E = 6.4 \times 10^6 m$ (1 mark) **To find:** Altitude above earth's Surface = h = ? **Formula:** $g_h = \frac{g r_E{}^2}{(r_E + h)^2}$ (1 mark) **Solution:**	KPTBB Grade 9th Page#134

	$h = \sqrt{\frac{g{r_E}^2}{g_h}} - r_E$ Putting values h= 2.6 x 10^6m (1 mark)	
4(a)	Explain the terms Stress, Strain and Young's modulus. Possible answer: **<u>Stress:</u>** The stress is defined as the force applied per unit area of cross section on an elastic body to produce deformation. Mathematically it can be written as Stress = Force/Area of cross section. Stress = F/A Unit: The SI unit of stress is Nm-2 or Pascal (Pa). (1 mark) **<u>Strain</u>**: The strain is defined as the extension per unit length. Or It is the ratio of change in length to the original length of a body. Mathematically, it can be written as; Strain = extension/ original length Strain = x/l As strain is the ratio of two lengths, so, it does not have a unit. (1 mark) **<u>Young's Modulus:</u>** "The strain produced in an elastic body is directly proportional to the stress with in the limit of proportionality." Or "It is the ratio of stress to the linear strain". Mathematically, Stress $\propto$ strain Stress = Young's Modulus x Strain ……….(i) Where Young's Modulus is constant of proportionality and is denoted by "Y" Now, rearrange the eq.…(i), we get Young's modulus = $\frac{Stress}{Strain}$ Whereas stress = F/A and strain = x/l	KPTBB Grade 9^{th} Page#190,191

	we get Y= $\frac{\frac{F}{A}}{\frac{x}{l}}$ …..(ii) Rearrange the eq, Y = $\frac{F \times l}{A \times x}$ As young's modulus is constant of proportionality, so within elastic limit, the ratio is constant where value depends on the nature of materials. Unit: The unit of young's modulus is N/m^2 Or Nm^{-2} (2 marks)	
Marking	1+1+2	4
4(b)	An 0.8m long, 1mm diameter steel guitar string must be tightened to a tension of 2000N by turning the tuning screws. By how much is the string stretched? **<u>Given data:</u>** L = 0.8m D= 1mm = 1x 10^{-3}m r =0.5 x 10^{-3}m F= 2000N Y = 20 x 10^{10}Pa **<u>To find:</u>** X =? (1mark) **<u>Formula:</u>** Y = $\frac{F \times l}{A \times x}$ (1 mark) **<u>Solution:</u>** x = $\frac{F \times l}{A \times Y}$ $A = \pi r^2$ Putting values X = 1cm (1 mark)	KPTBB Grade 9th Page#190,191
Marking	1+1+1	3
5(a)	What is evaporation, and how the nature and temperature of liquid affect the rate of evaporation? Possible answer: <u>Evaporation</u>: The process by which a liquid slowly changes into <u>vapours</u> at any temperature (<u>below its</u>	KPTBB Grade 9th Page#224

	<u>boiling point</u>) without any aid of any external source of heat is called evaporation of liquids.(2 marks) <u>Nature of liquid</u>: Liquid with low boiling points evaporates more rapidly than those with higher boiling points. For example the rate of evaporation of alcohol is higher than that of water .(1 mark) <u>Temperature of liquid:</u> Due to higher temperature, molecules of liquid at the surface have more kinetic energy and chances of escaping will increase and evaporation will be fast. His can be seen while ironing clothes. Under a hot iron wet clothes dry out quickly as the water evaporates quickly.(1 mark)	
Marking	2+1+1	4
5(b)	What is the specific heat of a metal substance if 200kJ of heat is needed to raise 2.2kg of the metal from 21 °C to 40.2°C? **<u>Given data:</u>** ΔQ= 200kJ = 21°CT_1 = 40.2°CT_2 ΔT = 19.2 °C Or 19.2 K m = 2.2kg **<u>To find:</u>** Specific heat of metal, C =? (1 mark0 **<u>Formula:</u>** $C = \frac{\Delta Q}{m\Delta T}$ (1 mark) **<u>Solution:</u>** $C = \frac{200000}{2.2 \times 19.2}$ C= 4735 $Jkg^{-1}K^{-1}$ (1 mark)	KPTBB Grade 9^{th} Page#232
Marking	1+1+1	3