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| Qn | **Scores** | Mks |
| 1. (a) | (i) Displacement- Distance covered by a body in a specified direction.  Acceleration due to gravity- is rate of change of velocity for a body falling freely under gravity. | 1  1 |
|  | (ii) If a particle, moving along a straight line with constant acceleration, a, has a velocity u initially (i.e at time t = 0) its velocity at any subsequent instant, t, is given by  *Final velocity = initial velocity + increase in velocity*  **∴** ***v = u + at*** …………………………………. (1)  The displacement, ***s***, of the particle during this time is given by  *Displacement = Average velocity* x *time*  **∴** *s = ½(u + v)* x *t*  ∴  … ……………………….. (3) | 1  ½  ½  1 |
| (b) | This is the velocity of a particle as perceived by a moving observer.  Resultant velocity is a single velocity having the same effect as a number of velocities experienced by a body. | 1  1 |
| (c) | (i) Using :  Let t be the time taken by A before it is hit by B, then time taken by B is t – 5.  For A;  …….(i)  For B;  ……(ii)  Equating (i) and (ii);    So time taken by B = 7.04 – 5 = 2.04 s. | ½  ½  1  1  1 |
| (ii) | 2 |
| (iii) | 3 |
| (d) | The resultant velocity must be along AC  Distance AC = = 56.8 m  C B  2 ms-1  4 ms-1  v  A  θ  α  Now, 42 = v2 + 22 – 2x2vcosα  But cosα = -cosθ = -0.440  ∴ 16 = v2 + 4 + 4 x 0.440v  ∴ v2 + 1.76v – 12 = 0  ∴ v = 2.69 ms-1  ∴ time to reach C is t =  =  **21.2 s** | ½  ½  ½  ½  1 |
| 2.(a) | (i) Dimensions of a physical quantity refers to the a derived physical quantity is related to the fundamental quantities of length, mass and time. | 1 |
|  | (ii)      Since , the equation is dimensionally correct. | 2  2  1 |
| (b) | ;  Comparing powers, | 2  3 |
| (c) | (i) Using ; the car is retarding  ……..(i)    Solving (i) and (ii) simultaneously, | 1  2  1 |
|  | (ii) | 2 |
|  | (iii) using  Further distance travelled is 1668.6 - 1000 = 668.6 m | 2  1 |
| ***20 Marks*** | | |
| 3. (a) | (i) Uniform acceleration- is the constant rate of change of velocity with time.  Displacement  Time (s)  v  t | 1  2  ½  ½  ½  ½ |
| (b) | (i) Car;  Motorcycle;  Let the time taken by the car catch up with the motorcycle be t. The distance covered are also the same.  Car:  ……….(i)  Als1o:  ……(ii)  From (i)  Motorcycle:  Then | 1  1  1  1 |
| (ii) | 1  1 |
| (c) | (i) A vector is a quantity which is specified by magnitude together with direction.  Examples of vectors:  A scalar is a quantity which is specified by magnitude only  Examples of a scalars: | 1  1  1  1 |
| (ii) | 1  1  1  1  1 |
|  |  |
| ***Total = 20*** | | |
| 4. (a) | (i) Temperature is a measure of the average kinetic energy possessed by each molecule of the substance.  *OR* ***Temperature is the degree of hotness of a body expressed as a number on some scale****.* | 1 |
| (ii) A suitable thermometric property should   * vary continuously with temperature, in value or otherwise, over a wide range   Any 2 @   * be observable * be measurable * have reproducible values at the respective temperatures * have distinguishable values even for small differences in temperature |  |
|  | (iii) – Volume of a fixed mass of gas at constant pressure.   * Pressure of a fixed mass of gas at constant volume   Any 4 @ 1/2   * Length of liquid column in liquid- in- glass thermometer * Thermoelectric e.m.f of thermo couple * Electrical resistance of platinum wire | 2 |
| (b) | http://ramadan.50megs.com/IGC_Te2.jpg  The bulb of thermometer contains liquid (e.g. mercury, alcohol) which expands when temperature rises and pushes a thread of liquid along the scale where temperature can be read.  ***Increasing sensitivity:***-  Any one  - increase in the volume of the bulb - decreases the diameter of the tube (bore) | 2  2  1 |
| (c) | (i) θ =  where  = pressure at the temperature θ  P0 = pressure at the temperature at the ice point  P100 = pressure at the temperature at the steam point | 1  1 |
| (ii)   * the gas in the capillary tube E is not at the temperature being measured. The error due to this can be reduced by making the capillary tube very narrow and the bulb large. * the bulb B expands. This is why a metal with very small expansivity, like platinum-iridium alloy is used for B. * the density of the mercury changes with temperature and a correction is needed for these changes. | 2 |
| (d) | (i) Different thermometric properties respond differently to change in temperature. | 1 |
|  | (ii) | 5 |
| ***Total = 20*** | | |
| 5. (a) | (i) The rate of loss of heat from a body is directly proportional to the exces temperature over the surroundings. |  |
| (ii) Water is heated to the boiling point and is then placed in a calorimeter containing a thermometer and stirrer. It is left in draught (or placed near an open window).  The temperature of the water is taken at a half a minute interval for at least five readings.  A cooling curve is plotted.  A  B  C  P  θ  θR  (θ-θR)  Temperature  Time    Excess temp    Tangents are drawn at different temperatures and their respective gradients found. The gradient The excess temperatures over the surrounding are calculated in each case. A gradient versus excess temperature graph is then plotted. If it is found to be a straight line through the origin, Newton’s law of cooling is verified. |  |
| (b) | Specific heat capacity is quantity of heat required to increase the temperature of 1 kg mass of a substance by 1K. Unit: |  |
| (c) | Assuming there are no heat losses to the surroundings,and that the flask was initially at room temperature, 250C  Heat lost by Water = Heat gained by the flask |  |
| (d) | (i) When two dissimilar metals are joined together and the junctions maintained at different temperatures, a thermoelectric e.m.f is generated. Each junction is referred to as a thermo junction. |  |
| E  0 θn B θoC  Advantages:   * measures temperature at a point * can measure rapidly changing temperature |  |
| ***Total = 20*** | | |
| 6. (a) | (i) A thermometric property is a physical property of a substance which chances linearly and continuously with temperature. | 1 |
| (ii) The resistance of the platinum wire is determined at the triple point of water,  The resistance of the platinum wire is the determined at the unknown temperature,  The unknown temperature is calculated from | 1  1  1 |
|  | (iii)  Thermometer  Stirrer  Calorimeter  Lagging |  |
| (b) | Steam  θ3  Wool  m, c  The solid is weighed to find its mass, m, heated in a steam jacket as shown in the diagram, for sufficient time, say 30 minutes. Its temperature, θ3, is recorded and it is then quickly transferred to a weighed calorimeter of mass mc containing a determined mass of water, mw, at temperature θ1. The water is stirred and the highest reading, θ2, on the thermometer is noted.  Assuming no heat loss from the calorimeter, we have  Heat given out by the solid cooling from θ3 to θ2  Heat gained by water warming from θ1 to θ2  Heat gained by calorimeter warming from θ1 to θ2  **=**  **+**    If c is the specific heat capacity of the solid, cw that of water and cc that of the calorimeter, then  mc(θ3 - θ2) = mwcw(θ2- θ1) + mccc(θ2- θ1)  Assumptions made:   * No heat loss to the surroundings * Negligible heat capacity of the thermometer * No heat loss from the solid during transfer * No heat loss by evaporation the temperature rises |  |
| (c) | (i)  A  V  T1  T2  Constant head tank  Copper lining  Vacuum  Heating coil  Constant temperature jacket | ½  1  ½  ½  ½  ½  ½ |
| (ii) V1 = 6.0 V, I1 = 2.5 A, m1 = , θ1 = 25oC  V2 = 7.2 V, I2 = 3.0 A, m2 = , θ2 = 35oC  V1I1 = m1c(θ2 - θ1) + h ……………. (1)  V2I2 = m2c(θ2 - θ1) + h ……………. (2)  ∴ c =  =  = **4068 J kg-1K-1** | 1  1  1  1 |
| (iii) From (1) h = V1I1 - m1c(θ2 - θ1)  = 6.0 x 2.5 - x 4068 x 10  = 15 – 9.94 = **5.06 W** | 1  1 |
| ***Total = 20*** | | |