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| **Qn** | **Answer** | **Mark** |
| 1. (a) | (i) …the distance moved in a specified direction.  L | 1  1 |
| (ii) …equal changes of velocity in equal time intervals.  LT-2 | 1  1 |
| (b) | All the terms should have the same dimensions, i.e. dimensions of force  [F] = MLT-2  [r] = L  [p] = ML-1T-2  Now, γ =  ∴ [γ] = MLT-2 L-1 = **MT-2**  and MLT-2 = Lx. ML-1T-2  ∴ 1 = x – 1 ⇒ x = **2** | ½  ½  ½  ½ |
| (c) | (i)  Time  Displacement  Time  Displacement  OR  Time  Velocity | 2 |
| (ii)  Velocity  Time  OR | 2 |
| (d) | v  25  vo  5  to- 7.5  2.5  Time  90 km h-1 =  = 25 m s-1  (i) If the acceleration is double the retardation, then the distance covered during retardation is twice that during acceleration, i.e. 2 x 37.5 = 75 m  ∴ total distance = 75 + 100 + 37.5  =  **212.5 m**  (ii) Let vo = constant velocity  Then 75 =  x 5(vo + 25)  ∴ vo + 25 = 30  ∴ vo = **5 m s-1 = 18 km h-1** | 1  ½  ½  1  1  1  1  1  1 |
| (iii) Time at constant speed =  = **20 s** | 2 |
| ***Total = 20*** | | |
| 2. (a) | Relative velocity of a body is the velocity of that body as perceived by an observer who is also moving whereas resultant velocity is that single velocity that has the same effects on the body as the many velocities experienced by the body | 2 |
| (b) | The resultant velocity must be along AC  C B  2 ms-1  4 ms-1  v  A  θ  α  Distance AC = = 56.8 m  ∴ cos θ =  = 0.440  Now, 42 = v2 + 22 – 2 x 2vcosα  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** | 1  ½  ½  1  1  1  1 |
| (c) | A  -vp  vq  vqp  BA  α  135o    The relative velocity of Q w.r.t P must be along the line BA  Now, vqp = vq - vp  ∴ vq2 = vp2 + vqp2 – 2vpvqp cos135o  ∴ 202 = 152 + vqp2 + x 15vqp  ∴ vqp2 + 21.1vqp – 175 = 0  ∴ vqp = 12.7 kmh-1  ∴ α = 24.5o  So, Q must sail in the direction N 69.5o W | 1  1  1  1  1  1 |
| (ii) The time taken by Q to catch up with P is  t =  = 0.787 hrs ≅ 47 minutes  So it will catch up at **8.47 am.** | 2  1 |
| (d) | P  Q  R  S  100o  75o    Fx = 5 + 5cos75o - 5cos5o - 5cos85o  = 5(1 + 0.259 – 0.996 – 0.087)  = 0.88 N  Fy = 0 + 5sin75o + 5sin5o – 5sin85o  = 5(0.966 + 0.087 – 0.996)  = 0.285 N  Now, the resultant force, F =  =  = **0.925 N** | 1  1  1 |
| ***Total = 20*** | | |
| 3. (a) | 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*  But from above, v = u + at  **∴** *s = (u + at + u)t*    ∴  **∴ *v2 = u2 + 2as*** ………… ……………………….. (3) | 1  ½  1  1  ½  1 |
| (b) | α  g sinα  (i)  Acceleration, a = g sin α, where α = sin-1  Let v = velocity on reaching the bottom  Then, using v2 = u2 + 2as, we have  v2 = 0 + 2g sinα x 12  = 2 x 9.8 x x 12 = 52.9  ∴ v =  = **7.27 m s-1** | 1  1  1  1 |
| (ii) v = u + at, where u = 0  ∴ t =  = **3.3 s** | 1  1 |
| (c) | (i) Let u = velocity at the beginning  Then 500 = 16u - x 162a  ∴ 1000 = 32u – 256a ………………..….(1)  and 1000 = 36u - x 362a  ∴ 1000 = 36u – 648a ………………….. (2)  Eq(1) x 81: 81000 = 2592u – 81 x 256a ….. (3)  Eq(2) x 32: 32000 = 1152u – 32 x 648a …. (4)  Eq(3) – Eq(4): 49000 = 1440u  ∴ u =  = **34 m s-1** | 1  1  ½  ½  1 |
| (ii) From (1): a =  = **0.344 m s-2** | 2 |
| (iii) Let x be the further distance required  Then, using v2 = u2 – 2as, where v = 0 and s = 100 + x  0 = u2 – 2a(1000 + x)  ∴ 1000 + x =  ∴ x = - 1000 = 680 m = **0.680 km** | 1  2 |
| ***Total = 20*** | | |
| 4. (a) | (i) … a property whose value varies continuously with temperature.  e.g. – electrical resistance  - thermoelectric emf  Any 4 @½  - volume of a fixed mass of gas at constant pressure  - volume of a liquid  - pressure of a fixed mass of gas at constant volume | 1  2 |
| (ii) Advantages: can measure temperature at a point  can measure rapidly changing temperature  Disadvantages: A particular emf corresponds to two different temperatures.  There is a temperature beyond which the emf reverses | 1  1  1  1 |
| (b) | The silica tube containing the resistance wire is placed in the region whose temperature is to be measured and left for some minutes.  Then the resistance, Rθ, of the resistance wire is measured on the Wheatstone bridge.  The procedure is repeated when the silica tube is in melting ice to find Ro, the resistance at the ice point; and when the silica tube is in steam to find R100.  Then the temperature of the bath, θ = | 1  1  2  1 |
| (c) | (i) θ =  where Rθ = resistance at the temperature θ  R0 = resistance at the tempe rature at the ice point  R100 = resistance at the temperature at the steam point | 1  1 |
| (ii) θ =  = oC  =  = **384.8oC** | 1  2  2 |
| (iii) The resistance of the wire and the pressure of the gas at constant volume do not vary exactly the same way as the temperature varies. | 1 |
| ***Total = 20*** | | |
| 5. (a) | (i) .. the quantity of heat required to raise the temperature of 1 kg of a substance by 1 K.  J kg‑1K-1 | 1  1 |
| (ii) Advantages:-  The heat capacity of the apparatus is not required.  The cooling correction is eliminated easily by doing two experiments.  Disadvantages:- Large quantities of liquid are required. | 1  1  1 |
| (b) | A  V  T1  T2  Constant head tank  Copper lining  Vacuum  Heating coil  Constant temperature jacket  Collecting vessel | ½  ½  ½  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 |
| (c) | The resistance of the coil, R =  = 57.6 Ω  Now,  ∴ t =  =  = **4.27 s**  No heat is lost to the surroundings | 1  1  1  1  1 |
| ***Total = 20*** | | |