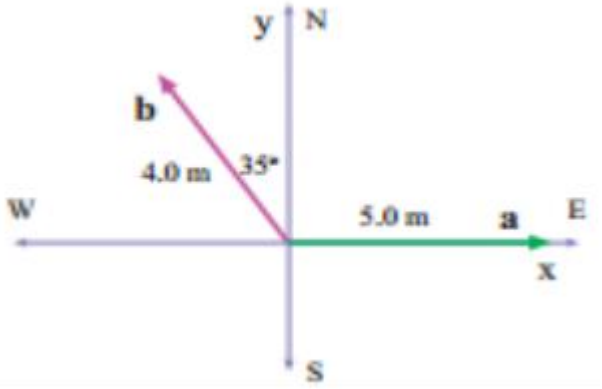
Assignment for Mechanics and heat for chemists (Phys 2031)

**Assignment-one (Vectors)**

1. Vector **a** has magnitude 5 m and is directed east. Vector **b** has magnitude 4 m and is directed $35^0$ west of north. What are (a) the magnitude and (b) the direction of **a + b**? What is (c) the magnitude and (d) the direction of b − a?
   Draw a vector diagram for each combination.




2. If **a − b = 2c**, **a + b = 4c** and **c = 3i + 4j**, then what are **a** and **b**?
3. If A = (6i − 8j) units, B = (−8i + 3j) units, and C = (26i + 19j) units, determine *a* and *b* so that *a*A + *b*B + C = 0.
4. A vector **B**, when added to the vector **C = 3i +4j**, yields a resultant vector that is in the positive *y* direction and has a magnitude equal to that of **C**. What is the magnitude of **B**?
5. A car travels 10 km due north and then 5 km due west. Find graphically and analytically the magnitude and direction of the car's resultant displacement.

**Assignment-2 (Motion in one and two dimension)**

1. A particle starts from the origin at $t$ =0 with a velocity of 8**j** m/s and moves in the *xy* plane with a constant acceleration of (4i + 2**j**) m/s$^2$. At the instant the *x* -coordinate of the particle is 29 m, what is the value of its *y*- coordinate?
2. At $t$ = 0, a particle leaves the origin with a velocity of 9 m/s in the positive *y* direction and moves in the *xy*- plane with a constant acceleration of (2**i** – 4**j**) m/s$^2$. At the instant the *x*-coordinate of the particle is 15 m, what is the speed of the particle?

3. An electron moving along the $x$- axis has a position given by $x = (16te^{-t})$ m, where $t$ is in seconds. How far is the electron from the origin when it momentarily stops?
4. The initial speed of a projectile is 80 m/s. If the projectile is to strike a target that is a horizontal distance of 0.45 km away, what is the minimum time of flight?
5. An object moving at a constant speed requires 6 second to go once around a circle with a diameter of 4.0m. What is the magnitude of the instantaneous acceleration of the particle during this time?
6. A particle moves at a constant speed in a circular path with a radius of 2 cm. If the particle makes four revolutions each second, what is the magnitude of its acceleration?
7. The position of an electron is given by $\mathrm{r} = 3t\,\mathrm{i} - 4t^2\mathrm{j} + 2\mathrm{k}$ (where $t$ is in seconds and the coefficients have the proper units for r to be in meters). (a)What is v($t$) for the electron? (b) In unit–vector notation, what is v at $t$ = 2.0 s? (c) What are the magnitude and direction of v just then?
8. A particle moves so that its position as a function of time in SI units is $\mathrm{r} = \mathrm{i} + 4t^2\mathrm{j} + t\mathrm{k}$. Write expressions for (a) its velocity and (b) its acceleration as functions of time.
9. A projectile is fired in such a way that its horizontal range is equal to three times its maximum height. What is the angle of projection?
10. A particle moves along a circular path having a radius of 2m. At an instant when the speed of the particle is equal to 3 m/s and changing at the rate of 5 m/s$^2$, what is the magnitude of the total acceleration of the particle?