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Solid State Physics

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Physics 1 for Nano: written Exercises

WS 2019 (sheet 1)

Exercise 1.

You drive the A45 from Siegen to Dortmund, half of the time your velocity is 65 km/h and the other half is 120km/h. On the way back you travel half the distance (50km) at 65km/h and the other half at 120km/h. a) what is your average speed to Dortmund and what is your average speed on the way back. b) what the average speed of the whole tour. c) how much time you need for the total trip? d) Sketch x (positive towards Dortmund) versus time t for a) and b).

Exercise 2.

The maximum acceleration (deceleration) that is tolerable for passengers in a subway is 1.35m/s². The mean distance between two subway stations is 1850m. a) How much is the maximum speed of a subway train reached between the two stations? b) what is the travel time between the station? c) if the subway stops for 30s at each station, what is the maximum average speed of the train from one start to the next ? d) graph x, v, and a as function of time t for the interval from one start to the next.

Excercise 3)

The position of a particle is given by the function: $x(t)=20t-5t^3$ (x in meters, t in seconds). a) when is the particle´s velocity zero? b) when is the acceleration zero? c) for what time span acceleration is positive/negative? d) graph x(t), v(t) and a(t).

Exercise 4.

An ion´s position vector is initially $\vec{r} = 5.0\vec{i} - 6.0\vec{j} + 2.0\vec{k}$ and 10 s later it is $\vec{r} = -2.0\vec{i} + 8.0\vec{j} - 2.0\vec{k}$, all in meters. Calculate the difference vector $\Delta\vec{r}$. What is the mean velocity, $\vec{v}_{mean}$, during this 10s ?

Excercise 5)

A particle *A* moves along a line at y=30m with constant velocity $\vec{v}$=3.0m/s and parallel to x- axis; At the instant of particle *A* passes the y-axis , particle *B* leaves the origin (y=0) with zero initial speed but a constant acceleration of magnitude $\vec{a}$=0.4m/s². What is the angle Θ between the direction of movement of particle *B* and the positive y-axis that *A* and *B* can collide? Determine the point of collision (x_c,y_c)? Describe the problem within a coordinate system (x,y) and give a numerical and graphical solution

Excercise 6)

A stone with initial speed of 42.0 m/ under an angle of 60° with respect to the horizon is projected towards a hill with height h. The stone strikes the top of the hill t=5.5s after launching. a) Find the height h of the hill, b) What is the speed of the stone just before impact on the hill. C) What is the maximum height H of the stone reached above the ground.

Note: Exercises have to give back to Ali at lecture 15.10. and will be discussed in Exercise hours at 16.10.