Year 12 Physics Revision Table

Topics 4-5

Topic 4: Momentum in Two Dimensions

Expectation From SACE Subject Outline *Note: these can be asked in converse*	***Summary of things I know about this*** (for formulae, for example, this could be: what the symbols mean, what the units of each variable is, and some possible rearrangements)	***Example question(s) to practice until I can do under test conditions without help*** There are likely to be some in the textbook too; also take note of questions you'd like examples of from the teacher
Given the initial velocity of a particle bouncing off a surface without a change of speed, and the duration of the collision, calculate the average acceleration of the particle.		Assignment 1 Q1 (a)
Using $\vec{F} = m\vec{a}$, calculate the average force applied to the particle by the surface.		
Using Newton's third law, deduce the average force applied to the surface by the particle.		Assignment 1 Q1 (c)
Derive $\vec{F} = \Delta\vec{p}/\Delta t$ by substituting the defining expression for acceleration ($\vec{a} = \Delta\vec{v}/\Delta t$) into Newton's second law of motion $\vec{F} = m\vec{a}$ for particles of fixed mass. (The net force $\vec{F}$, and hence the acceleration $\vec{a}$, are assumed to be constant. Otherwise, average or instantaneous quantities apply.)		Assignment 1 Q3
Draw a vector diagram in which the initial momentum is subtracted from the final momentum, giving the change in momentum $\Delta\vec{p}$. Solve problems involving the use of the vector relation $\vec{F} = \Delta\vec{p}/\Delta t$.		Assignment 1 Q1 (b) Assignment 3 Q1
Derive an equation expressing the conservation of momentum for two interacting particles by substituting $\vec{F}_1 = \Delta\vec{p}_1/\Delta t$ and $\vec{F}_2 = \Delta\vec{p}_2/\Delta t$ into $\vec{F}_1 = -\vec{F}_2$.		Assignment 2 Q1 (a)

Compare the magnitudes and directions of the total momentum vectors before and after a two-puck air-table collision recorded using a multi-image photograph, in order to show that momentum is conserved. Consider only examples in which the mass of one puck is an integral multiple of the mass of the other puck. Ignore the scale of the photograph, the flash rate, and the actual masses of the pucks.		
Using trigonometric relations or scale diagrams, perform calculations in one or two dimensions, applying the law of conservation of momentum to two objects or to one object that explodes into two or three fragments.		Assignment 1 Q2 (c) Assignment 2 Q3 Assignment 3 Q2, 3
Explain qualitatively, in terms of the law of conservation of momentum, the change in motion (in a straight line) of a spacecraft as a result of the emission of discrete particles (e.g. ions emitted by an ion thruster on a satellite).		Assignment 1 Q2 (b)
Explain qualitatively, in terms of the law of conservation of momentum, how the reflection of light particles (photons) can be used to accelerate a solar sail.		Assignment 2 Q4 (a)
Use vector diagrams to compare the acceleration of a spacecraft using a solar sail where photons are reflected with the acceleration of a spacecraft using a solar sail where photons are absorbed.		Assignment 2 Q4 (b)

Topic 5: Electric Fields

Expectation	*Summary of things I know about this*	*Example question(s) to practice*
Solve problems involving the use of $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$ where F is the magnitude of the electric forces, q_1 and q_2 are the charges, r is the distance between them, and $1/4\,\pi\varepsilon_0$ is the proportionality constant.		
Using proportionality, discuss changes in the magnitude of the force on each of the charges as a result of a change in one or both of the charges and/or a change in the distance between them.		Assignment Q1 (b)
Explain that the electric forces are consistent with Newton's third law.		Assignment Q2
Using vector addition, calculate the magnitude and direction of the force on a point charge due to two other point charges.		
Describe how the concept of the electric field replaces the concept of action at a distance (inherent in Coulomb's law) with the localised action of the field of one charge on the other charge.		
Solve problems involving the use of $\vec{E} = \vec{F}/q$.		
Determine the direction of the electric field at any point due to a point charge.		
Using Coulomb's law, derive the expression $E = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$ for the magnitude of the electric field at a distance r from a point charge q.		Assignment Q4
Solve problems involving the use of $E = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$.		Assignment Q1 (c) Assignment Q3
Sketch the electric field lines for an isolated positive or negative point charge.		

Calculate the magnitude and direction of the electric field at a point due to two charges with the same or opposite sign.		
Sketch the electric field lines for two point charges of equal magnitude with the same or opposite sign.		
Describe and draw the electric field due to an infinite conducting plate of positive or negative charge.		
Using the principle of superposition, draw the electric field due to two infinite parallel conducting plates with equal and opposite charges per unit area.		
Sketch the electric field between and near the edges of two finite oppositely charged parallel plates.		
In terms of the motion of the charges in the conductor, explain why: • the component of the electric field parallel to the conducting surface must be zero • there is no electric field inside the conducting material.		Assignment Q5 (b) Assignment Q8
Sketch the electric field that results when a solid uncharged conducting sphere is placed in the region between two oppositely charged parallel plates.		Assignment Q6
Sketch the electric field produced by a hollow spherical charged conductor.		Assignment Q5 (a)
Sketch the electric field produced by a charged pear-shaped conductor.		
Describe how the large electric field in the vicinity of sharp points may ionise the air.		Assignment Q7
Describe the action of a corona wire in charging the photoconductive surface of a photocopier or laser printer.		
Describe the action of the corona wire in: • charging the paper so as to transfer the toner from the photoconductive surface to the paper • discharging the paper so that it does not cling to the photoconductive surface.		