

所別：太空科學研究所碩士班 一般生 科目：普通物理

1. State the following terminologies (30%)
 - (i) Kepler's Laws
 - (ii) Pascal's Principle
 - (iii) Bernoulli's Equation
 - (iv) The Principle of Superposition
 - (v) The Second Law of Thermodynamics
 - (vi) Ohm's Law
 - (vii) The Hall Effect
 - (viii) Maxwell's Equations
 - (ix) Lenz's Law
 - (x) Poynting Vector

2. A crate whose mass is 15 kg is pulled a distance d ($=5.7$ m) up a frictionless ramp, to a height h of 2.5 above its starting point. (a) What force F must be exerted along the ramp? (b) How much work is done by the force F ? (c) How much work would be required to lift the crate vertically upward, through a height h ? (10%)

3. A rocket whose initial mass M_i is 850 kg ejects mass during a burn at the rate $R = 2.3$ kg/s. The speed u of the exhaust gases relative to nozzle of the rocket engine is 2800 m/s. (a) What thrust does the rocket engine provide? (b) What is the initial acceleration of the rocket? (c) The mass M_f of the rocket when its fuel is exhausted is 180 kg. What is its speed at that time? (15%)

4. If you are driving a convertible toward a police car at 50 m/s and sounding a stereo system with frequency ν of 1000 Hz. A police car, parked by the roadside, is equipped by a radar/speed gun with frequency f of 1.2 GHz. Sound speed: 340 m/s and light speed: 3×10^8 m/s. (a) What frequencies ν' and f' will be heard and observed by the police? (b) Are those lower or higher than their originals? (c) Will you apply the same formula to derive the frequencies ν' and f' ? Why? (15%)

5. A 22.5 eV electrons moves in a magnetic field $B=4.55 \times 10^{-4}$ T, its velocity making an angle of 30 degree with the field direction. (a) Draw the trace/path of the electron motion or the orbit together with the field. (b) What are the orbit radius and (c) the angular frequency of the electron? (15%)

6. A long coaxial cable consists of two concentric cylinders with radii a and b . Its central conductor carries a steady current i , the outer conductor providing the return path. (a) What are the magnetic energy densities at $a/2$, b , and $2b$? (b) Calculate the energy stored in the magnetic field between the conductors for a length l of such a cable. (15%)