

科目：普通物理(甲)

系所組：物理學系碩士班物理組

1. A car accelerates with constant acceleration from rest to 30 m/s in 10 s. It then continues at constant velocity. Find: (a) its acceleration (5%); (b) how far it travels while speeding up (5%); (c) the distance it covers while its velocity changes from 10 m/s to 20 m/s (5%).
2. A block of mass 100 g is attached to the end of a spring whose spring constant is $k = 40$ N/m. The block slides on a horizontal surface for which $\mu_k = 0.1$. The spring is extended by 5 cm and then released. (a) Find the work done by the spring up to the point at which it is compressed by 3 cm (8%). (b) Find the net work done on the block up to this point (8%). (Use $g = 10 \text{ m/s}^2$)
3. An ideal monatomic gas, for which $\gamma = 5/3$, undergoes a quasistatic expansion to one-third of its initial pressure. Find the ratio of the final volume to the initial volume if the process is (a) isothermal (8%); (b) adiabatic (8%). (Leave your answers in powers)
4. The equation of a wave is $y(x, t) = 0.05 \sin[0.5\pi(10x - 40t) - 0.25\pi]$ m. Find: (a) the wavelength (4%), the frequency (4%), and the velocity (4%); (b) the particle velocity (5%) and acceleration (5%) at $x = 0.5$ m and $t = 0.05$ s. (Leave your answers in π , sin, and cos)
5. A non-conducting uniformly charged sphere of radius R has a total charge Q uniformly distributed throughout its volume. Find the electric field (a) inside (8%), and (b) outside, the sphere (8%).
6. The heating element of a heater is rated 1000 W when operating at 100 V. (a) What is the current through it under normal conditions (5%)? (b) What would its power consumption be if the potential difference drops to 50 V (5%)? (c) What is the resistance of the element (5%)?

※ 注意：1. 考生須在「彌封答案卷」上作答。

2. 本試題紙空白部份可當稿紙使用。

3. 考生於作答時可否使用計算機、法典、字典或其他資料或工具，以簡章之規定為準。