

系所組別：環境醫學研究所甲組

考試科目：物理學

考試日期：0307 · 題次：3

※ 考生請注意：本試題 可 不可 使用計算機

- Three coplanar vectors are expressed, with respect to a certain rectangular coordinate system, as
 $a=4i-j$,
 $b=-3i+2j$,
 $c=-3j$,
in which the components are given in arbitrary units. Find the vector r which is the sum of these vectors. (10%)
- Calculate the speed of an artificial earth satellite, assuming that it is traveling at an altitude h of 140 miles above the surface of the earth where $g=30\text{ft}/\text{sec}^2$. The radius of the earth R is 3960 miles. (10%)
- A 10-lb block is thrust up a 30° inclined plane with an initial speed of 16ft/sec. It is found to travel 5.0 ft along the plane, stop, and slide back to the bottom. Compute the force of friction f (assumed to have a constant magnitude) acting on the block and find the speed v of the block when it returns to the bottom of the inclined plane. (10%)
- A flywheel completes 40 revolutions as it slows from an angular speed of 1.5 radians/sec to a complete stop. Assuming uniform acceleration, (a) what is the time required for it to come to rest? (b) What is the angular acceleration? (c) How much time is required for it to complete one-half of the 40 revolutions? (15%)
- A thin rod of length l and mass m is suspended freely at its end. It is pulled aside and swung about a horizontal axis, passing through its lowest position with an angular speed ω . How high does its center of mass rise above its lowest position? Neglect friction and air resistance. (10%)
- (a) Explain how a pitcher can make a baseball curve to his right or left. Justify your answer by drawing a diagram of the streamlines and applying Bernoulli's equation. (b) Why is it easier to throw a curve with a tennis ball than with a baseball? (10%)
- The maximum pressure variation P that the ear can tolerate in loud sounds is about 28 Nt/m^2 . Normal atmospheric pressure is about 100,000 Nt/m^2 . Find the corresponding maximum displacement for a sound wave in air having a frequency of 1000cycles/sec. (10%)
- The speeds of ten particles in m/s are 0, 1.0, 2.0, 3.0, 3.0, 3.0, 4.0, 4.0, 5.0, and 6.0. Find (a) the average speed, (b) the root-mean-square speed, and (c) the most probable speed of these particles. (10%)
- A parallel-plate capacitor has plates with area A and separation d . A battery charges the plates to a potential difference V_0 . The battery is then disconnected, and a dielectric slab of thickness d is introduced. Calculate the stored energy both before and after the slab is introduced and account for any difference. (15%)