國立彰化師範大學106學年度碩士班招生考試試題

系所：機電工程學系(選考乙)　　科目：動力學
車輛科技研究所(選考丁)

☆☆請在答案紙上作答☆☆　　

1. As shown in Fig. 1, two automobiles A and B are approaching each other in adjacent highway lances. At t=0, A and B are 1 km apart, their speeds are $v_A = 108\,{}^{km}/_{h}$ and $v_B = 63\,{}^{km}/_{h}$, and they are at point P and Q, respectively. Knowing that A passes point Q 40 s after B was there and that B passes point P 42 s after A was there, determine (a) the uniform acceleration of A and B, (b) when the vehicles pass each other, (c) the speed of B at that time. (20%)

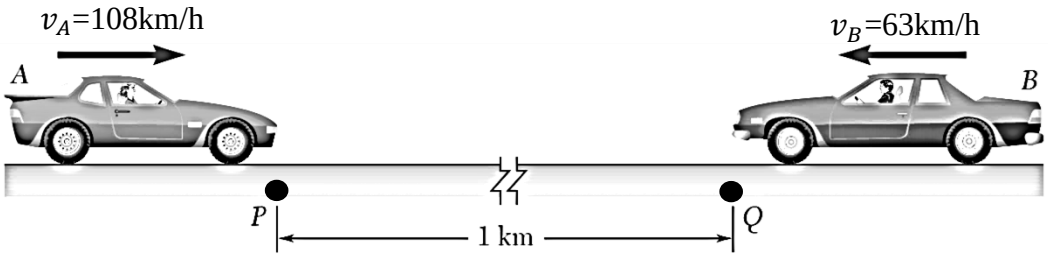

Fig. 1

2. As shown in Fig. 2, a projectile is fired from the edge of a 150-m cliff with an initial velocity of $108\,{}^{m}/_{S}$ at an angle of 30° with the horizontal. Neglecting air resistance, determine (a) the horizontal distance from the gun to the point where the projectile strikes the ground, (b) the greatest elevation above the ground reached by the projectile. (20%)

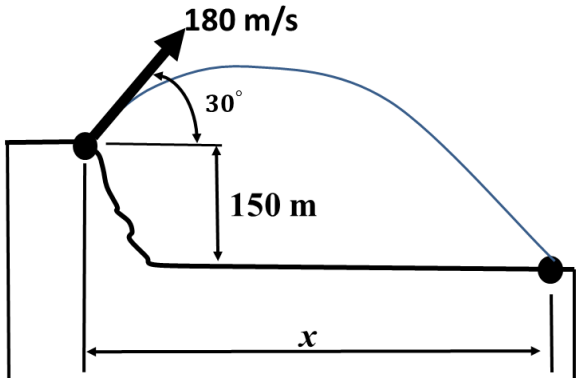

Fig. 2

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3. As shown in Fig. 3, the 12-lb block B starts from rest and slides on the 30-lb wedge A, which is support by a horizontal surface. Neglecting friction, determine (a) the acceleration of the wedge, (b) the acceleration of the block relative to the wedge. (20%)

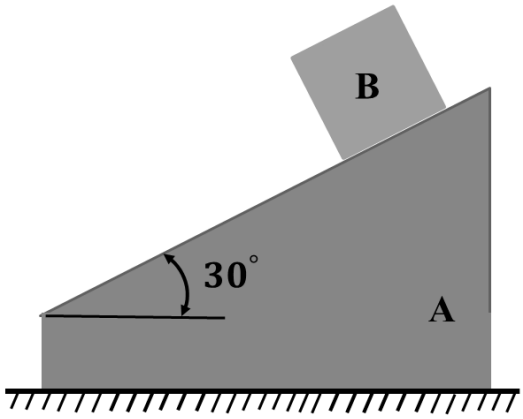

Fig. 3

4. As shown in Fig. 4, rod *OA* rotates about *O* in a horizontal plane. The motion of the 200-g collar *B* is defined by relations $r = 250 + 150\sin\pi t$ and $\theta = \pi(4t^2 - 8t)$, where *r* is expressed in millimeters, *t* in seconds, and θ in radians. Determine the radial and transverse components of the force exerted on the collar when (a) *t*=0, (b) *t*=0.5 s. (20%)

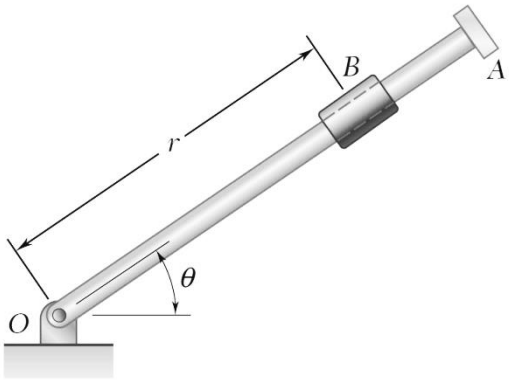

Fig. 4

5. Two blocks are joined by an inextensible cable as shown in Fig. 5. If the system is released from rest, determine the velocity of block A after it has moved 2 m. Assume that the coefficient of kinetic friction between block A and the plane is $\mu_k = 0.25$ and that the pulley is weightless and frictionless. (20%)

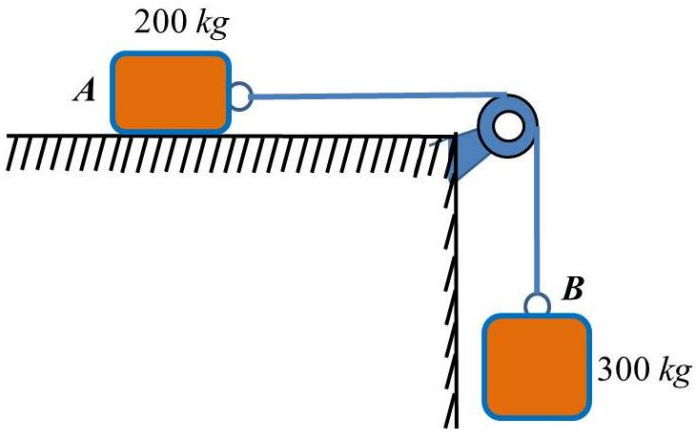

Fig. 5

Formula

$$\Sigma F_r = m(\ddot{r} - r\dot{\theta}^2)$$
$$\Sigma F_\theta = m(r\ddot{\theta} + 2\dot{r}\dot{\theta})$$

$$\mathbf{a}_B = \mathbf{a}_A + \mathbf{a}_{B/A}$$

$$v = v_0 + at$$

$$v^2 = v_0^2 + 2as$$

$$x = x_0 + v_0 t + \frac{1}{2}at^2$$

Reference: VECTOR MECHANICS FOR ENGINEERS Dynamics Ferdinand Beer et al. 9th ed.