一、計算、問答題 55 %

1. 10 %  A jet (噴射機) lands on an aircraft carrier (航空母艦) at ~216 km/h (60 m/s). What is the
displacement (滑行距離) of the plane while it is stopping, if it stops in 2 s at constant deceleration?

2. 10 %  A car (m=2000kg) operating at its maximum power can accelerate from 0 to 72 km/h in 4 s.
Find the car’s maximum power in hp (1 hp ~ 750 Watt).

3. 15%  Draw a schematic diagram of an ac generator (交流發電機), the output voltage as a function
of time, and explain how it works.

4. 20 %  In the circuit showing on the right, switch S has been open
for a long time.  a) How much energy (Joule) is stored in each of
the two capacitors C₁, C₂ (4, 6 μF)?  b) The switch is then closed at
t=0. Calculate the time constant of the discharging circuit in second.

二、選擇題 45% (請將各題題目號碼與答案標示清楚)

1. The electrical energy is purchased (購買) at a price of 2 Taiwan dollars per kilowatt hour. The cost of
cooking a Peking roast duck (烤鴨) for 2 hours in an oven that operates continuously at 20 A and 120
V.  A. 1   B. 5   C. 10   D. 30   E. 60  Taiwan dollars.

2. A metal sphere has a radius of about 9 nano-meters (9x10⁻⁹ m). If an excess electron is place on the
nano-particle, what is the work necessary to place the second excess charge onto the nano-particle?
A. +0.16  B. −0.16  C. −0.8  D. +0.8  E. −1.6  eV.

3. Now, the rest mass M₀ of the Sun is about 2x10³⁰ kg. Assuming that the average power output of
the Sun is 9x10²⁶ W. If only considering the loss by radiation, the rest mass of the Sun is reduced
by ΔM in 3 billion years (~10¹⁷ s). ΔM/M is about  A. 1/2  B. 1/20  C. 1/200  D. 1/2000  E. 1/20000.

4. A speeding empty truck travels at an initial speed v=72 km/h. It slides a distance d to a halt (停止)
after the driver slams on the brake (死剎煞車). The coefficients of friction μₕ and μₑ between rubber (橡膠) against concrete (水泥) are 1.0 and 0.8, respectively. If the wheels were
skidding (輪胎打滑), the stopping distance is about  A. 65  B. 25  C. 45  D. 15  E. 5
m.
5. A uniform rod of mass M=1 kg and length L=1 m is pivoted about one end and oscillates in a vertical plane. If the amplitude of the motion is small, the period of oscillation is about A. 0.15  B. 1.5  C. 15  D. 5  E. 0.015  seconds.

6. A uniform rod of length L and mass M is free to rotate on a frictionless pin passing through one end. The rod is released from rest in the horizontal position. What is its initial linear speed of its right end? g=10 m/s²  A. 0.1  B. 1  C. 5  D. 10  E. 15  m/s².

7. The density of dust at an altitude of 100 m is n(100), and that at the ground is n(0). We assume no wind, g=10m/s², a temperature of 300 K, and an average dust mass of 2x10⁻²³ kg. n(100)/n(0) is about A. e⁻⁵  B. e⁻³  C. e⁻¹  D. 1  E. e².

8. In braking a car, the friction (摩擦) between the brake drums (煞車鼓) and brake shoes converts the car's kinetic energy into heat. If a 1600-kg car traveling at 40 m/s brakes to a halt (停止), the maximum temperature rise in each of the four 8-kg brake drums is about A. 10  B. 20  C. 40  D. 80  E. 160 °C. (The specific heat (比熱) of each iron brake drum is 500 J/Kg·°C.)

9. The magnitude of the magnetic field on the Earth surface B₀ is about 50 μT (5x10⁻⁵ Tesla). A high voltage transmission line (超高壓輸電線) (diameter =20 mm) carries a current of 1000 A. The magnitude of the magnetic field 20 m from the axis of the wire is B. B/B₀ is about A. 500  B. 50  C. 5  D. 1  E. 1/5.  \[ \frac{\mu_0}{4\pi} = 10^{-7} \text{T} \cdot \text{m/A} \]