

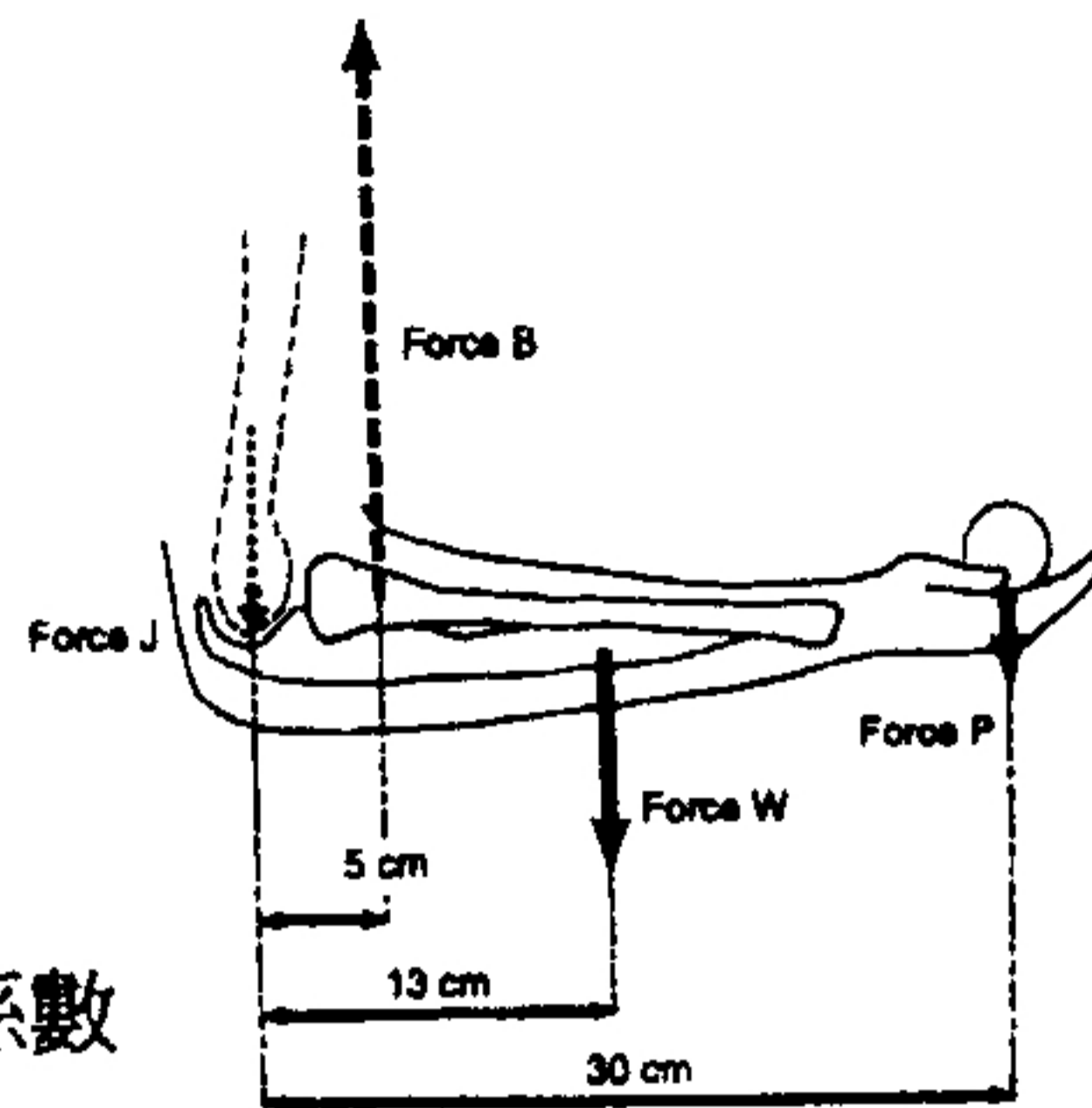
一、單選題（13分）：請就下列問題選出最適合的答案，答對每題給1分，答錯每題倒扣0.5分。請務必在答案線內標明題號。

1. If a car is moving straight forward with constant velocity 100 km/hr (kilometers per hour). How many seconds does it take to complete a journey of 5 km? (a) 30 seconds. (b) 60 seconds. (c) 120 seconds. (d) 180 seconds.
2. Similar to the above question, if the car starts with 0 velocity and accelerate (with constant acceleration  $3 \text{ m/s}^2$ ) to the velocity 30 m/s and remains at this velocity, how much time does it take to complete the journey of 6 km? (a) 180 seconds. (b) 200 seconds. (c) 210 seconds. (d) 220 seconds.
3. A free-fall body released from Taipei 101 building is subject to what forces? (a) gravitational force only. (b) air resistance only. (c) both gravitational force and air resistance. (d) none of the above.
4. Similar to the above, suppose ball A and ball B have the same size, shape, and surface roughness, but ball A is heavier than B. If the two balls are released from the top of the building at the same time, which one strikes the ground first? (a) ball A. (b) ball B. (c) both at the same time. (d) cannot be compared.
5. Because of air resistance (usually with magnitude proportional to the speed), a free-fall body will (a) reach a constant terminal velocity after a while. (b) keep increasing velocity until striking the ground. (c) keep decreasing velocity until striking the ground. (d) none of the above is correct.
6. Neglecting air resistance, a projectile with 9.8 m/s initial upward velocity released from the ground will fall back to the ground after (a) 1 second. (b) 2 seconds. (c) 3 seconds. (d) 4 seconds.
7. If a projectile's motion starts and ends at the ground, which release angle (measured from the ground) will maximize its horizontal distance? (a) 45 degrees. (b) 50 degrees. (c) 55 degrees. (d) 60 degrees.
8. Similar to the above, if a projectile's motion starts from the ground but ends at somewhere higher than the ground, the release angle which maximizes its horizontal distance will be (a) lower than (b) higher than (c) the same as (d) similar to the answer in question 7.
9. If a particle's position  $X$  can be expressed as a function of time, that is  $X(t) = 2t + \sin(t) + e^t$ , then its **acceleration** should be (a)  $2 + \cos(t) + e^t$ . (b)  $2 - \cos(t) + e^t$ . (c)  $\cos(t)$ . (d)  $-\sin(t) + e^t$ .
10. Suppose 3 particles with mass  $m_1, m_2, m_3$  and position  $x_1, x_2, x_3$ , respectively. The center of mass position of the 3-particle system is at (a)  $(x_1 + x_2 + x_3)/3$  (b)  $((x_1 + x_2 + x_3))/(m_1 + m_2 + m_3)$  (c)  $(m_1x_1 + m_2x_2 + m_3x_3)$  (d)  $(m_1x_1 + m_2x_2 + m_3x_3)/(m_1 + m_2 + m_3)$
11. Suppose air resistance is neglected. A gymnast takes off for performing somersaults (body rotations) in the air. From takeoff to the instant when the gymnast's center of mass reaches the highest point, the total linear momentum will be (a) decreased. (b) increased. (c) the same. (d) cannot be estimated.
12. Similar to the above, the angular momentum will be (a) decreased. (b) increased. (c) the same. (d) cannot be estimated.
13. In the air, if the gymnast suddenly extends her upper and lower limbs to perform a straight (lay out) somersault, the angular velocity will be (a) decreased. (b) increased. (c) the same. (d) cannot be estimated.

(背面仍有題目,請繼續作答)

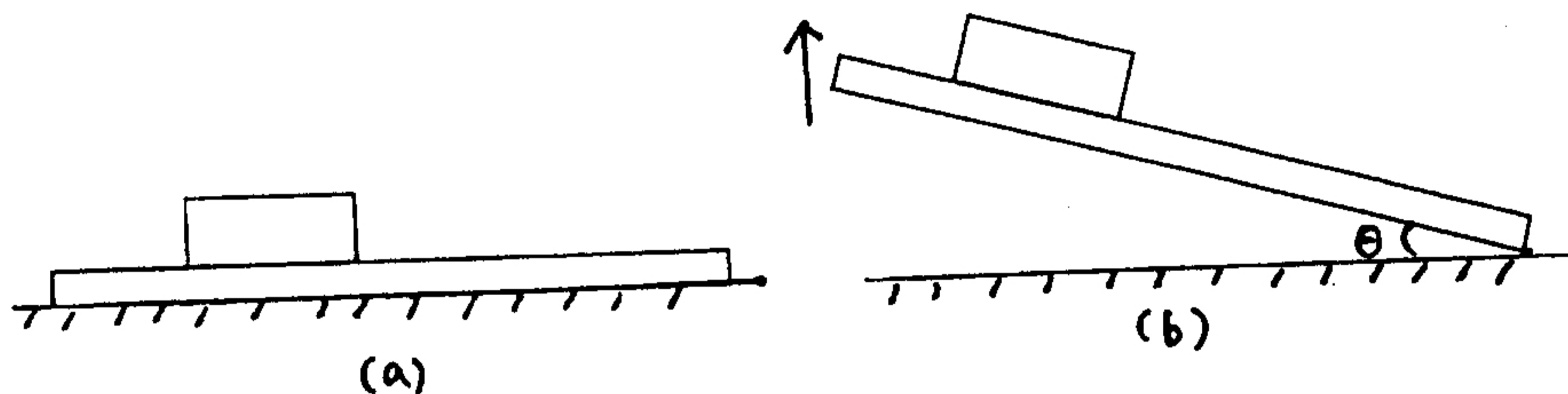
二、跨欄選手在跨欄時，選手身體四肢通常都在不同的方向以維持身體的平衡，請問是利用牛頓哪個運動定律？請詳加敘述。(15分)

三、在手肘屈曲 90 度持物體時(如右圖)，手肘重為 20 N，重物為 10 N，假設主要由肱二頭肌收縮來達成平衡穩定狀態，請問此時二頭肌收縮力量為何？(15分)



四、有一密度均勻之長方形物體(長 L，高 H，質量 M) 如圖(a)，靜止於一置放於水平面上的平板，物體與平板接觸面的靜摩擦係數 (coefficient of static friction) 為  $\mu$ ，試回答下列問題？

- (1) 此時物體與平板間的摩擦力為多少？(2分)
- (2) 如圖(b)將平板一端抬起，當  $\theta = 30^\circ$ ，物體依舊靜止於平板上，此時物體與平板間的摩擦力為多少？(4分)
- (3) 當  $\theta$  漸漸加大，若要使物體在斜面上還未滑動之前先發生翻滾，則  $\mu$  的最小值應為多少？(3分)
- (4) 承上題，當  $\theta$  大於多少時，長方形物體會在斜面上開始翻滾？(3分)



- 五、試解釋 submaximal exercise 下，ventilatory control 的機轉。(8分)
- 六、請說明 altitude training 的利與弊？其較佳之 training method 為何？(7分)
- 七、試說明運動中的 acid-base balance 是如何調控。(5分)
- 八、說明 skeletal muscle 的 age-related change。如何可改善或維持？(5分)

九、解釋名詞(20分):

- A. blood doping
- B. arterial-venous oxygen difference
- C. double-blind research design
- D. anaerobic threshold
- E. heat injury