

九十二學年度 生命科學系(所) 甲組碩士班研究生招生考試

科目 生理學 科號 0803 共 3 頁第 1 頁 *請在試卷【答案卷】內作答

1. 請根據下列圖表寫出其主要意思 並予以補充說明相關之生理意義 (10%)

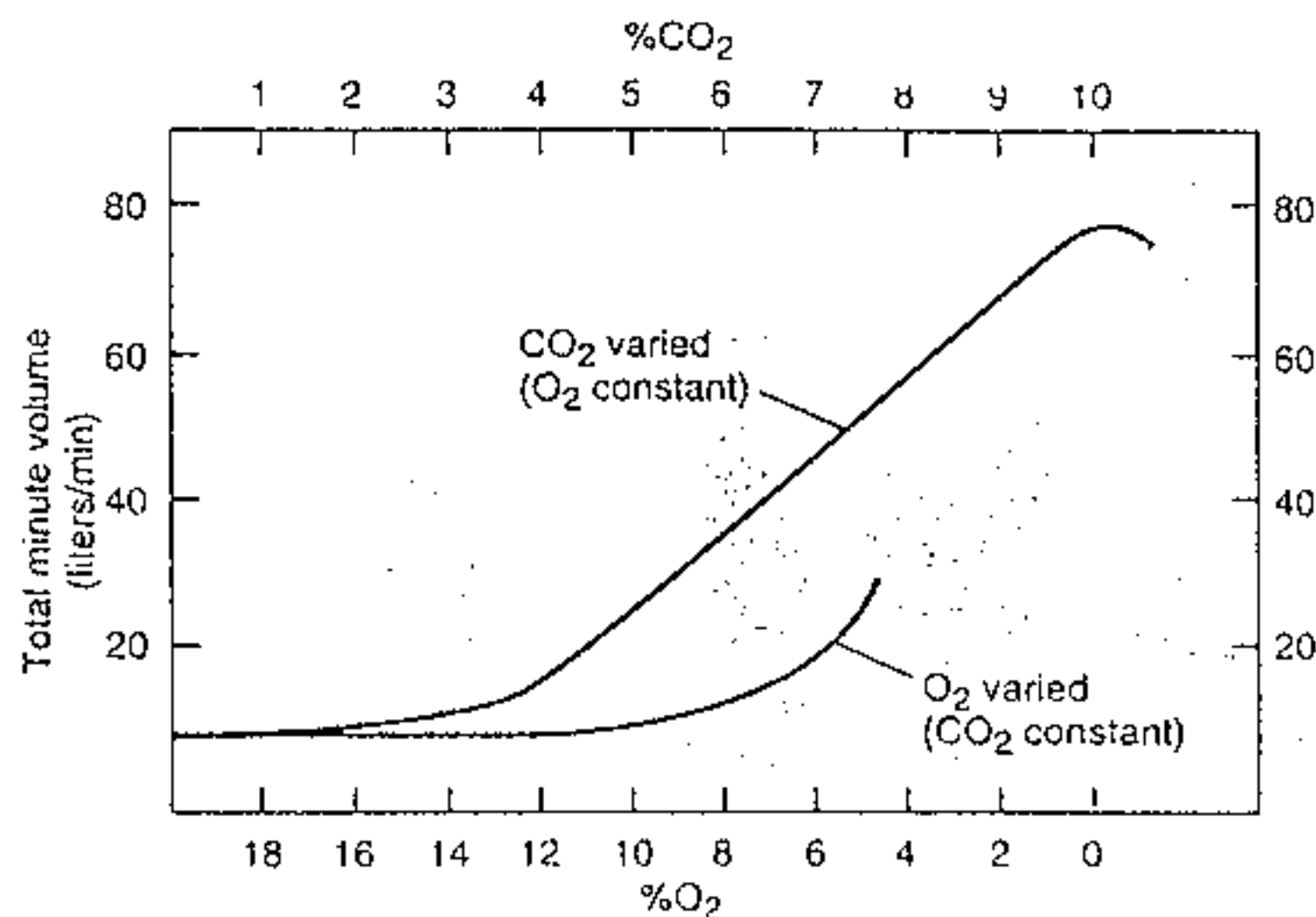


Figure Comparing the effects of blood CO_2 and O_2 on breathing. The graph depicts the effects of increasing blood concentrations of CO_2 (see the scale at the top of the graph) on breathing, as measured by the total minute volume. The effects of decreasing concentrations of blood O_2 (see the scale at the bottom of the graph) on breathing are also shown for comparison. Notice that breathing increases linearly with increasing CO_2 concentration, whereas O_2 concentrations must decrease to half the normal value before breathing is stimulated.

2. 請根據下列圖表寫出其主要意思 並予以補充說明相關之生理意義 (10%)

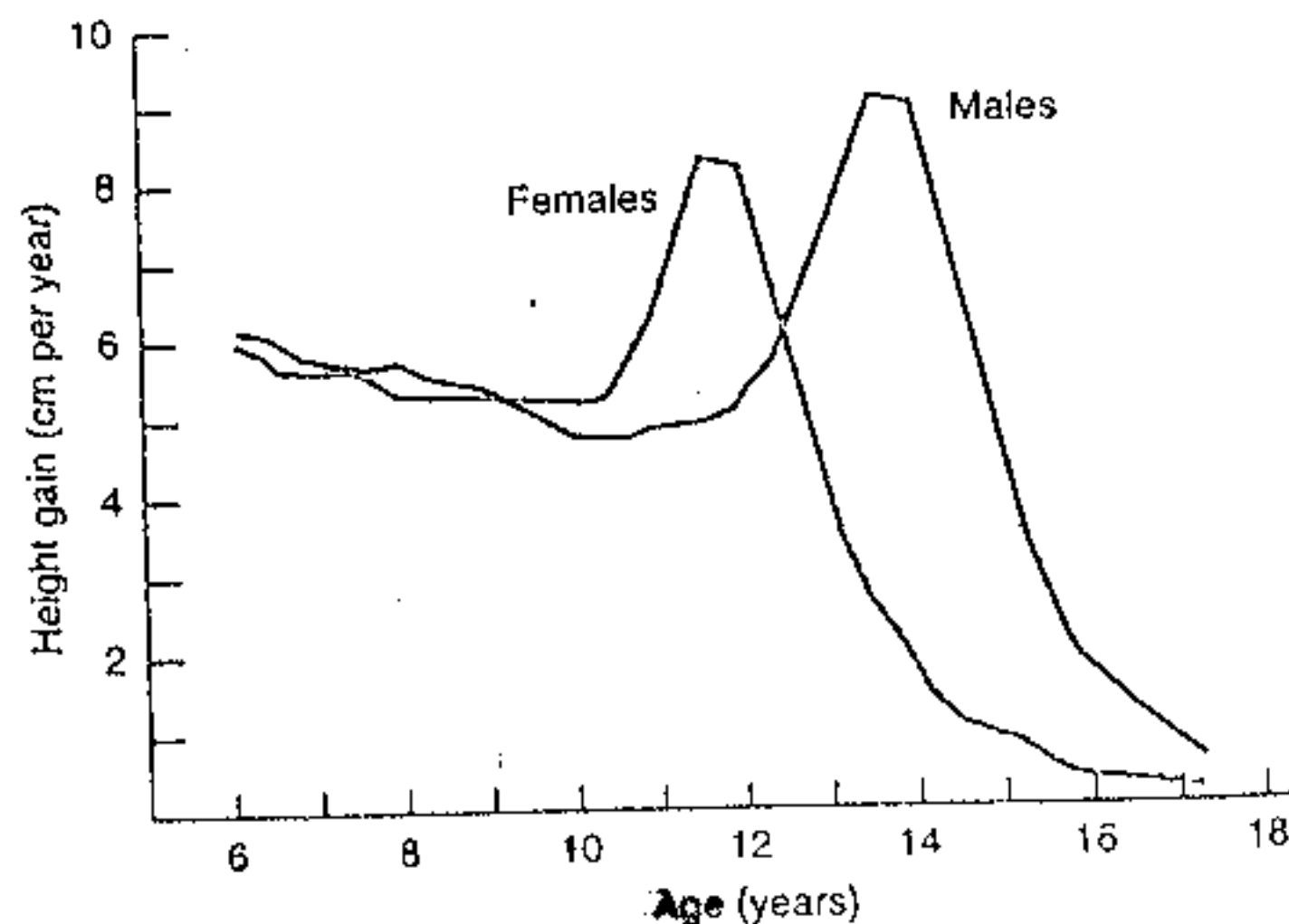


Figure Growth as a function of sex and age. Notice that the growth spurt during puberty occurs at an earlier age in females than in males.

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3. 請說明胎兒為何需要這些 hormones? 又為何需要 placenta? (10%)

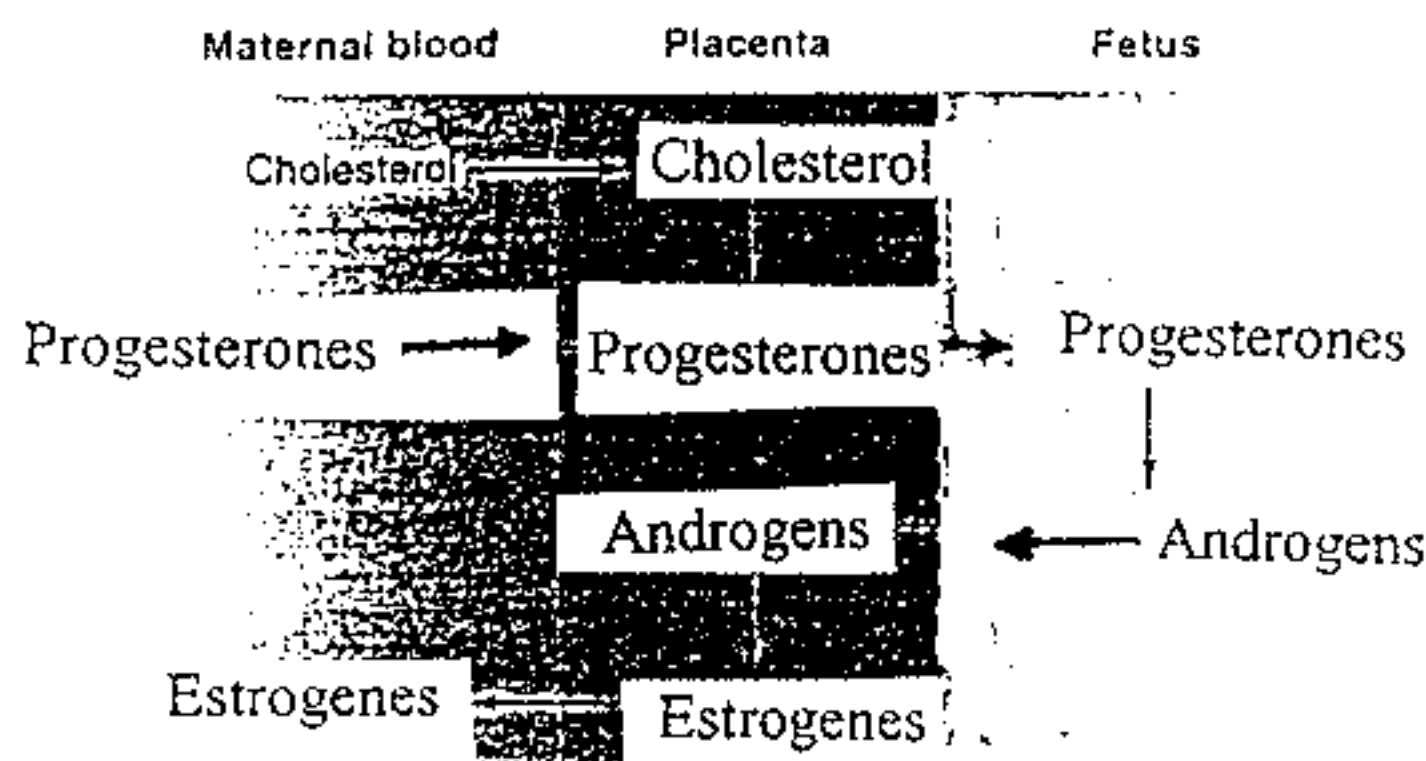


Figure Interactions between the embryo and placenta produce the steroid hormones. The secretion of progesterone and estrogen from the placenta requires a supply of cholesterol from the mother's blood and the cooperation of fetal enzymes that convert progesterone to androgens.

4. 請根據下列圖表說明高度之變化 最後如何影響呼吸 (10%)

Table Blood Gas Measurements at Different Altitudes

Altitude	Arterial P_{O_2} (mmHg)	Percent Oxyhemoglobin Saturation	Arterial (mmHg)
Sea level	90-95	96%	40
1,524 m (5,000 ft)	75-81	95%	32-33
2,286 m (7,500 ft)	69-74	92%-93%	31-33
4,572 m (15,000 ft)	48-53	86%	25
6,096 m (20,000 ft)	37-45	76%	20
7,620 m (25,000 ft)	32-39	63%	13
8,848 m (29,029 ft)	26-33	58%	9.5-13.8

5. 根據下列圖表可見 proteins 與 K^+ 有不同的 clearance rate 請解釋說明其生理意義 (10%)

Table Renal "Handling" of Different Plasma Molecules

If Substance Is:	Example	Concentration in Renal Vein	Renal Clearance Rate
Not filtered	Proteins	Same as in renal artery	Zero
Filtered, not reabsorbed or secreted	Inulin	Less than in renal artery	Equal to GFR (115-125 mL/min)
Filtered, partially reabsorbed	Urea	Less than in renal artery	Less than GFR
Filtered, completely reabsorbed	Glucose	Same as in renal artery	Zero
Filtered and secreted	PAH	Less than in renal artery; approaches zero	Greater than GFR; up to total plasma flow rate (~625 mL/min)
Filtered, reabsorbed, and secreted	K^+	Variable	Variable

國 立 清 華 大 學 命 題 紙

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6. Breathing enriched air Nitrox (32% or 36% O₂) gives a larger margin of safety than diving with compressed air. Since there is less nitrogen than "regular" air, the bottom time may be longer with less risk of decompression sickness. Please explain the underlying physiological mechanism of the Nitrox diving advantage. (10%)
7. Propagation of action potentials along an ideal conductive fiber is bidirectional. Why the propagation of action potentials in the axon is unidirectional (toward axon terminals)? (8%)
8. How does the sinus node generate the rhythmicity? (8%)
9. If you are designing an artificial heart, what are the major features you will consider? (8%)
10. Why does color vision require at least two types of cone photoreceptors? What is the advantage of trichromatic vision (using 3 types of cones) over dichromatic vision (using 2 types of cones)? (8%)
11. What is the physiological mechanism of drug addiction? (8%)