



IG.B4 Pregnancy, the Placenta and Fetal Development

EDEXCEL 4BI1 · Calculator allowed · about 40 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** Describe what is meant by implantation of the embryo in the uterus wall during early pregnancy, naming the tissue involved.

(Total for Question 1 is 2 marks)

- 2** State two functions of the placenta during pregnancy, in the context of supporting the fetus.

(Total for Question 2 is 2 marks)

- 3** Describe the key structural features of the placenta that allow exchange between maternal and fetal blood in pregnancy.

(Total for Question 3 is 2 marks)

- 4** Explain the role of the umbilical cord during pregnancy, naming the vessels it contains.

(Total for Question 4 is 2 marks)

- 5** State two functions of the amniotic fluid surrounding the fetus during pregnancy.

(Total for Question 5 is 2 marks)

- 6** Describe how the placenta acts as a selective barrier during pregnancy, giving one example of a substance that crosses and one that is largely blocked.

(Total for Question 6 is 3 marks)

- 7** Explain why alcohol consumption by the mother can harm fetal development, naming one effect on the fetus.

(Total for Question 7 is 3 marks)

- 8** State two ways in which the placenta changes to increase efficiency of exchange as pregnancy progresses.

(Total for Question 8 is 2 marks)

- 9** Describe briefly the main features of fetal growth and development during pregnancy, giving one typical change that occurs in each trimester (first, second, third).

(Total for Question 9 is 3 marks)

- 10** Explain the roles of the placenta during pregnancy. In your answer include reference to exchange of substances, protection, hormonal support and how placental structure supports these roles.

(Total for Question 10 is 6 marks)

- 11** State two ways that maternal smoking can affect the fetus during pregnancy.

(Total for Question 11 is 2 marks)

- 12** Explain how poor maternal nutrition during pregnancy may affect fetal development. Give two distinct effects and explain the biological reason for each.

(Total for Question 12 is 4 marks)

Mark scheme · IG.B4 Pregnancy, the Placenta and Fetal Development

Question 1

- **B1** embryo embeds into the lining of the uterus, named as the endometrium
- **B1** attachment forms a site where maternal tissues begin to supply nutrients and oxygen to the embryo
- **Answer: The embryo attaches and embeds into the endometrium (uterus lining), forming a site where maternal tissues begin to supply the embryo with nutrients and oxygen.**

Question 2

- **B1** exchanges nutrients and oxygen from the mother to the fetus
- **B1** removes fetal waste products, including carbon dioxide, into the maternal blood for disposal
- **Answer: Exchanges nutrients and oxygen to the fetus; removes fetal wastes and carbon dioxide into the mother's blood.**

Question 3

- **B1** many villi or projections (chorionic villi) that increase surface area
- **B1** a thin membrane or thin layer of cells between maternal blood spaces and fetal capillaries to allow diffusion
- **Answer: The placenta has many chorionic villi to increase surface area and a thin barrier between maternal blood spaces and fetal capillaries to allow rapid diffusion.**

Question 4

- **B1** transports blood and dissolved substances between the fetus and the placenta
- **B1** contains two umbilical arteries that carry deoxygenated fetal blood to the placenta and one umbilical vein that returns oxygenated blood to the fetus
- **Answer: The umbilical cord transports blood between fetus and placenta; it contains two umbilical arteries carrying fetal blood to the placenta and one umbilical vein returning oxygenated blood to the fetus.**

Question 5

- **B1** protects the fetus by cushioning against mechanical shocks
- **B1** allows the fetus to move, enabling muscle and skeletal development and helping to maintain a constant temperature
- **Answer: Cushions and protects the fetus from shocks, and allows fetal movement for development while helping to maintain a stable temperature.**

Question 6

- **B1** maternal and fetal blood are kept separate but are very close, so substances diffuse across a thin membrane
- **B1** small molecules such as oxygen, glucose and alcohol can cross the placental barrier by diffusion
- **B1** many large molecules and most pathogens are largely blocked or are limited by the placental barrier
- **Answer: Maternal and fetal blood are kept separate but close so substances diffuse across a thin membrane; small molecules like oxygen, glucose and alcohol can cross, whereas many large molecules and most pathogens are largely blocked by the placental barrier.**

Question 7

- **B1** states that alcohol crosses the placenta into fetal blood
- **B1** explains that the fetus has an immature liver and cannot metabolise alcohol effectively, so exposure persists
- **B1** gives a relevant effect, e.g. increased risk of fetal growth restriction or developmental problems such as brain damage
- **Answer: Alcohol crosses the placenta into fetal blood; the fetus cannot metabolise alcohol well so it is exposed for longer, which can lead to growth restriction and damage to developing organs such as the brain.**

Question 8

- **B1** increase in size and surface area of the placenta
- **B1** development of more extensive villi and greater fetal capillary network to shorten diffusion distance
- **Answer: The placenta grows in size, increasing surface area, and develops more extensive villi and fetal capillaries to shorten diffusion distance and improve exchange.**

Question 9

- **B1** first trimester: organ formation and early development of major body systems
- **B1** second trimester: continued growth and refinement, e.g. fetal movements felt, organs mature further
- **B1** third trimester: rapid growth in mass and fat deposition, lungs and brain mature in preparation for birth
- **Answer: First trimester: formation of major organs and body systems; second trimester: growth, further organ maturation and fetal movements; third trimester: rapid increase in size and fat, and final maturation of lungs and brain.**

Question 10

- **Level 1** (1-2): A brief answer giving one or two simple statements about a placental role, with limited or no linkage to structure or physiological effect.
- **Level 2** (3-4): A clear answer describing several roles of the placenta, with some explanation of how these roles help the fetus and at least one reference to structure supporting exchange or protection.
- **Level 3** (5-6): A detailed answer that explains multiple placental roles and links them to structural features. Includes explanation of exchange of nutrients and wastes, barrier and transfer of substances, hormonal support and how surface area, thin membranes and vascular connections support these functions.
- **Indicative content:**
 - Exchanges oxygen and nutrients from maternal blood to fetal blood and transports carbon dioxide and waste products from fetal to maternal blood for removal
 - Placental structure supports exchange: many chorionic villi give large surface area, thin barrier and rich fetal capillary network shorten diffusion distance
 - Acts as a partial barrier that limits many pathogens and large molecules while allowing small molecules and some substances such as alcohol and nicotine to cross, with potential harm to the fetus
 - Produces hormones such as progesterone and human chorionic gonadotropin that maintain pregnancy and support fetal development, and transfers maternal antibodies to provide passive immunity
 - The umbilical cord and vessels connect fetal circulation to the placenta so materials can be transported efficiently between mother and fetus

Question 11

- **B1** reduced oxygen supply to the fetus due to carbon monoxide binding to maternal haemoglobin or nicotine causing vasoconstriction
- **B1** increased risk of low birth weight or restricted fetal growth
- **Answer: Reduced oxygen supply to the fetus (carbon monoxide and nicotine effects) and increased risk of low birth weight or restricted growth.**

Question 12

- **B1** effect 1 named, e.g. low birth weight or restricted growth
- **B1** reason for effect 1, e.g. insufficient nutrients available for cell growth and tissue formation
- **B1** effect 2 named, e.g. poor development of specific organs or impaired brain development
- **B1** reason for effect 2, e.g. deficiency of specific nutrients such as folic acid affecting neural development, or lack of protein/energy limiting organ growth
- **Answer: Poor nutrition can cause low birth weight because there are insufficient nutrients and energy for normal cell growth, and can impair development of specific organs such as the brain, for example folic acid deficiency increases the risk of neural development problems.**