WJEC EDUQAS A-LEVEL BIOLOGY · COMPONENT 2

BIOLOGY



EXAM QUESTION PACK

2.3 SEXUAL REPRODUCTION IN HUMANS

SCORE	PERCENTAGE
/41	%

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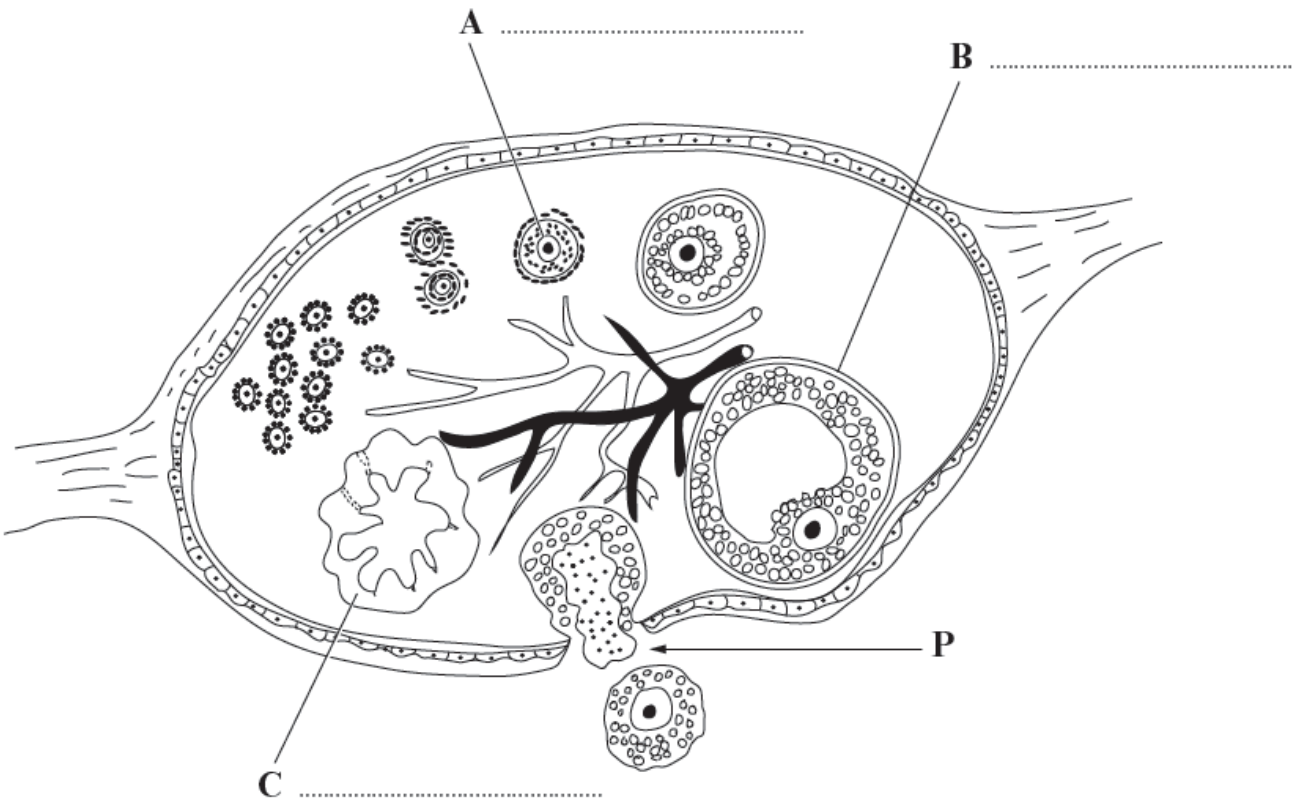
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1. The diagram below represents a section through a human ovary showing the developmental stages which lead to ovulation.



(a) (i) Label the structures **A - C** shown on the diagram above.

[3]

(ii) What process is taking place at **P**?

[1]

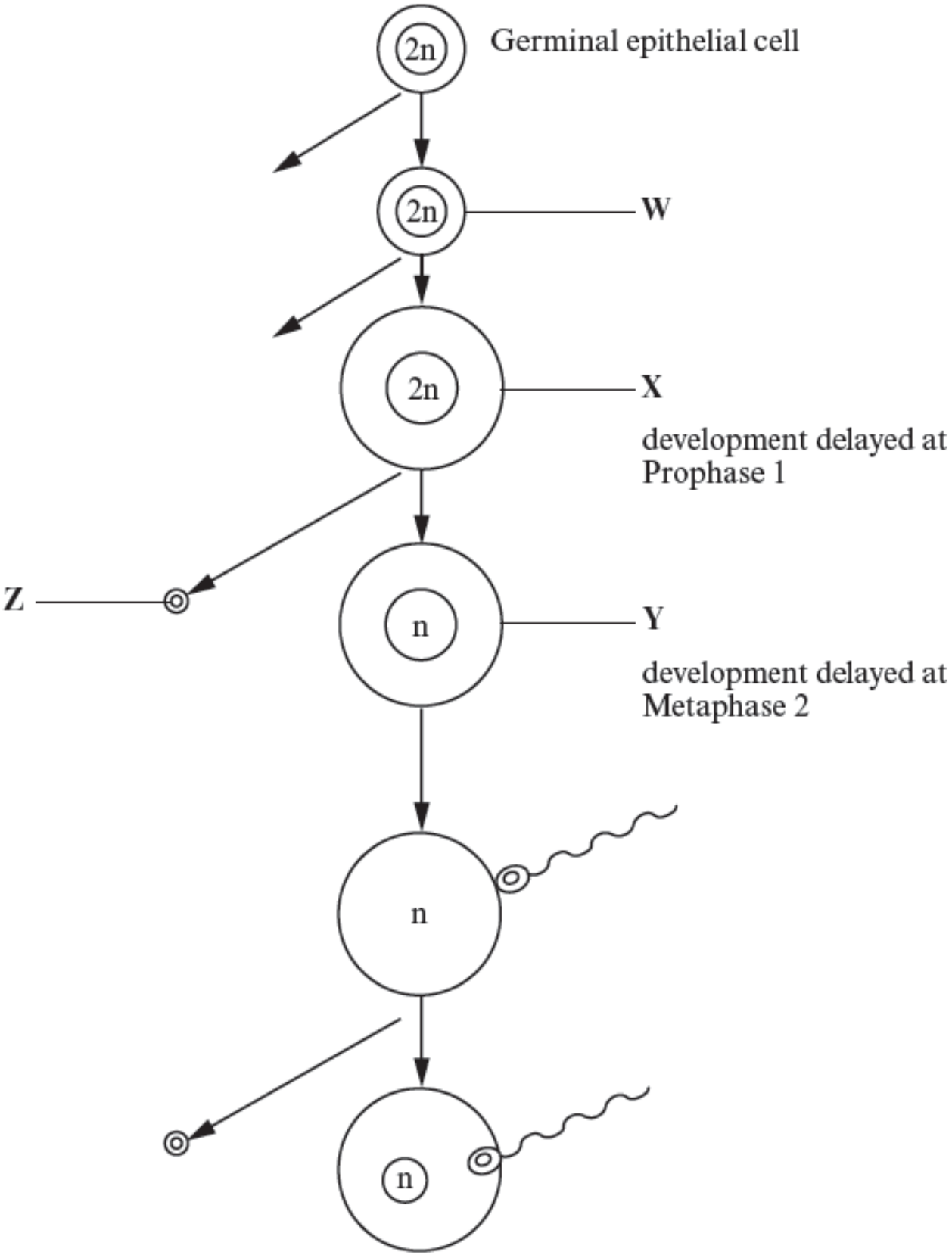
.....

(iii) Name the hormone produced by the developing embryo which prevents the breakdown of structure **C**.

[1]

.....

(b) The diagram below represents the stages of oogenesis and fertilisation.



(i) Name cells **W, X, Y and Z** shown on the diagram above.

[4]

W . . . . . .

. . . . . .

X . . . . . .

. . . . . .

Y . . . . . .

. . . . . .

Z . . . . . .

. . . . . .

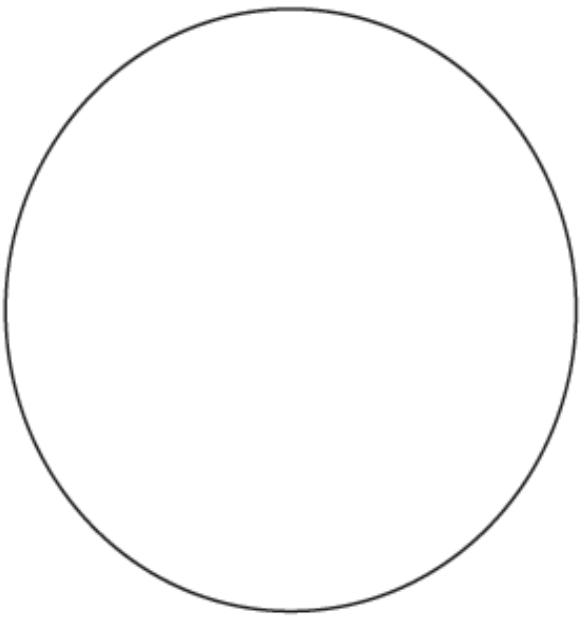
(ii) What process is involved in the production of cell **W**?

[1]

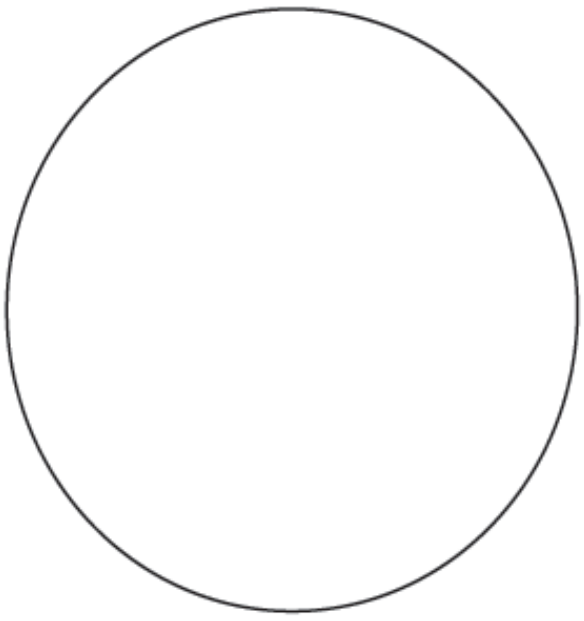
(iii) In the circles below draw diagrams showing **two pairs** of homologous chromosomes as they would appear in cell **X** on the diagram opposite (Prophase 1) and the appearance of the chromosomes following cell division to form cell **Y** on the diagram opposite (Metaphase 2).

[3]

Cell X



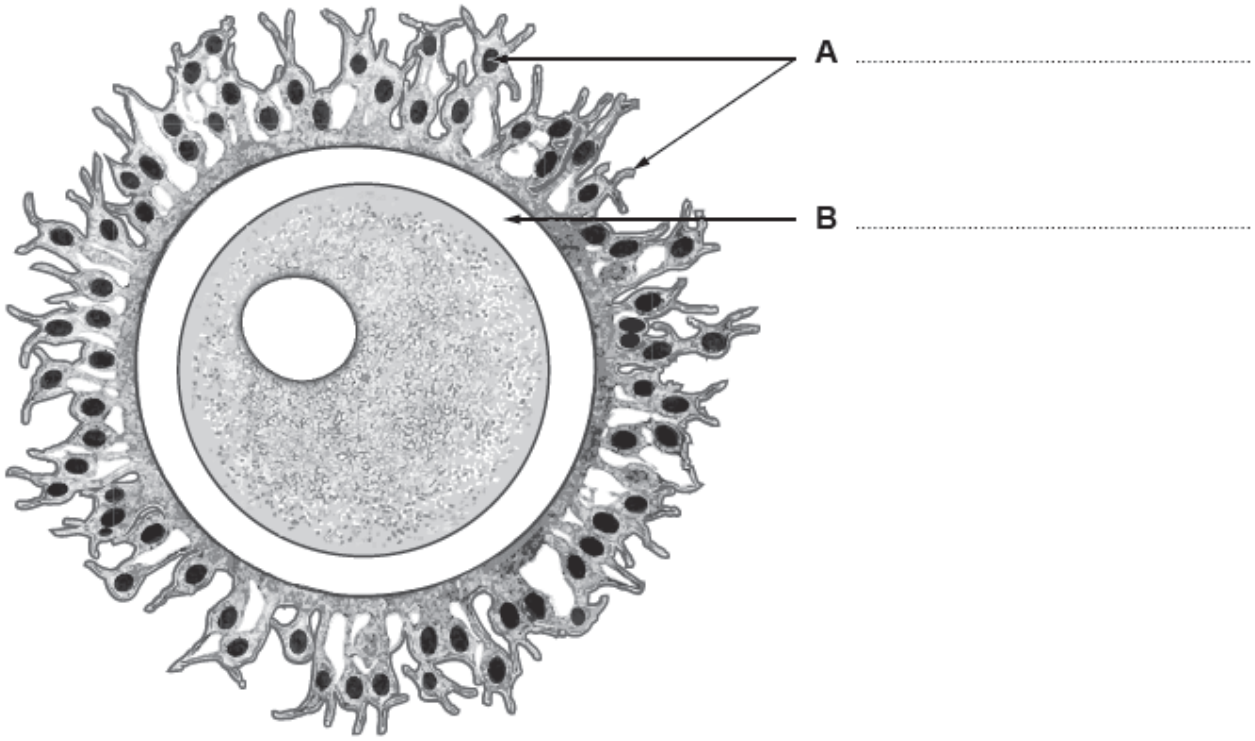
Cell Y



(c) Suggest why only one functional female gamete is produced as a result of meiosis.

[2]

2. The illustration below shows a secondary oocyte.



(a) Label parts **A** and **B**.

[2]

(b) The diagram below shows a sperm cell.



(i) Name the structure labelled **C**.

[1]

(ii) Describe the role that structure **C** plays in fertilisation of the ovum.

[2]

(c) Explain each of the following.

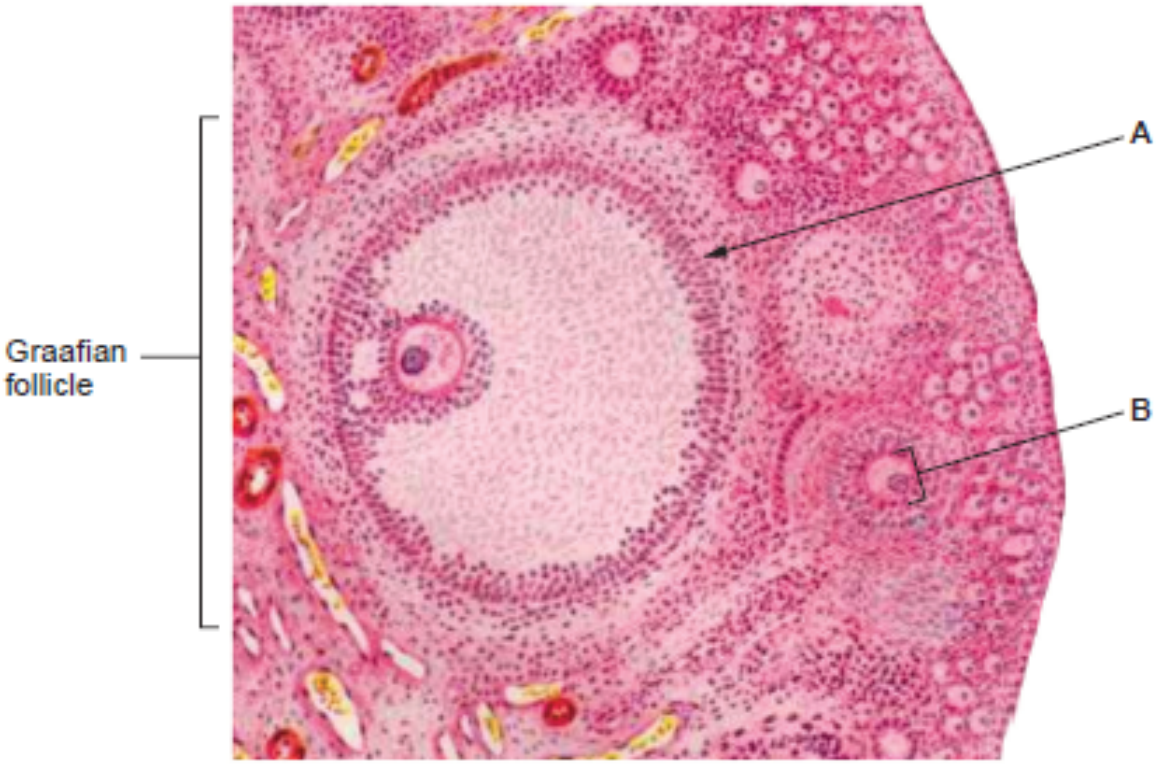
[3]

(i) cell cleavage

(ii) blastocyst

(iii) implantation

3. The photomicrograph below shows a section through part of a human ovary.



(a) (i) Name the structures A and B. [2]

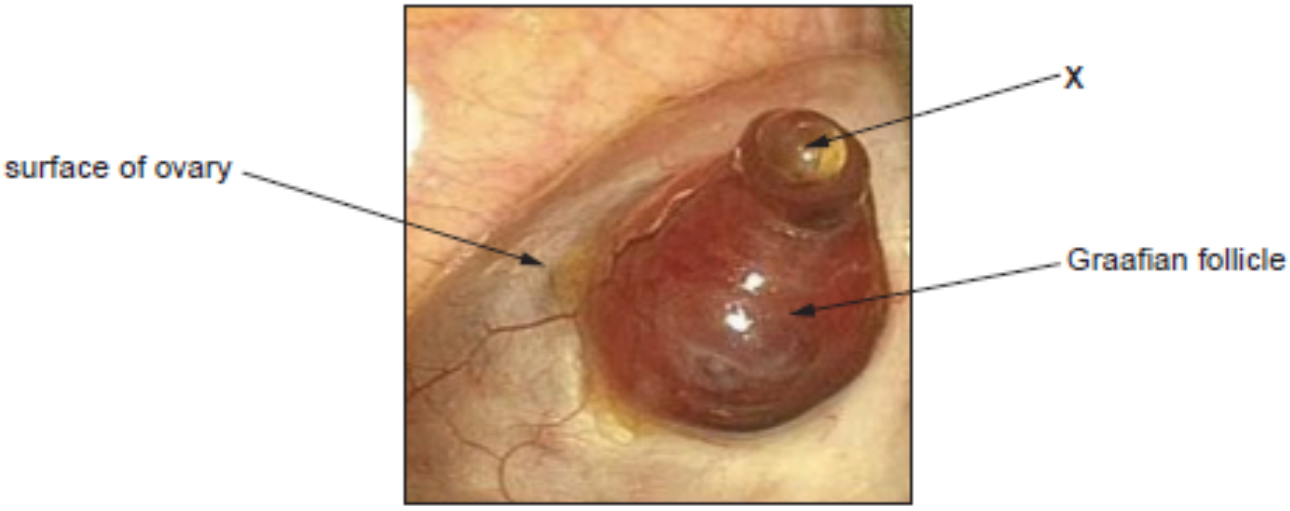
A .....

B .....

(ii) The volume of a primary follicle is $0.00005\,mm^3$ and the volume of a mature Graafian follicle is $4.19 \times 10^3\,mm^3$. By how many times is the volume of the Graafian follicle bigger than the volume of the primary follicle? Express your answer in standard form. [3]

Graafian follicle is ..... times bigger than the primary follicle

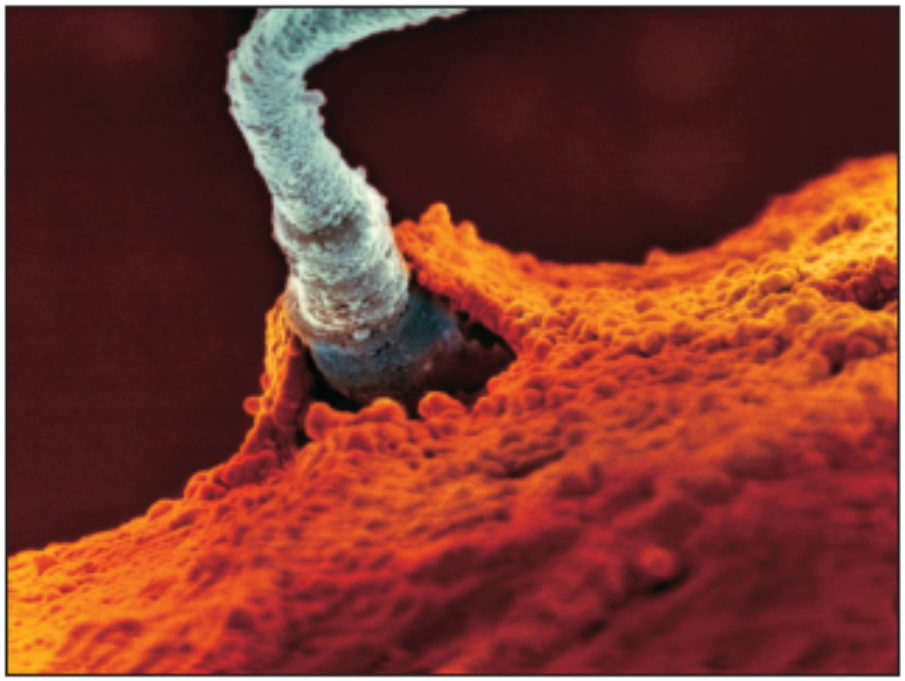
In the human female, the first half of the meiotic division takes place just before ovulation. The photograph below shows the surface of an ovary at ovulation.



(b) Structure **X** contains the secondary oocyte. Name the two outer layers of structure **X**. [1]

....

The scanning electron micrograph shows a sperm penetrating the surface of structure **X**.



(c) Describe how the sperm is able to penetrate the outer layers of this structure. [2]

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.....

(d) In vitro fertilisation (IVF) is a technique available to help people with fertility problems. During IVF, secondary oocytes are removed from a woman's ovaries and are fertilised with sperm in a laboratory.

(i) There is a risk that during fertilisation more than one sperm enters the secondary oocyte. The risk is increased if the secondary oocyte is not fully mature. There is a 6% increased chance of more than one sperm entering the secondary oocyte with IVF.

State how the secondary oocyte usually prevents the entry of more than one sperm and suggest a reason why there is an increased risk with IVF. [2]

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(ii) The developing embryo is not transferred into the uterus until three days after IVF. Using your knowledge of fertilisation and implantation explain why this delay is needed. [3]

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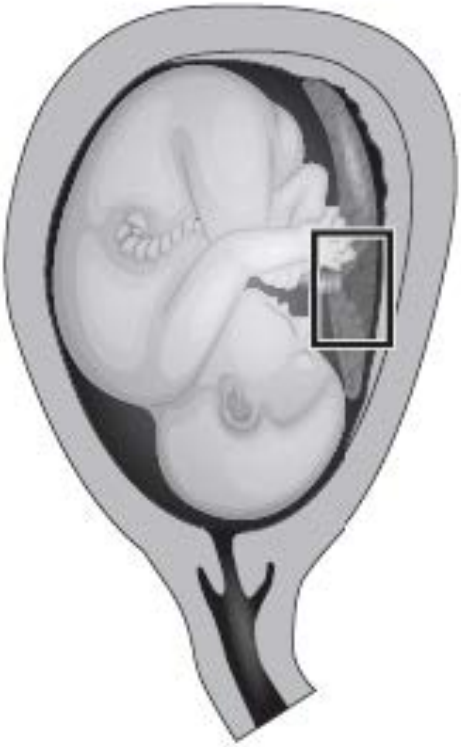
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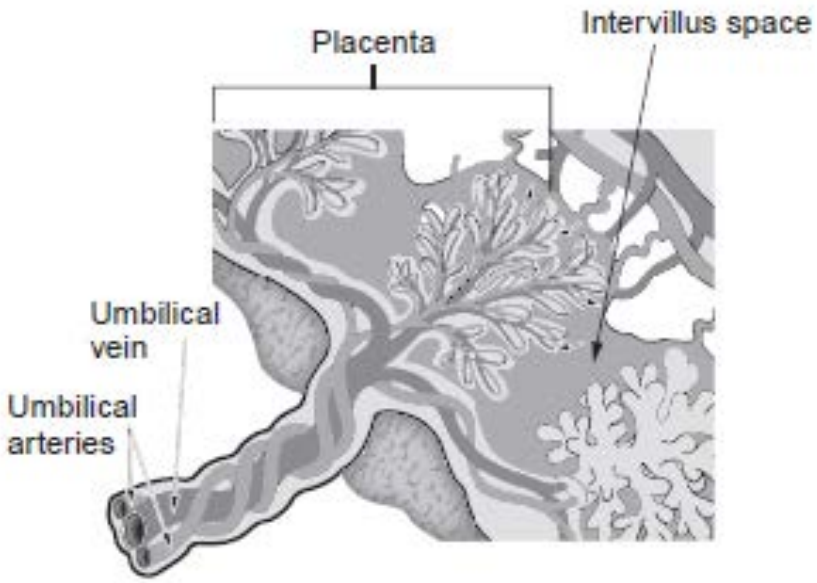
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4. The diagram below shows the structure of a human placenta.





(a) State **four** differences between the composition of the blood in the umbilical arteries and the umbilical vein. [2]

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(b) Give **two** reasons why there must be a barrier between foetal and maternal blood systems. [2]

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(c) Suggest how the following features of the placenta enable it to carry out its function.

(i) The arterial blood flow to the placenta is high (700 $cm^3 min^{-1}$) and the blood in the intervillus space is exchanged three times per minute. [1]

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(ii) The pressure in the uterine arteries is ten times greater than the pressure in the intervillus space. [1]

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(iii) The length of the capillaries in the placenta is about 320 km. [1]

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1.

Question			Marking details	Marks Available
1.	(a)	(i)	A = Primary oocyte/ Primary follicle; B = Graafian follicle; *Accept secondary follicle/ theca* C= Corpus luteum; *reject yellow body*	3
		(ii)	Ovulation;	1
		(iii)	HCG/ human chorionic gonadotrop(h)in;	1
	(b)	(i)	W = Oogonium/ oogonia; X = primary oocyte; Y = Secondary oocyte; Z = (first) Polar body; *reject nucleus accept polar cell*	4
		(ii)	Mitosis;	1
		(iii)	Correct number of chromosomes in each; X = 4 Y =2 Cell X Prophase 1 drawn correctly; chromosomes inside nuclear membrane, not on equator Cell Y Metaphase 2 drawn correctly; must be clearly on equator	3
	(c)		Polar bodies produced/ reduction in genetic material at each stage of meiosis; ecf from bi – accept polar nucleus if used in bi Functional gamete retains (most of) the cytoplasm; (Cytoplasm) acts as a focd store for zygote/ provide mitochondria for zygote; needed until implantation takes place/ obtained from placenta;	2
			Question 1 Total	**[15]**

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2.

MARK SCHEME - SUMMER 2014

Question			Marking details	Marks Available
2	(a)		A – Corona radiata / follicle (cells)/ cumulus cells/ granulosa cells; B- Zona pellucida;	2
	(b)	(i)	Acrosome;	1
		(ii)	{Releases/ contains} {enzymes/proteases/carbohydrase}; To {digest/ break down/ penetrate/ soften} {corona radiata/ zona pellucida};	2
	(c)	(i)	{Splitting/dividing} of {zygote/early embryo} cells to form new cells;	1
		(ii)	Hollow ball of cells/ ball of {undifferentiated/ partly differentiated} cells;	1
		(iii)	The {burying/ embedding/ implanting} of the {blastocyst/ embryo} into the {uterine lining/endometrium};	1
			Question 2 Total	**[8]**

3.

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		A = theca/thecal cells/follicle cells/granulosa cells (1) B = Primary oocyte/primary follicle (1) Accept primordial follicle	2			2		1
		(ii)		8.38×10^{7} = 3 marks 83800000 = 2 marks Accept any correct standard form 83.8×10^{6} = 2 marks 4190/0.00005 = 1 mark Ignore units		3		3	3	
	(b)			Zona pellucida **and** Corona radiata (1)	1			1		
	(c)			acrosome(1) releases {enzymes/named enzyme} which {hydrolyse/digest/break down} (layers)(1)	2			2		
	(d)	(i)		{ Cortical granules rupture/cortical reaction} + Zona pellucida {thickens/hardens}/fertilisation membrane forms (1) NOT corona radiata thickening (Secondary oocyte taken from graafian follicle is immature) so cannot form a fertilisation membrane/zona pellucida cannot {harden/thicken}/{fewer/less} developed cortical granules (1)	1	1		2		
		(ii)		**Any three (x1) from :** 1. Fertilisation normally in fallopian tube (1) 2. Embryo needs to reach uterus/ blastocyst to form/allow cleavage to take place(1) 3. If embryo put into uterus immediately, endometrium would not be fully developed/or description (1) 4. {Trophoblastic/chorionic villi} will not have developed (1) 5. {Embryo/blastocyst} would not {implant/survive} (1)			3	3		
				Question 3 total	**6**	**4**	**3**	**13**	**3**	**1**

4.

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			<table><tr><th>Umbilical artery</th><th>Umbilical vein</th></tr><tr><td>Less oxygen</td><td>More oxygen</td></tr><tr><td>More CO_2</td><td>Less CO_2</td></tr><tr><td>More urea</td><td>Less urea</td></tr><tr><td>Less nutrients/named</td><td>More nutrients/named</td></tr><tr><td>Less antibodies</td><td>More antibodies</td></tr></table> Ignore ref to water 4 correct for 2 marks 2/3 correct for 1 mark 0/1 = 0 marks	2			2		
	(b)			**Any two (x1) from:** (Barrier) {against hormones/toxic substances/microorganisms/cells/mothers rhesus group/mothers antigens } (1) Protection against differences in pressure (1) Protection against mother's {immune system/antibodies} (1)	2			2		
	(c)	(i)		Maintain {concentration/diffusion} gradients/prevents equilibrium being reached(1)		1		1		
		(ii)		(Pressure difference) forces materials through (capillaries) (1)		1		1		
		(iii)		Large (surface) area for exchange.(1)		1		1		
				Question 4 total	**4**	**3**	**0**	**7**	**0**	**0**