Name	Date started	Target end date

GCE A LEVEL — BIOLOGY UNIT 4 QUESTION PACK

1075 (Legacy BY5) · New spec Unit 4 Topic 1 · A2 unit, first sat 2017, 90 marks, 2h paper

REVISE
.wales

BIOLOGY — UNIT 4 · HUMAN REPRODUCTION — SYSTEMS, GAMETOGENESIS, FERTILISATION & EMBRYO

4.1 Sexual reproduction in humans — the reproductive systems, gametogenesis, fertilisation and embryo development

Structure of the male and female reproductive systems, spermatogenesis and oogenesis in the gonads, the menstrual cycle and its hormonal control, the events of fertilisation and the early development of the embryo, and the role of the placenta in nourishing the foetus.

LEGACY 2008 SPECIFICATION

Estimated time for entire question pack: ~2 h 5 min

Derived from the legacy BY5 papers' pace of ~1.6 min/mark, padded for long-prose answers (78 marks over 8 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains every question from the legacy WJEC BY5 papers (2008 modular spec, 2011–2017) that maps onto new-spec A2 Unit 4 Topic 1 (4.1).

Questions are ordered by source paper date.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — quality of written communication will affect marks. A calculator is allowed. Diagrams included in answers must be fully annotated.

For Examiner's use only

Q	Source	Max	Mark
1	BY5 Jun 11 Q7	6	
2	BY5 Jun 12 Q2	8	
3	BY5 Jun 13 Q1	8	
4	BY5 Jun 13 Q4	15	

Q	Source	Max	Mark
5	BY5 Jun 14 Q1	8	
6	BY5 Jun 15 Q3	12	
7	BY5 Jun 16 Q2	10	
8	BY5 Jun 17 Q4	11	
Total		**78**	

Human Reproduction — Systems, Gametogenesis, Fertilisation & Embryo — what the new spec asks

WJEC GCE A Level Biology (from 2015) · Unit 4: Variation, Inheritance & Options · Topic 4.1.

Male reproductive system

- Testes (seminiferous tubules + Leydig cells) produce sperm and testosterone.
- Sperm matures in the epididymis; vas deferens to the urethra.
- Accessory glands (seminal vesicle, prostate) provide seminal fluid.

Female reproductive system

- Ovaries house primary follicles; release secondary oocytes at ovulation.
- Fallopian tube site of fertilisation; uterus implants the blastocyst.
- Cervix and vagina form the birth canal.

Spermatogenesis

- Germinal epithelium → spermatogonia → primary → secondary spermatocytes.
- Meiosis I and II yield haploid spermatids; FSH and LH driven.
- Sertoli cells nourish; spermiogenesis adds flagellum & acrosome.

Oogenesis

- Oogonia → primary oocytes arrested at prophase I before birth.
- Each cycle, one primary oocyte completes meiosis I → secondary oocyte.
- Meiosis II only completes if fertilised; polar bodies degenerate.

Menstrual cycle

- FSH stimulates follicle growth; oestrogen builds endometrium.
- LH surge at ~day 14 triggers ovulation.
- Corpus luteum secretes progesterone; falls if no fertilisation.

Fertilisation & embryo

- Acrosome reaction releases hydrolytic enzymes to penetrate zona pellucida.
- Cortical reaction prevents polyspermy; zygote begins cleavage.
- Blastocyst implants ~6 days; placenta forms from trophoblast + endometrium.

Crib sheet »

Human Reproduction — Systems, Gametogenesis, Fertilisation & Embryo in one page

Quick-reference notes — revisit before each question.

Male tract

Testes (seminiferous tubules) → epididymis → vas deferens → urethra.

Leydig cells secrete testosterone (LH-driven).

Sertoli cells support spermatogenesis (FSH-driven).

Female tract

Ovary → fallopian tube (fertilisation) → uterus (implant) → cervix → vagina.

~400 follicles ovulate in a lifetime.

Spermatogenesis

Spermatogonia → primary → secondary spermatocyte → spermatid → sperm.

Meiosis I + II inside seminiferous tubule walls.

Acrosome from Golgi; flagellum from centriole.

Oogenesis

Oogonia all formed before birth, arrested at prophase I.

Each cycle: 1 primary oocyte completes meiosis I → 2° oocyte + polar body.

Meiosis II finishes only at fertilisation.

Menstrual cycle

FSH builds follicle; oestrogen builds endometrium.

LH surge → ovulation ~day 14.

Progesterone (corpus luteum) maintains lining; falls → menses.

Fertilisation

Acrosome reaction releases enzymes → penetrates zona pellucida.

Cortical reaction — blocks polyspermy.

Pronuclei fuse → diploid zygote.

Embryo & placenta

Cleavage → morula → blastocyst.

Implants in endometrium ~day 6.

Placenta exchanges O_2, nutrients, wastes; secretes hCG.

Hormones summary

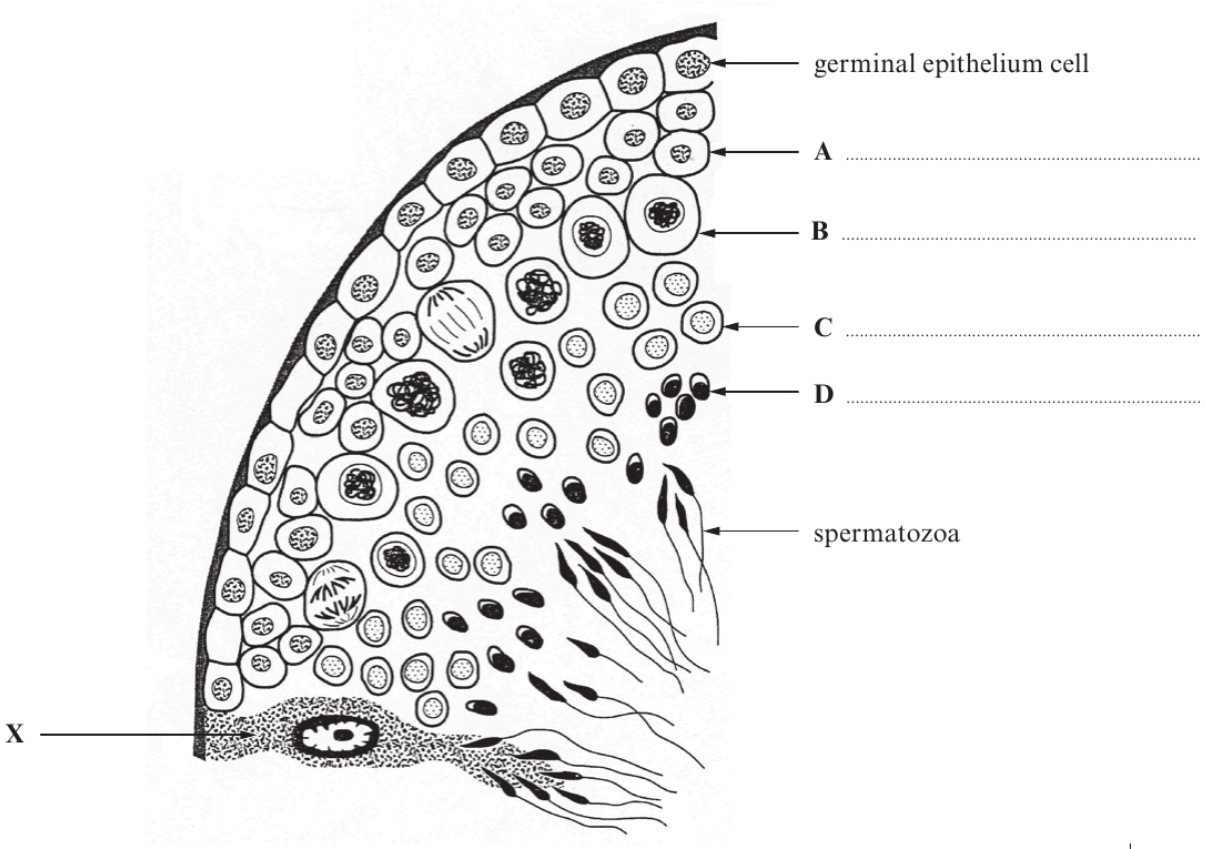
FSH & LH from anterior pituitary.

Oestrogen + progesterone feedback on hypothalamus.

hCG sustains corpus luteum in early pregnancy.

Examiner only

7. The drawing below shows a cross section through a seminiferous tubule.



(a) (i) On the diagram, label cells **A-D**. [2]

(ii) Name the cell labelled **X** in the diagram. [1]

.....

(iii) What is the function of the cell labelled **X**? [1]

.....

.....

(b) (i) State the type of cell division involved in the production of cell **A**. [1]

.....

(ii) Explain why there are more spermatozoa than cell type **A** in the tubule. [1]

.....

.....

(Total 6 marks)

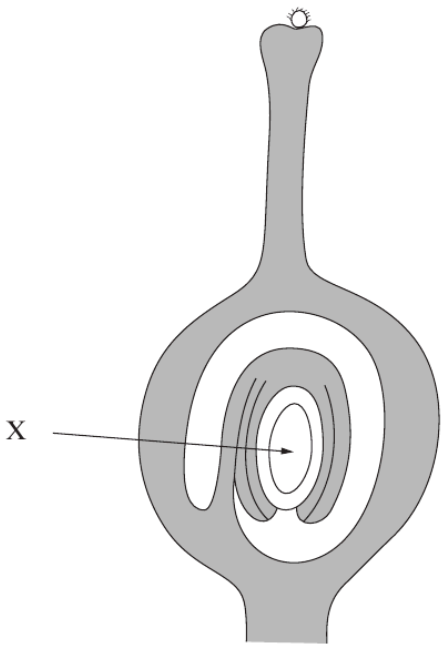
Examiner only

2. *(a)* Most flowering plants are adapted for pollination by wind or insects.
Define the term pollination. [1]

.....

.....

(b) After pollination a pollen tube grows through the carpel of a flower.
The diagram shows a longitudinal section through a carpel with a pollen grain on the stigma.



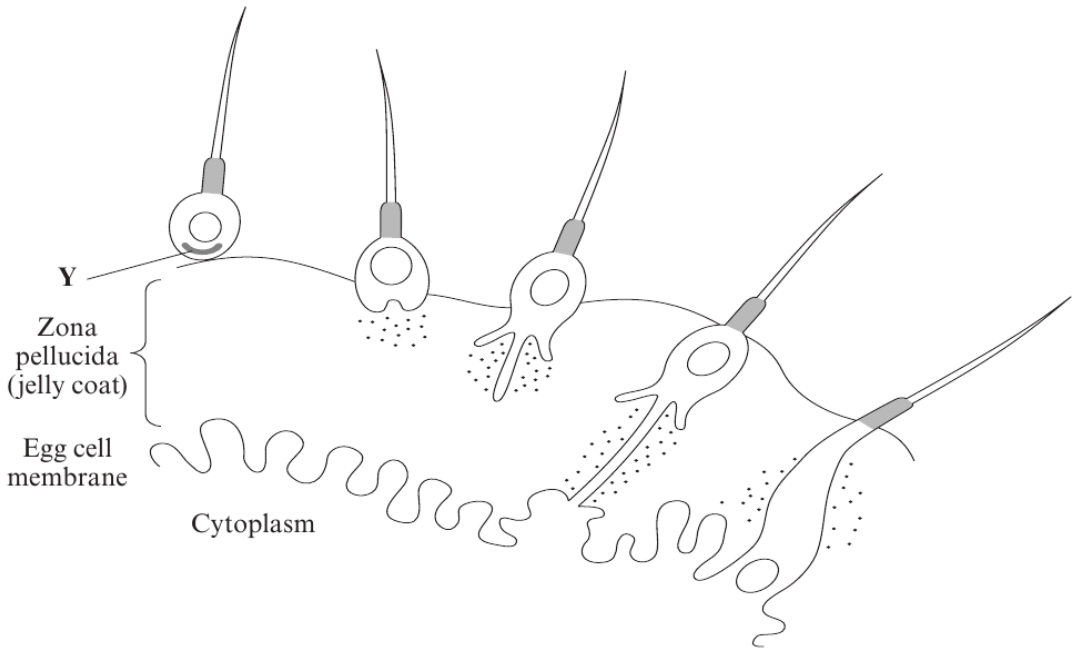
(i) Name the structure **X** shown in the diagram. [1]

.....

(ii) Draw a line **on the diagram** to indicate the route of growth of a pollen tube through the carpel to structure **X**. [1]

Examiner only

(c) The diagram below shows the sequence of events which take place when the nucleus of an animal sperm enters the cytoplasm of the egg.



(i) Name the part of the reproductive tract in which these events take place. [1]

.....

(ii) Use the information in the diagram to explain the role of **Y** in the process. [2]

.....

.....

.....

(d) State **two** similarities between the process visible in the diagram in part *(c)* and the process by which the male nucleus enters a plant ovule. [2]

1. .....

.....

2. .....

.....

(Total 8 marks)

Examiner only

1. Distinguish between the following pairs of biological terms.

(a) seminiferous tubule and seminal vesicle; [2]

(b) DNA ligase and DNA polymerase; [2]

(c) gene and allele; [2]

(d) primary succession and secondary succession. [2]

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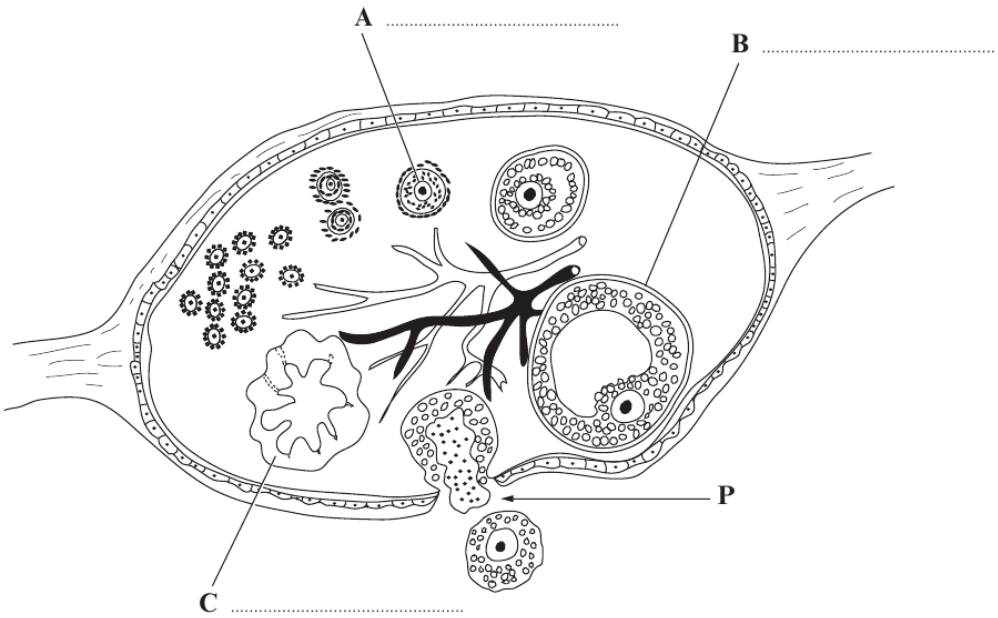
Examiner only

4. 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]

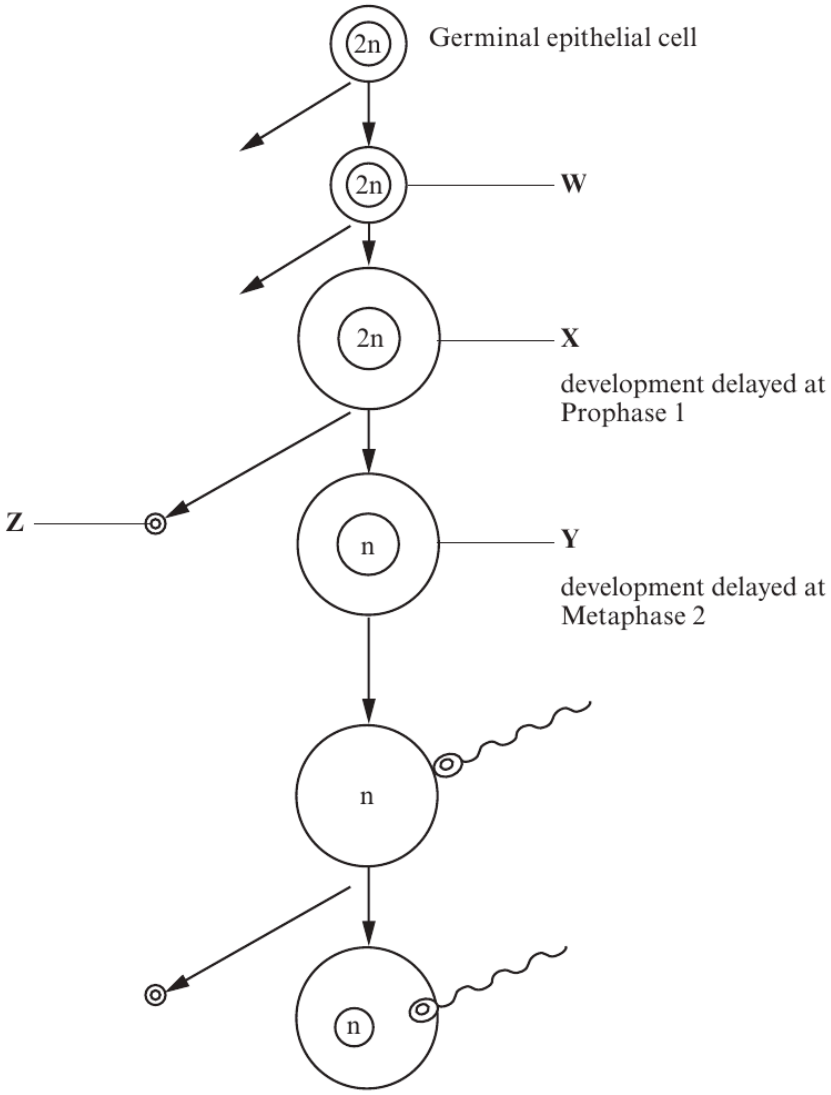
.....

(iii) Name the hormone produced by the developing embryo which prevents the breakdown of structure **C**. [1]

.....

Examiner only

(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 .....

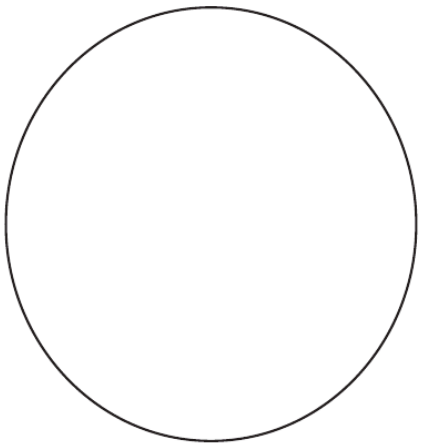
(ii) What process is involved in the production of cell **W**? [1]

.....

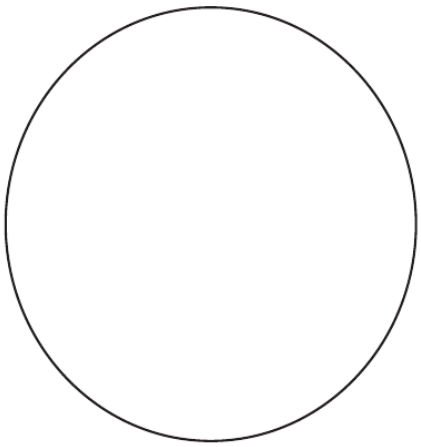
Examiner only

(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]

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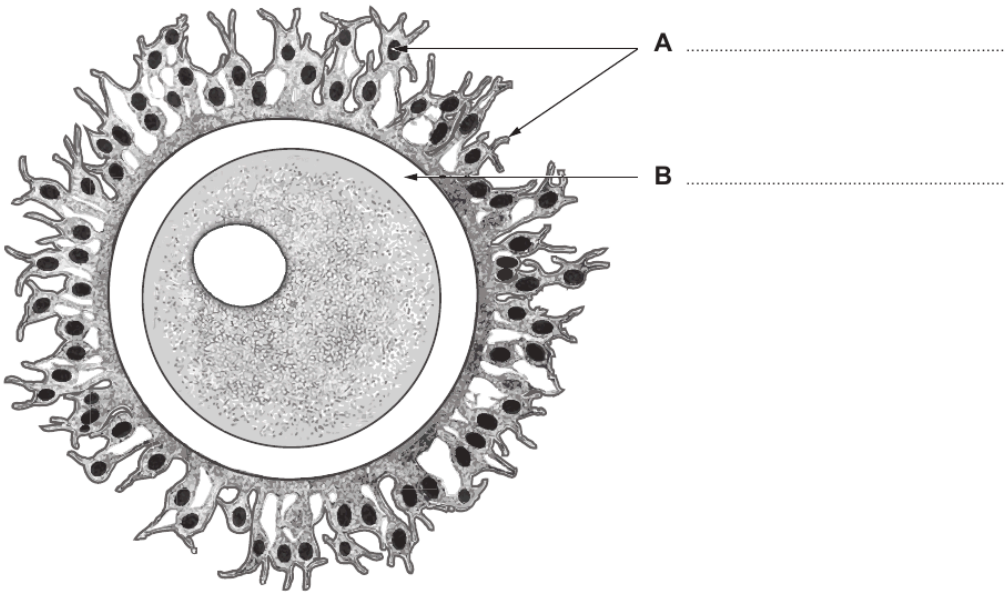
Examiner only

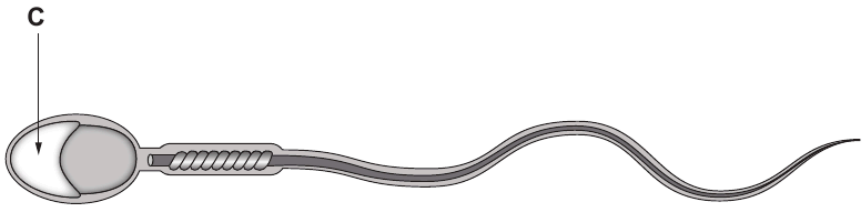
Answer **all** *questions.*

1. 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]

Examiner only

(c) Explain each of the following. [3]

(i) cell cleavage

.....

.....

.....

(ii) blastocyst

.....

.....

.....

(iii) implantation

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.....

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Examiner only

3. *(a)* Meiosis is a type of cell division.

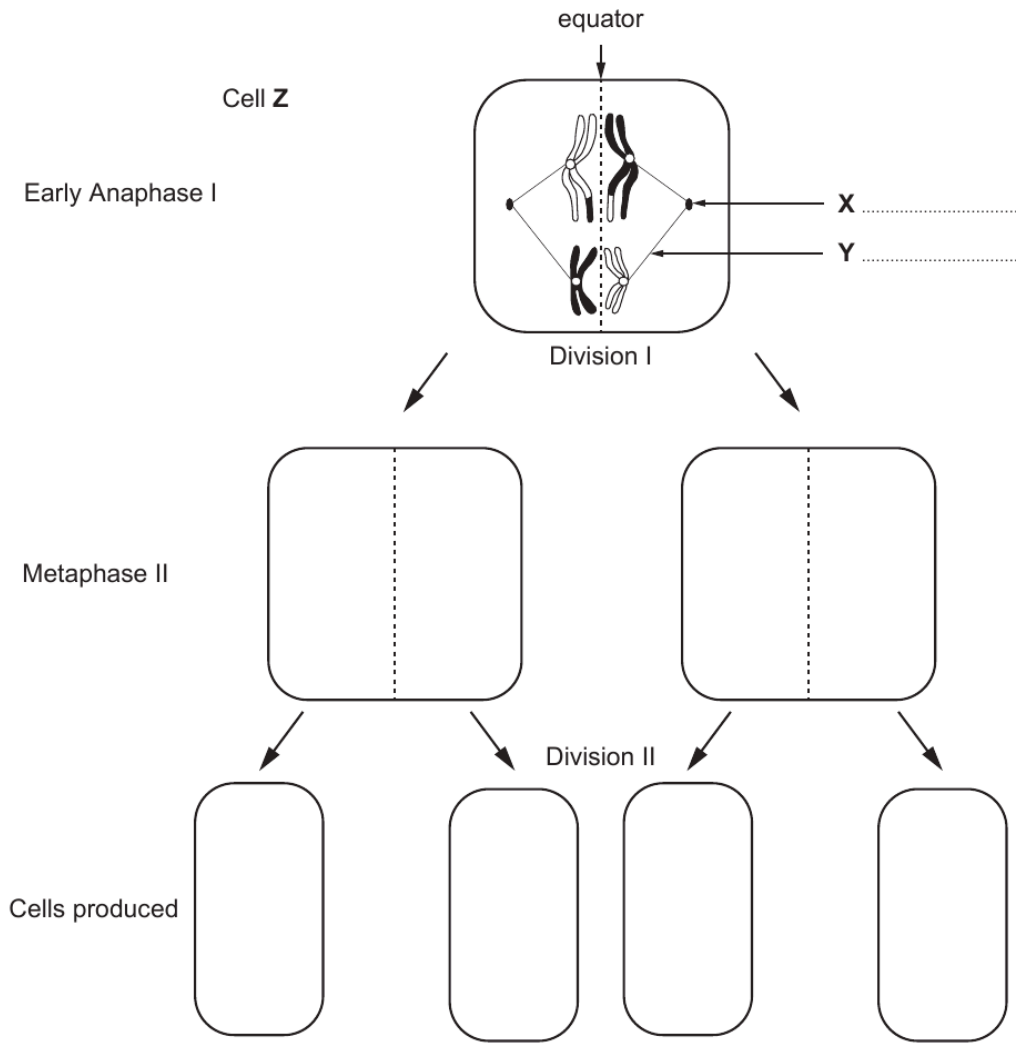
(i) State the purpose of meiosis. [1]

.....

(ii) Name the organs in animals where meiosis occurs. [1]

.....

(b) The diagram below represents meiosis in a cell with two pairs of chromosomes.



(i) Label parts **X** and **Y**. [1]

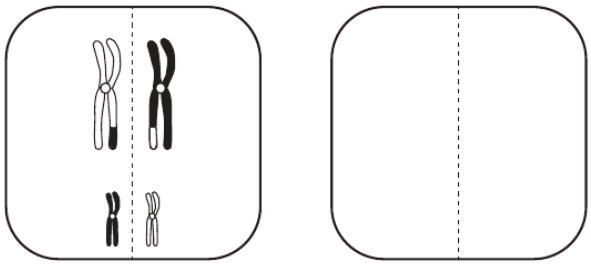
(ii) Draw chromosomes in the cell outlines for: [4]

I. metaphase II

II. the cells produced

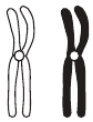
Examiner only

(c) The drawing of cell **W** below is an outline of another cell from the same individual as cell **Z**. Complete the drawing of cell **W** to show how **independent assortment** could produce an alternative outcome. [1]



Cell **Z** Cell **W**

(d) The drawing below shows the two larger chromosomes from cell **Z** at a different stage of meiosis.



(i) Name the stage of meiosis. [1]

.....

(ii) Explain with the aid of diagrams how the larger chromosomes in cell **Z** took on the appearance shown in part *(c)*. [2]

(iii) Name the process shown in your drawings. [1]

.....

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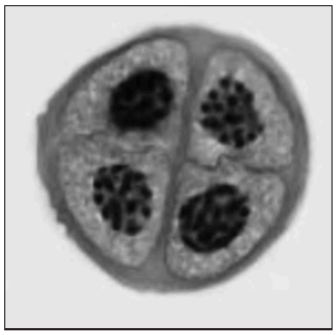
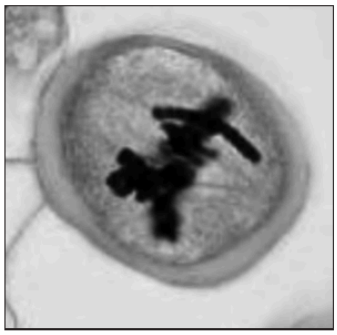
Examiner only

2. The photomicrographs show some stages of cell division in a flower of a lily, *Lilium candidum*.

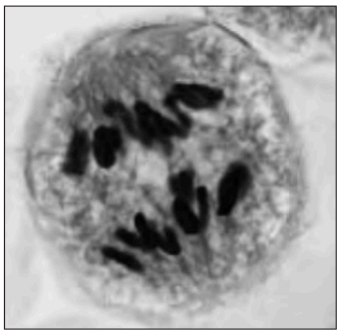
A



B

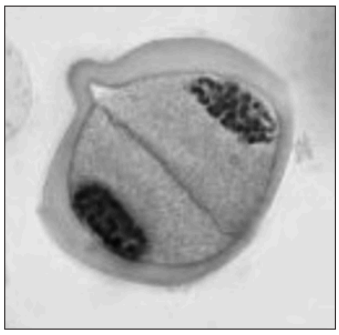


C



D

E



F

(a) (i) Identify the type of cell division shown. [1]

.....

(ii) State a part of the flower that could have been used to produce the photomicrographs. [1]

.....

(iii) Write the letters in the order the stages would occur (the first one has been done for you). [2]

1 **E** 2 ..... 3 ..... 4 ..... 5 ..... 6 .....

(iv) Use photomicrograph **E** to find the haploid number of *Lilium candidum*. [1]

Haploid number .....

(b) (i) Name the stages shown in the following photomicrographs. [1]

A ..... **C** .....

Examiner only

(ii) Use your knowledge of cell division to describe **two** differences between the arrangement of chromosomes in stages **A** and **C**. [2]

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.....

.....

(c) Name **two** processes occurring during this type of cell division which help to ensure genetic variation in the offspring. [2]

.....

.....

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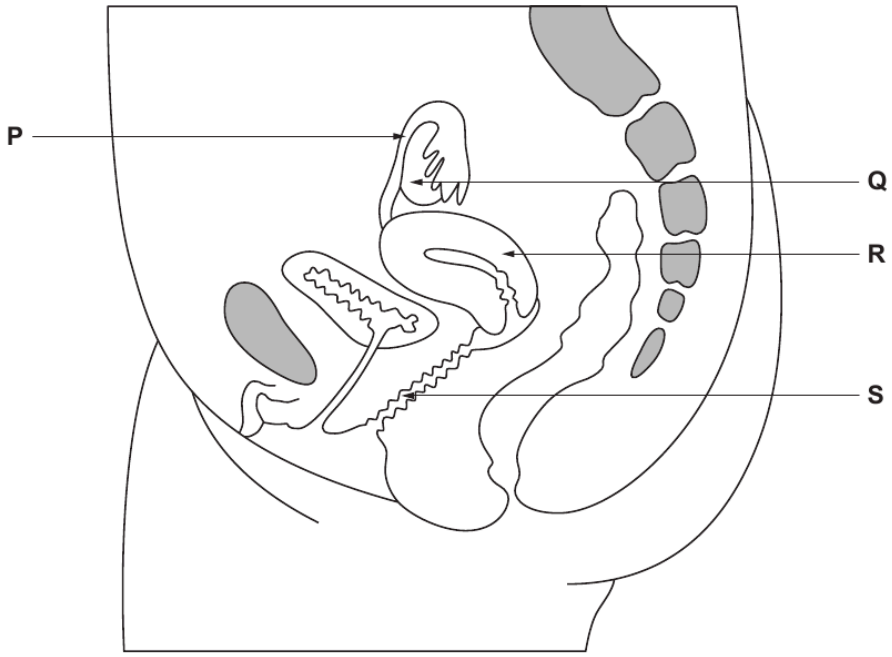
Examiner only

4. The illustration below shows the reproductive system of a human female:



(a) Name the parts labelled; [2]

P .....

Q .....

R .....

S .....

(b) (i) Name and describe the key event which occurs on day 14 of the menstrual cycle. [2]

.....

.....

Examiner only

(ii) Explain why it is important that events in **Q** and **R** are coordinated. [3]

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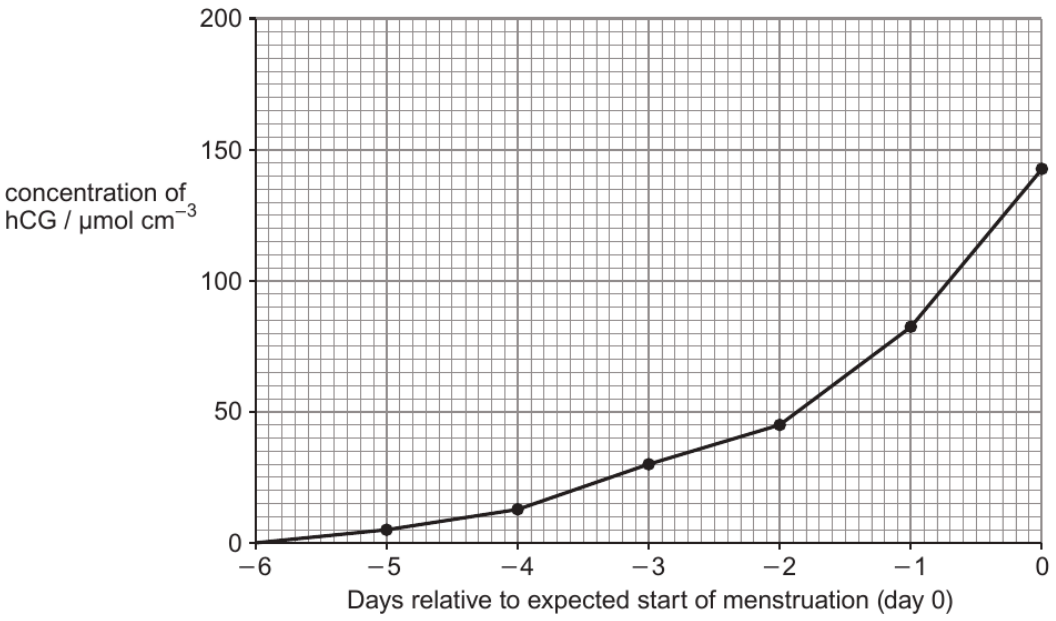
Pregnancy testing kits contain monoclonal antibodies bound to coloured beads. The test involves the reaction between the antibodies and the hormone, human chorionic gonadotrophin (hCG), in urine.

The graph below shows a typical rise in urinary level of hCG from the first detection of pregnancy.



Most manufacturers recommend that the test is taken after the expected start of menstruation.

(c) (i) One manufacturer claims that their product is sensitive enough to be used as many as four days before menstruation is due.
Use the graph to determine the lowest concentration of hCG that this product can detect. [1]

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(ii) Some research indicates that the levels of hCG naturally increase with age in some women. How might this affect the result of a pregnancy test? [1]

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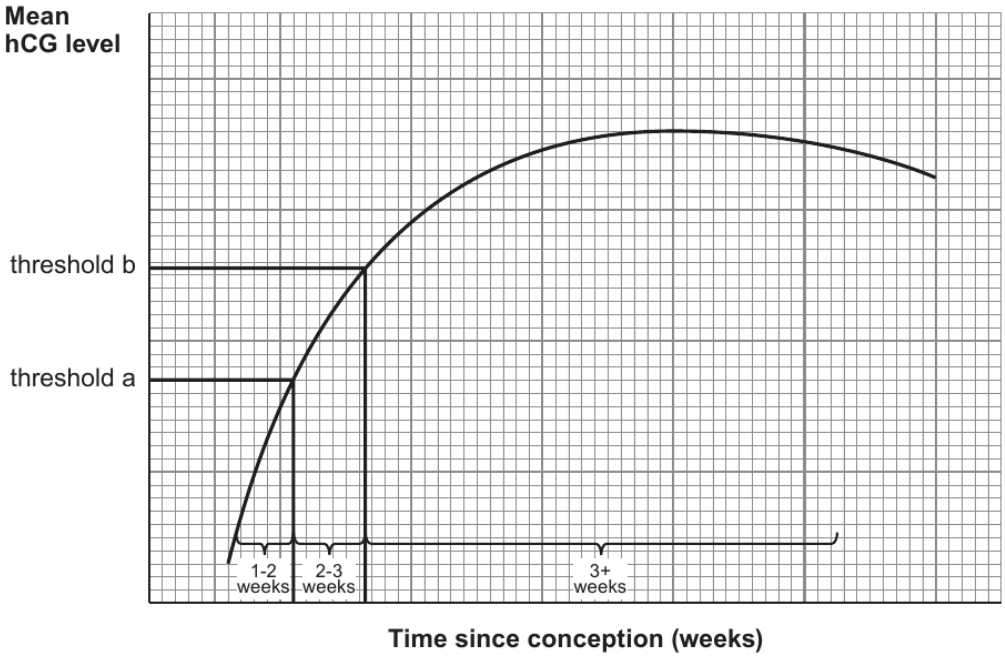
Examiner only

Levels of hCG may be used to estimate the time since conception. Thresholds for the urinary hCG hormone can be used to determine time since conception in categories: 1-2 weeks, 2-3 weeks and 3+ weeks since conception, as shown in the graph below.



(iii) Use this information to explain how the product might be used to give a value for time since conception. [2]

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END OF QUESTION PACK

8 questions · 78 marks · ~2 h 5 min
Source: WJEC BY5 (2008 modular spec, 2011–2017)
Curated for WJEC Biology 2015 spec A2 Unit 4 — Topic 1 (4.1)