

# Organisms (Continuity and change) practice questions

15 questions · 53 marks · mark scheme at the back

For IB Diploma Biology SL undefined. **HL only** is additional higher level content, for HL students only.

Name .....

Total ..... / 53

## Reproduction **Spec D3.1**

**1** PAPER 1A STYLE**[1 mark]**

Which statement describes an advantage of asexual reproduction compared with sexual reproduction?

- A. ☐ It produces offspring with new combinations of alleles.
- B. ☐ It produces offspring that are well adapted if the environment changes.
- C. ☐ It produces genetically identical offspring of a parent adapted to an existing environment.
- D. ☐ It increases genetic variation within a population.

**2 PAPER 1B STYLE****[5 marks]**

The table shows the concentrations of four hormones in the blood of a woman on selected days of one menstrual cycle (arbitrary units, data for practice). (a) Identify the day on which ovulation most probably occurred. [1] (b) Explain the change in LH concentration between day 10 and day 14. [2] (c) Explain why the endometrium breaks down after day 26. [2]

| Hormone concentrations (arbitrary units) |     |    |            |              |
|------------------------------------------|-----|----|------------|--------------|
| Day                                      | FSH | LH | Oestradiol | Progesterone |
| 2                                        | 8   | 6  | 4          | 1            |
| 10                                       | 6   | 8  | 14         | 1            |
| 14                                       | 14  | 58 | 18         | 2            |
| 21                                       | 3   | 5  | 10         | 16           |
| 26                                       | 4   | 4  | 5          | 4            |

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**3 PAPER 2A STYLE****[4 marks]**

(a) Outline what happens to the sperm and egg nuclei after a sperm's membrane fuses with the egg membrane. [2] (b) Outline how hormones are used at the start of IVF treatment. [2]

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**[7 marks]**

[illegible]

**[3 marks]**

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## Spec D3.2

[1 mark]

A. ☐ 3 red : 1 white

B. ☐ 1 red : 2 pink : 1 white

C. ☐ All pink

D. ☐ 9 red : 3 pink : 3 white : 1 other

[1 mark]

A. ☐ 0

B. ☐ 0.25

C. ☐ 0.5

D. ☐ 1.0

**[3 marks]**

| Individuals in the pedigree |        |           |             |
|-----------------------------|--------|-----------|-------------|
| Individual                  | Sex    | Affected? | Parents     |
| I-1                         | Male   | No        | Not shown   |
| I-2                         | Female | No        | Not shown   |
| II-1                        | Female | Yes       | I-1 and I-2 |
| II-2                        | Male   | No        | I-1 and I-2 |
| II-3                        | Male   | Yes       | I-1 and I-2 |

[illegible]

**[5 marks]**

| Height (cm) |         |     |        |     |         |
|-------------|---------|-----|--------|-----|---------|
| Group       | Minimum | Q1  | Median | Q3  | Maximum |
| X           | 151     | 162 | 168    | 172 | 188     |
| Y           | 149     | 155 | 160    | 166 | 176     |

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13

**[5 marks]**

minutes. [1] (b) Describe the changes in blood glucose for person A. [2] (c) Person B has type 2 diabetes. Explain the differences between the results for B and A. [2]

| Time (min) | Person A | Person B |
|------------|----------|----------|
| 0          | 5.0      | 7.5      |
| 30         | 8.0      | 12.5     |
| 60         | 6.5      | 14.0     |
| 90         | 5.5      | 13.0     |
| 120        | 5.0      | 11.5     |

[illegible]

14

**[3 marks]**

.....

Explain how the body temperature of a human is returned to normal after exposure to cold conditions.

[illegible]

## Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

C C [1]

2. [5]

- (a) day 14 / when LH peaks [1]
- (b) LH rises sharply / LH surge from 8 to 58 units [1]
- (b) oestradiol concentration rises to a high level / from 14 to 18 units [1]
- (b) high oestradiol stimulates (pituitary) LH secretion / positive feedback [1]
- (c) progesterone falls / from 16 to 4 units [1]
- (c) because the corpus luteum degenerates (no pregnancy / no hCG) [1]
- (c) progesterone no longer maintains the endometrium [1]
- [max 5]

3. [4]

- (a) sperm nucleus enters the egg; tail and mitochondria destroyed [1]
- (a) nuclear membranes of sperm and egg nuclei dissolve [1]
- (a) chromosomes from both take part in one (joint) mitosis producing two diploid nuclei [1]
- (b) drug suspends normal secretion of (FSH/LH) hormones / down-regulation [1]
- (b) large / artificial doses of FSH injected [1]
- (b) to induce superovulation / many follicles develop [1]
- [max 4: max 2 for each part]

4. [7]

- male gametes are inside pollen grains; female gametes are inside ovules [1]
- pollination is transfer of pollen from anther to stigma [1]
- cross-pollination is transfer to a different plant (of the same species) [1]
- pollen and stigma mature at different times (in the same flower) [1]
- separate male and female flowers on one plant (e.g. maize) [1]
- separate male and female plants (e.g. holly) [1]
- animals / insects carry pollen between plants, attracted by petals / scent / nectar [1]
- wind carries pollen between plants [1]
- self-incompatibility genes / S alleles cause pollen from the same plant to be rejected [1]
- pollen with an allele matching the stigma / style fails to germinate / tube stops growing [1]
- self-pollination leads to inbreeding, which reduces genetic diversity / vigour [1]
- pollen tube grows down the style to the ovule so the male gamete can fuse with the egg [1]
- [max 7]

**5. [3]**

- (a) pollination moves pollen from anther to stigma (before fertilization) whereas dispersal moves seeds away from the parent plant (after fertilization) [1]
- (b) water absorbed, activating enzymes / gibberellin production [1]
- (b) amylase digests starch into maltose / sugars OR proteases digest proteins into amino acids [1]
- (b) soluble products transported to the embryo for respiration / growth [1]
- [max 3]

**6. [1]**

**B B [1]**

**7. [1]**

**B B [1]**

**8. [3]**

- recessive because II-1 / II-3 is affected but neither parent (I-1, I-2) is [1]
- so both parents must be carriers / heterozygous [1]
- autosomal because a daughter (II-1) is affected while her father (I-1) is not [1]
- if X-linked recessive, an affected daughter's father would have to be affected [1]
- [max 3]

**9. [5]**

- (a)  $172 - 162 = 10$  cm [1]
- (b)  $1.5 \times 10 = 15$ ;  $172 + 15 = 187$  cm (ECF) [1]
- (b)  $188 > 187$  so it is an outlier [1]
- (c) group X has a higher median (168 vs 160 cm) OR group Y has a larger IQR / spread (11 vs 10 cm) [1]
- (d) polygenic / controlled by many genes [1]
- (d) and environmental factors such as nutrition [1]
- [max 5]

**10. [6]**

- PKU is caused by a recessive allele [1]
- of an autosomal gene / gene not on a sex chromosome [1]
- gene codes for the enzyme that converts phenylalanine to tyrosine [1]
- affected individuals are homozygous recessive / pp [1]
- two carrier / heterozygous parents have a 0.25 / 1 in 4 chance of an affected child [1]
- shown with a Punnett grid: Pp  $\times$  Pp gives PP, Pp, Pp, pp [1]
- heterozygote has one dominant allele coding for functional enzyme [1]
- one allele produces enough enzyme to convert phenylalanine [1]
- so heterozygote has the same phenotype as homozygous dominant / is a carrier [1]
- phenylalanine builds up in affected individuals damaging the brain unless a low-phenylalanine diet is followed [1]
- [max 6]

**11. [1]**

**B B [1]**

**12. [1]**

**C C [1]**

**13. [5]**

- (a)  $(8.0 - 5.0) \div 5.0 \times 100 = 60\%$  [1]
- (b) rises to a peak ( $8.0 \text{ mmol L}^{-1}$ ) at 30 minutes [1]
- (b) then falls back to the starting value /  $5.0 \text{ mmol L}^{-1}$  by 120 minutes [1]
- (c) B starts higher / rises higher / stays high (above  $11 \text{ mmol L}^{-1}$  at 120 min) [1]
- (c) B's target cells are resistant / less responsive to insulin [1]
- (c) so liver / muscle cells absorb less glucose / convert less to glycogen [1]
- (c) A secretes insulin which returns glucose to the set point by negative feedback [1]
- [max 5]

**14. [3]**

- obesity / high body mass [1]
- physical inactivity / lack of exercise [1]
- diet high in sugar / fat / refined carbohydrates [1]
- increasing age / family history / genetic factors / ethnicity [1]
- treatment: low-sugar diet / regular exercise / weight loss / drugs that improve insulin sensitivity / insulin injections [1]
- [max 3: max 2 for risk factors]

**15. [7]**

- negative feedback control [1]
- peripheral thermoreceptors in the skin detect the fall in temperature [1]
- hypothalamus detects / compares with the set point (about  $37^\circ\text{C}$ ) [1]
- hypothalamus sends nerve impulses to effectors [1]
- vasoconstriction of arterioles supplying skin capillaries [1]
- less blood near the surface so less heat lost (by radiation) [1]
- shivering: rapid contractions of skeletal muscle generate heat from respiration [1]
- uncoupled respiration in brown adipose tissue releases heat instead of producing ATP [1]
- hair erection traps an insulating layer of air [1]
- hypothalamus stimulates the pituitary (TSH) to increase thyroxine secretion [1]
- thyroxine raises the metabolic rate so more heat is generated [1]
- sweating reduced / stops [1]
- behavioural responses, e.g. putting on clothes / seeking warmth [1]
- [max 7]