Biology Paper 2: Higher

Practice Questions - Set 2

Name: _____

Class: _____

Date: _____

Time: **46 minutes**

Marks: **44 marks**

Comments:

Q1.

This question is about reproduction.

(a) Describe the difference between the way hormonal and non-hormonal methods of contraception work.

Give **one** example of each method of contraception.

_____

_____

_____

_____

_____

_____

(3)

The urine of women using hormonal methods of contraception contains high levels of progesterone.

Concentrations of 1–3 ng/dm^3 of progesterone are found in the water of rivers near sewage outflow points.

Scientists investigated the effect of different concentrations of progesterone in water on fish reproduction.

This is the method used.

1. Prepare tanks of water containing different concentrations of progesterone.

2. Put a breeding pair of fish into each tank.

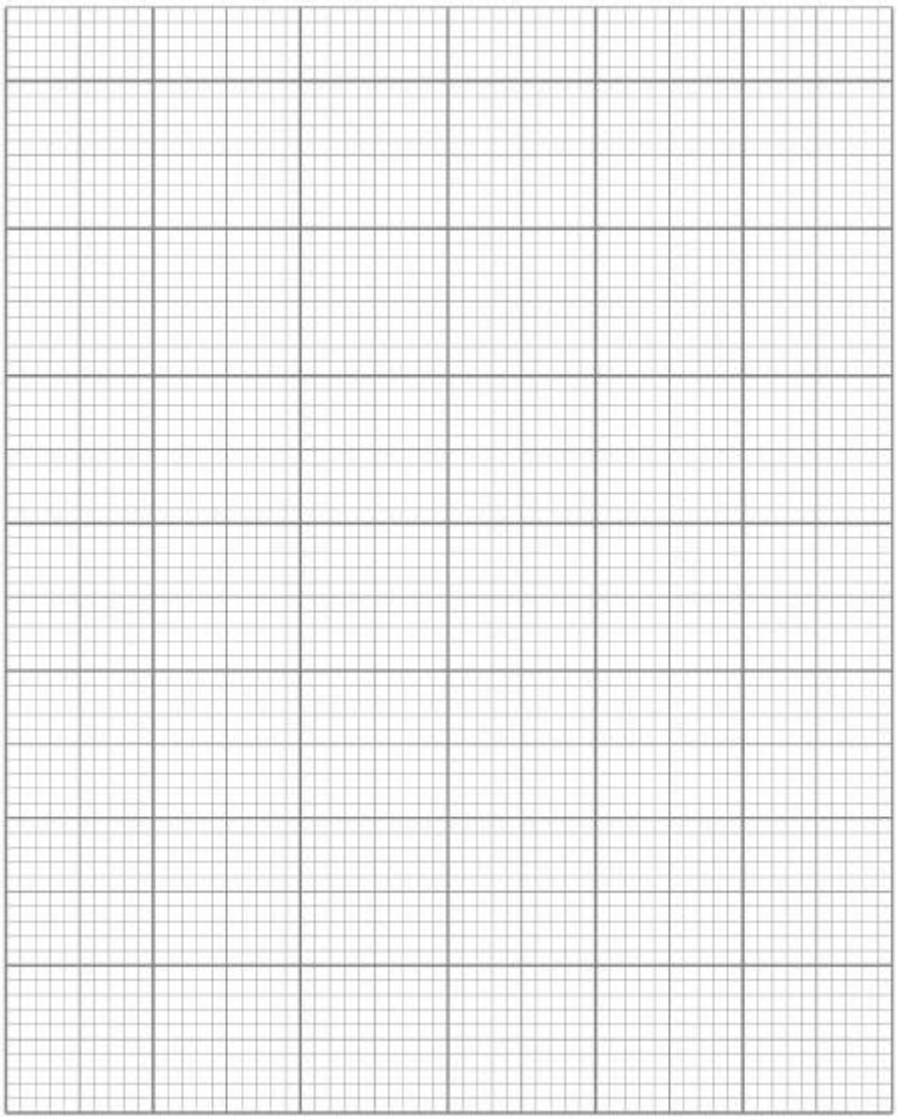
3. Record the number of eggs produced per day by the female in each tank for 14 days.

The table shows the results.

Concentration of progesterone in water in ng/dm^3	**Mean number of eggs produced per day**
0.0	28.6
0.8	4.5
1.5	3.2
3.0	2.8
10.0	1.1
20.0	0.2

(b) Plot the data from the table on the grid.

You should:
- label each axis
- use a suitable scale
- draw a line of best fit.



(4)

(c) Describe the effect on fish reproduction of the concentrations of progesterone found in rivers near sewage outflows.

Use data from your graph.

_____

_____

_____

_____

(2)

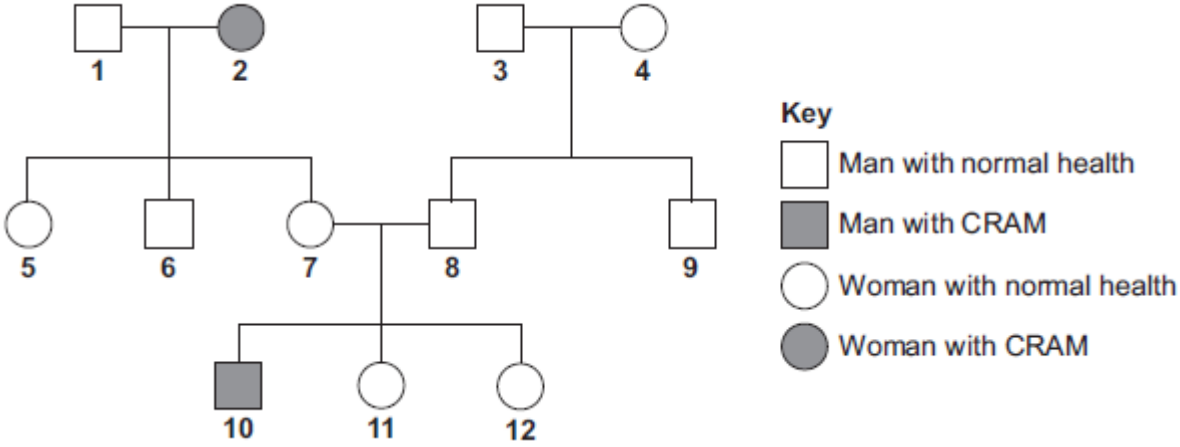
(Total 9 marks)

Q2.

CRAM is an inherited condition which causes muscle breakdown.

The breakdown products enter the urine, making it dark-coloured.

The diagram below shows the inheritance of CRAM in one family.



CRAM is caused by a recessive allele, **n**.

The allele for normal health is **N**.

(a) (i) What is an **allele**?

_____

_____

(1)

(ii) What does **recessive** mean?

_____

_____

(1)

(iii) Give evidence from the diagram that CRAM is caused by a **recessive** allele.

_____

_____

(1)

(b) (i) Person **2** is homozygous for CRAM.

What does **homozygous** mean?

_____

_____

(1)

(ii) None of person **2**'s children have CRAM.

Explain why.

_____

_____

_____

(2)

(c) Persons **7** and **8** want to have another child.

(i) What is the probability that this child will have CRAM?

Draw a genetic diagram to explain your answer.

Probability = _____

(4)

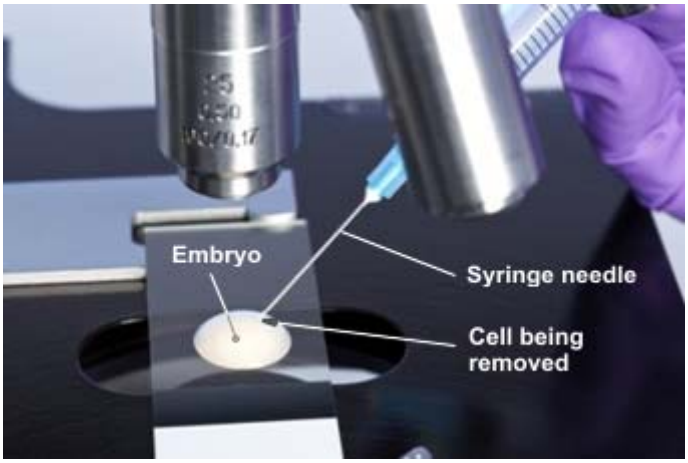
(ii) To avoid having another child with CRAM, persons **7** and **8** may decide to use embryo screening.

Two ways of doing this are:

- PGD (pre-implantation genetic diagnosis)
- CVS (chorionic villus sampling).

PGD involves IVF (in vitro fertilisation) of a few eggs, then taking a cell from each embryo when it is 3 days old.

The image below shows how the cell is removed.



The DNA in the cell can then be tested. An unaffected embryo can be implanted in the woman's uterus. The possibility of a false positive result is around 1 in 6. The procedure costs about £6000. Affected embryos would be discarded. Extra unaffected embryos might be frozen and kept for later implantation. Alternatively, the extra embryos might be used in scientific research.

CVS involves taking a sample of blood from the placenta a few weeks into pregnancy. DNA from white blood cells can then be tested.
If an affected embryo is detected, the parents then have to decide whether to

terminate the pregnancy or allow it to continue.

CVS has a 1 percent chance of giving an incorrect result and a 0.9 percent chance of causing a miscarriage. CVS costs about £600.

Evaluate the benefits of these two methods of embryo screening.
You should include a conclusion to your evaluation.

(5)
(Total 15 marks)

Q3.

Read the information.

Insects can be both useful and harmful to crop plants.
Insects such as bees pollinate the flowers of some crop plants. Pollination is needed for successful sexual reproduction of crop plants.
Some insects eat crops and other insects eat the insects that eat crops.

Corn borers are insects that eat maize plants.
A toxin produced by the bacterium *Bacillus thuringiensis* kills insects.
Scientists grow *Bacillus thuringiensis* in large containers. The toxin is collected from the containers and is sprayed over maize crops to kill corn borers.

A company has developed genetically modified (GM) maize plants. GM maize plants

contain a gene from *Bacillus thuringiensis*. This gene changes the GM maize plants so that they produce the toxin.

(a) Describe how scientists can transfer the gene from *Bacillus thuringiensis* to maize plants.

(3)

(b) Would you advise farmers to grow GM maize plants?

Justify your answer by giving advantages and disadvantages of growing GM maize plants.

Use the information from the box and your own knowledge to help you.

(4)

(Total 7 marks)

Q4.

Fall armyworms are native to America.

Fall armyworms eat corn plants.

(a) The binomial name for fall armyworms is *Spodoptera frugiperda*.

Fall armyworms belong to an order of insects called Lepidoptera.

The table shows a classification table for the fall armyworm.

Complete the table.

Classification group	**Name**
Kingdom	
	Arthropoda
	Insecta
Order	Lepidoptera
Family	Noctuidae
	frugiperda

(2)

Fall armyworms have been found in Africa.

By 2016 they had spread rapidly destroying corn crops.

(b) Suggest **one** reason why the fall armyworms are spreading so rapidly in Africa.

_____

_____

(1)

(c) Fall armyworms:
- are **not** worms (annelids)
- are the caterpillars of moths (arthropods).

Describe **one** way scientists could tell if a new 'worm' they found should be classified as an annelid or as an arthropod.

_____

_____

(1)

(d) In parts of Africa, aeroplanes have been used to spray insecticide on crops, to kill the worms.

Explain the advantages and disadvantages of spraying insecticide on the corn crops.

_____

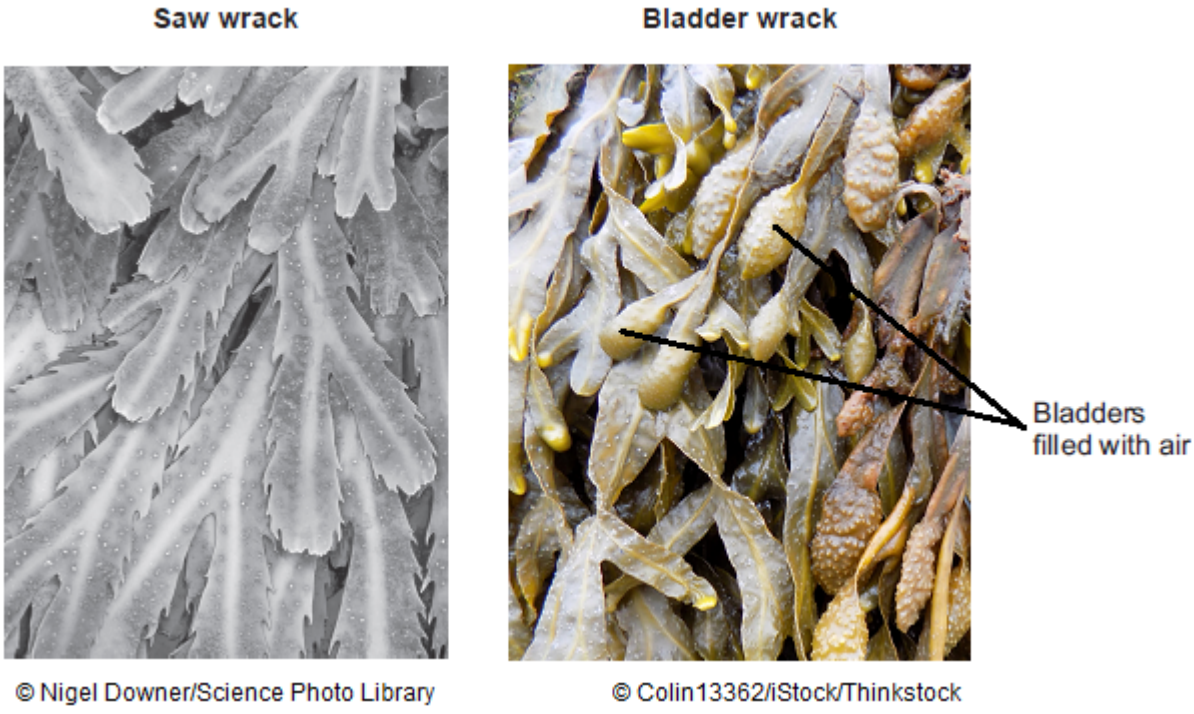
(4)
(Total 8 marks)

Q5.

Organisms compete with each other.

(a) **Figure 1** shows two types of seaweed which live in similar seashore habitats.

Figure 1



Most of the time the two seaweeds are covered with water.

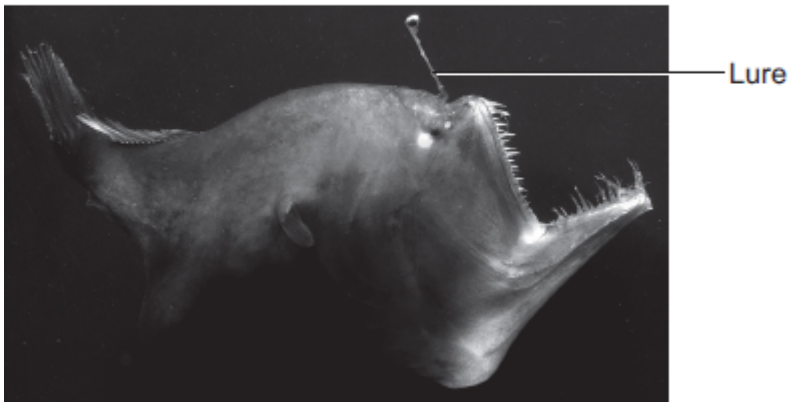
Bladder wrack has bladders filled with air.

Bladder wrack grows more quickly than saw wrack.
Suggest an explanation why.

(3)

(b) **Figure 2** shows an angler fish.

Figure 2



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Angler fish live at depths of over 1000 m.

In clear water, sunlight does not usually reach more than 100 m deep.
Many angler fish have a transparent 'lure' containing a high concentration of bioluminescent bacteria.
Bioluminescent bacteria produce light.

Suggest an advantage to the angler fish of having a lure containing bioluminescent bacteria.

(2)

(Total 5 marks)

Q1.

(a) (hormonal uses chemicals / synthetic) hormones to prevent an egg being released

allow 'to prevent maturation of eggs'

1

(non-hormonal has a barrier which) prevents the sperm reaching an egg **or** prevents implantation

1

a correct example of each type

1

(b) suitable scales and axes labels correct

1

all points plotted accurately

*allow **1** mark for 5 accurate points*

2

line of best fit

*allow a bar chart for max **3** marks*

1

(c) decrease egg production

1

by between 6–10 times

allow ecf from their graph

1

[9]

Q2.

(a) (i) alternative / different / one form of a gene

or

a mutation of a gene

do not allow a type of gene

(For info: CRAM = Childhood Recurrent Acute Myoglobinuria)

1

(ii) not expressed if dominant / other allele is present or it is heterozygous

or

only expressed if dominant allele not present / no other allele present or it is homozygous

need two copies to be expressed / not expressed if only one copy

allow 'gene' for allele

1

(iii) unaffected parents have an affected child

*allow **7** and **8** have **10***

allow skips a generation

1

(b) (i) has two <u>alleles</u> that are the same

*accept (person is) **nn** / **NN** or has two recessive / dominant alleles*

1

(ii) (all) inherit **N** / normal / dominant allele <u>from **1**</u> / <u>from father</u>

ignore they are carriers

1

all are **Nn** / none are **nn** / all are heterozygous

1

(c) (i) genetic diagram including:

1 gametes correct **or** parental genotypes correct:

N and **n + N** and **n or Nn + Nn**

accept alternative symbols, if defined

1

2 derivation of offspring genotypes:
NN + Nn + Nn + nn

allow alternative if correct for parental gametes

1

3 **nn** identified as CRAM

accept ¼ / 25% / 1 in 4 / 1 out of 4 / 1:3

1

4 correct probability: 0.25

*do **not** accept 3:1 / 1:4*

1

(ii) any **four** points + conclusion:

pro PGD:

detected at earlier stage / at 3 days c.f. several weeks / before becoming pregnant

no / less chance of miscarriage c.f. CVS

does not involve abortion / less trauma / less pain / ethical comparison

higher chance of having unaffected child – eg ref to use of spare embryos

provides embryos for research

4

pro CVS:

PGD may destroy some embryos

ethical implications of research on embryos (with PGD)

lower incidence of false positives / false results

low(er) financial cost

conclusion:

must relate to candidate's argument

must have at least one point from each technique for max marks

1

[15]

Q3.

(a) any **three** from:

- (gene) cut out
- (gene / cut out) from (bacterial) chromosome / DNA

  accept (gene / cut out) from (bacterial) plasmid
- ref to enzymes (at any point)
- (gene spliced) into maize chromosome / DNA
- (gene added) at an early stage of development

3

(b) any **four** from:

- justification based on comparison of the relative merits of at least one advantage and one disadvantage

  *max **3** marks if only advantages or disadvantages given*

Advantages:

- less effort for farmer **or** less likely to harm farmer

  ignore ref to cost
- (pesticide) always there **or** doesn't wash away

  allow examples eg no need to spray
- less insects to eat crop / maize **or** carry disease

  allow pesticide doesn't contaminate water courses
- so greater crop production / yield

Disadvantages:

- (toxin) kills other insects

  ignore ref to cost
- so (some) crops don't get pollinated / (sexually) reproduce

  allow maize not pollinated
- possible harm when eaten by humans / animals

  allow may have unpleasant taste
- damage to food chains

  allow reduced biodiversity
- gene may spread to other species

4

[7]

Q4.

(a)

	Animalia
Phylum	
Class	
Genus	*Spodoptera*
Species	

1
1

(b) any **one** from:
- no / few natural predators
- no / few pathogens / diseases
- more favourable climate
- plentiful food as corn crops grown over wide areas in Africa

1

(c) any **one** from:
- compare the structural features with those of annelids and arthropods

  allow named structural features eg is it a segmented worm, does it form a pupa, does it turn into an adult with legs.
- carry out DNA analysis and compare with known annelids and arthropods
- carry out electron microscopy of internal parts to see fine structure and compare with known annelids and arthropods

1

(d)

Level 2: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3-4
Level 1: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	1-2
No relevant content	0
Indicative content **advantages** • killing worms will mean more corn / food for African people • so food security or no famine • it will stop the spread of the worms • so stop it reaching other countries and causing food shortages there	

• it will remove an invasive species • and so restore the natural ecosystem balance in the area **disadvantages** • insecticide will kill other (pollinating) insects • so will stop fertilisation of crops and lead to poor yields • insecticide will kill other insects • and upset the ecological balance in the area or reduce biodiversity in the area • insecticide may be toxic to humans • causing illness if they ingest it • insecticide may build up in the food chain • and poison / kill organisms further up the chain (ignore cost as it could be argued either way)	

4

[8]

Q5.

(a) gets more light (near surface)

allow warmer (near surface)

allow bladders contain (more) carbon dioxide

1

(so) photosynthesises more

1

(because) bladders aid floating (when tide is in)

or

(so) more biomass / glucose / starch produced

*ref to 'more' needed only once, eg gets more light for photosynthesis gains **two** marks*

if 'more' not given do not award mark on the first occasion

1

(b) lets angler fish see / attract its prey / mates **or** see predators as it is dark (at 1000m)
or
lets angler fish see / attract prey to get food
or
lets angler fish see / attract mates to reproduce
or
lets angler fish see predators to avoid being eaten

*must be in a correct pair to gain **two** marks*

2

[5]