

Exam Prep 5 *[111 marks]*

1. *[1 mark]*

Markscheme

D

2. *[1 mark]*

Markscheme

D

3. *[1 mark]*

Markscheme

C

4. *[1 mark]*

Markscheme

C

5. *[1 mark]*

Markscheme

C

6. [1 mark]

Markscheme

A

7. [1 mark]

Markscheme

C

8a. [3 marks]

Markscheme

- a. sex linked/gene is on the X chromosome ✓
- b. allele «for red-green colour blindness» is recessive/colour blindness is recessive trait/disorder ✓
- c. heterozygous females are unaffected/carriers ✓
- d. X^B denotes normal allele and X^b denotes colour blindness allele ✓
- e. more frequent in males because they only have one X chromosome ✓
- f. 50 % chance of colour blindness in sons whose mother who is heterozygote/ $X^B X^b$ ✓

Accept any other letter for the alleles.

Award mpb, mpc, mpd and mpf if these points are clearly made on a Punnett grid.

Markscheme

- a. «happens in a group of species that» evolve from a common ancestor ✓
- b. evolution «of a structure» in different ways ✓
- c. for different functions ✓
- d. common features remain «despite the differences» ✓
- e. homologous structures are evidence «of adaptive radiation»

Must see "homologous" ✓

- f. an example of adaptive radiation ✓
- g. example of specific adaptation ✓
- h. second description of a specific adaptation ✓

example 1:

f. pentadactyl limb

g. human hand is adapted for grasping/climbing/manipulation

h. front limb of mole is adapted for digging»

example 2:

f. «Darwin's» finches'/birds' beaks

g. nectar feeding has a long/thin beak

h. seed feeding has a short/stout beak

8c.

[7 marks]

Markscheme

- a. skin/mucous membranes primary/first defence against pathogens ✓
- b. tears/mucus contain enzymes/lysozymes which destroy pathogens ✓
- c. stomach/skin/some mucus produces acid which kills pathogens ✓
- d. phagocytic white blood cells/phagocytes/macrophages ingest pathogens
OR
lysosomes in phagocytes/macrophages release enzymes that digest pathogens ✓
- e. phagocytes/macrophages give non-specific immunity «to diseases» ✓
- f. specific immunity provided by lymphocytes ✓
- g. lymphocytes divide to produce clones «of plasma cells» ✓
- h. plasma cells/lymphocytes produce antibodies ✓
- i. antibodies are specific to a pathogen/antigen ✓
- j. memory cells provide immunity against future attacks by same pathogen ✓
- k. blood clotting/fibrin closes opening in the body so pathogens cannot enter ✓

Accept leukocytes instead of white blood cells

9a.

[1 mark]

Markscheme

- a. they do not have a metabolism/homeostasis/other specifically named life function
- b. cannot reproduce by themselves
- c. they are not cells/they need a host cell

9b.

[1 mark]

Markscheme

bryophyta

9c.

[2 marks]

Markscheme

- a. unsegmented body (whereas arthropods are segmented)
- b. shell (versus exoskeleton in arthropods)
- c. muscular foot (which arthropods do not have)
- d. no (jointed) appendages/(jointed) legs (whereas arthropods have jointed legs/appendages)
- e. slimy/mucus-covered / arthropod is not slimy

Do not award marks for any answers after the first two given.

9d.

[3 marks]

Markscheme

- a. pigments/chlorophyll absorb light
- b. red and blue/violet light absorbed
- c. absorption of light energy is necessary for photolysis/use of water in photosynthesis
- d. other pigments allow for wider action spectrum than the absorption spectrum of chlorophyll

10a.

[1 mark]

Markscheme

Filicinophyta/Filicinophytes/Pteridophytes

Reject "ferns"

10b.

[2 marks]

Markscheme

a. have roots, stem and leaves

All three, roots, stem and leaves required

b. pinnate leaves/leaves divided «repeatedly» into leaflets

c. have vascular tissue/xylem and phloem

d. produce spores/sporangia

OR

no flowers/fruits/seeds

[Max 2 Marks]

10c.

[1 mark]

Markscheme

energy losses between trophic levels

OR

only part of the energy in one trophic level will become part of the next trophic level

11a.

[1 mark]

Markscheme

xanthophyll

11b.

[1 mark]

Markscheme

acetone

OR

alcohol

OR

ether

Accept other named organic solvent

If there is more than one answer accept only the first one. (Note: "Water mixed with alcohol" would be correct as would "alcohol, water" but "water, alcohol" would be incorrect)

11c.

[3 marks]

Markscheme

- a. they can be identified by their colour/analysis with spectrometer
- b. measure the distance travelled by the solvent front
- c. measure the distance travelled by the pigment
- d. calculate the R_f value
- e. they can be identified by comparing R_f values to known values

[Max 3 Marks]

12a.

[3 marks]

Markscheme

- a. spontaneous generation is life appearing from nothing / from non-living / cells only come from pre-existing cells/life
- b. broth/culture medium (for bacteria) (used/placed) in flasks
- c. broth boiled/sterilized «in some flasks» to kill microbes
- d. no clouding/signs of bacterial growth/reproduction / microbes did not appear «in flasks of boiled broth»

Allow bacteria or organisms instead of microbes.

- e. after necks of flasks were snapped boiled broth became cloudy/growth of microbes
- f. because microbes from the air contaminated the «boiled» broth
- g. curved necks allowed indirect exposure to air but prevented entry of microbes

12b.

[1 mark]

Markscheme

movement/locomotion

OR

feeding/nutrition

12c.

[1 mark]

Markscheme

homeostasis

OR

maintain osmotic balance / expels «excess» water / maintains «cell» water content

12d.

[3 marks]

Markscheme

Advantages:

- a. «adult stem cells» can divide «endlessly» / can differentiate
- b. «adult stem cells» can be used to repair/regenerate «tissues»
- c. fewer ethical objections «than with embryonic stem cells»
- d. adults can give «informed» consent for use of their stem cells
- e. adult source is not killed / «source» would not have grown into new human / no death of embryos used to provide stem cells
- f. no rejection problems / patient's own cells used
- g. less chance of cancer/«malignant» tumor development «than from embryonic stem cells»
- h. most tissues in adults contain some stem cells

Disadvantages:

- i. difficult to obtain/collect/find in adult body/very few available
- j. some «adult» tissues contain few/no stem cells
- k. «adult stem cells» differentiate into fewer cell types «than embryonic cells» /OWTTE

12e.

[2 marks]

Markscheme

- a. saprotrophs/decomposers feed on/break down dead «organic» matter
- b. saprotrophs/decomposers release energy «heat» accelerating decomposition/warming soil
- c. saprotrophs/decomposers recycle nutrients / make nutrients available (to producers)
OR
improves soil fertility / returns nutrients (minerals/nitrates/phosphates/carbon) to soil/water/environment
- d. saprotrophs/decomposers detoxify waste

13a.

[2 marks]

Markscheme

- a. I. cytosine
- b. II. sugar-phosphate/covalent/phosphodiester bond
- c. III. phosphate
- d. IV. deoxyribose

*Award **[1]** for any two correct responses.*

13b.

[2 marks]

Markscheme

- a. decided to combine what was known about chemical content of DNA with information from X-ray diffraction studies *OWTTE*.
- b. built scale models of components of DNA
- c. then attempted to fit them together in a way that agreed with the data «from separate sources»
- d. made several arrangements of scale model until found best one that fitted all the data

13c.

[1 mark]

Markscheme

- a. associated with «histone» proteins in eukaryotes but not prokaryotes
- b. is linear in eukaryotes but circular in prokaryotes
- c. in cytoplasm in prokaryotes, but within nucleus in eukaryotes.

13d.

[1 mark]

Markscheme

unwinds/separates strands/double helix (by breaking hydrogen bonds)

13e.

[2 marks]

Markscheme

- a. links nucleotides together to form a new strand of DNA
- b. uses pre-existing strand of DNA as template
- c. makes covalent bonds between nucleotides

14a.

[2 marks]

Markscheme

- a. as H_2O_2 concentration increases catalase activity increases / positive correlation (up to 70 mM)
- b. peak activity at approximately 70 mM
- c. activity decreases after the peak

14b.

[1 mark]

Markscheme

temperature / pH / enzyme concentration / enzyme volume / quantity of bacteria

2 answers for 1 mark.

14c.

[2 marks]

Markscheme

- a. maximum peak / optimum around 70 mM
- b. but overlapping error bars around 70 mM
- c. no clear optimum / range between 60 – 90 mM
- d. may only be true for this strain *Vibrio rumoiensis* / other variables not reported (*e.g.* another form of catalase)

15a.

[1 mark]

Markscheme

9.0 m² / 9 m²

Units required for the mark.

15b.

[3 marks]

Markscheme

a. in each quadrat determine the presence/absence «of plants» of each type

b. null hypothesis is that the presence of one is random/independent in relation to the presence of the other plant

OR

alternate hypothesis is that the presence of one is associated with the presence or absence of the other

c.
$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Equation may be written out in words.

d. accept alternative hypothesis / reject null hypothesis if the difference between observed and expected is statistically significant / $p < 0.05$ / calculated χ^2 higher than tabulated χ^2 / critical value

OR

it supports the association between the two species if the difference between observed and expected is statistically significant / $p < 0.05$ / calculated χ^2 higher than tabulated χ^2 / critical value

16a.

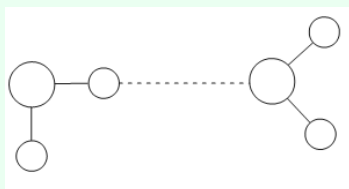
[2 marks]

Markscheme

- a. similar water molecule drawn with oxygen on one molecule facing hydrogen on the other water molecule
- b. one hydrogen bond drawn as a dotted/dashed line between the two water molecules and labelled

O and H do not have to be labelled but must be positioned correctly

eg :



Can get this mark even if atoms incorrect

16b.

[3 marks]

Markscheme

- a. water molecule is polar
- OR**
- water has «weak» positive and negative charges
- c. water forms hydrogen bonds with **polar** substances
- d. positive/hydrogen side/pole of water attracted to negative **ions**
- OR**
- negative/oxygen side/pole attracted to positive **ions**
- e. glucose/other example dissolves because it is polar

OR

sodium chloride/other example dissolves because ions are attracted to water

[Max 3 Marks]

17a.

[3 marks]

Markscheme

- a. decomposition of dead organic material «by saprotrophic bacteria»
- b. «decomposition» leads to CO₂ formation/regeneration due to respiration
- c. «saprotrophic bacteria only» partially decompose dead organic matter in acidic/anaerobic conditions in waterlogged soil
- d. results in peat formation in bogs/swamps
- e. photosynthetic bacteria/cyanobacteria fix CO₂ in photosynthesis

17b.

[4 marks]

Markscheme

- a. problem results from excessive use of antibiotics by doctors/veterinarians/in livestock
- OR**
- low antibiotic doses taken by patients (not finishing treatment)
- b. natural variation exists in any population of bacteria making some resistant to a specific antibiotic
- c. variation arises from mutation
- OR**
- antibiotic resistance can be transferred between bacteria by plasmids
- d. antibiotic kills all bacteria except those that are resistant
- e. resistant bacteria survive, reproduce and pass on resistance to offspring
- f. soon population is made of mainly antibiotic resistant bacteria
- g. this is an example of natural selection «increasing frequency of characteristics that make individuals better adapted to environment»

Markscheme

- a. genetic modification carried out by gene transfer between species
- b. genes transferred from one organism to another produce the same protein/amino acid sequence
- c. due to universality of genetic code
OR
organisms use same codons of mRNA to code for specific amino acids
- d. mRNA for required gene extracted/identified
- e. DNA copies of mRNA made using reverse transcriptase
- f. PCR used (to amplify DNA to be transferred)
- g. genes/DNA transferred from one species to another using a vector
- h. plasmid acts as vector to transfer genes to bacteria/*E. coli*
- i. plasmid cut open at specific base sequences using restriction endonuclease
OR
plasmid cut to produce blunt ends then extra cytosine/C nucleotides added
OR
sticky ends made by adding extra guanine/G nucleotides
OR
mention of sticky ends if not gained already
- j. cut plasmids mixed with DNA copies stick together (due to complementary base pairing)
- k. DNA ligase makes sugar-phosphate bonds to link nucleotides of gene with those of plasmid
- l. bacteria that take up plasmid are identified
- m. (genetically modified) bacteria will reproduce carrying the transferred gene
- n. example – eg: as production of human insulin using *E. coli* bacteria

Accept any of the points clearly explained in an annotated diagram.

18a.

[3 marks]

Markscheme

Oxygen must be taken up **AND** carbon dioxide must be released (*Both needed*)

Gases pass through a cell membrane by simple diffusion

Require a concentration gradient

OR

pass from high concentration to low concentration

Without requiring energy

OR

passive process

Large SA: vol ratio

18b.

[8 marks]

Markscheme

Evolution is «cumulative» change in population/species over time

OR

change in allele frequency

A population has variations amongst the individuals

Due to meiosis

OR

sexual reproduction

Due to mutations

Certain variations give an advantage to some organisms over others in certain environments

Populations/species produce more offspring than the environment can support

Individuals of the species compete for the same resources

The better-adapted organisms tend to survive and reproduce

OR

less adapted organisms tend to die or reproduce fewer offspring

Individuals «that reproduce» pass on their «heritable» characteristics/alleles/genes to their offspring (*“Traits” is an acceptable alternative to “characteristic”*)

Natural selection increases the frequency of «heritable» characteristics/alleles/genes of the better-adapted organisms (*Accept “genes”*)

Specific example described (*Example must be “described” to award marks*)

Award [7 max] if no reference to heritable characteristics or alleles.

19a.

[8 marks]

Markscheme

- a. light energy is the initial energy source for (all) organisms
- b. producers/autotrophs change light/radiant energy into chemical energy
OR
producers/autotrophs convert/trap light/radiant energy by photosynthesis
- c. producing $C_6H_{12}O_6$ /sugars/carbohydrates
- d. carbon/organic compounds used for energy/growth/repair/storage
- e. compounds/energy pass as food along food chains/trophic levels WTTE
- f. cellular respiration releases energy as ATP from food
- g. energy is lost as heat (during cellular respiration)
- h. loss of energy at each trophic level
OR
only approximately 10% of energy is passed to the next trophic level / 90% is lost at each trophic level
- i. energy lost in bones/hair when they die/not fully eaten by the next trophic level
- j. energy lost in feces/urine
- k. decomposers/saprotrophs remove energy from wastes/bodies
- l. energy is not recycled

19b.

[3 marks]

Markscheme

- a. by photosynthesis / using energy from light
- b. attached to carbon compounds
- c. phosphates used to make phospholipids/nucleotides/nucleic acids/DNA/RNA/ATP
Other phosphorus-containing metabolites are acceptable if verified.
- d. nitrates are used to make amino acids/proteins/nucleotides/nucleic acids/DNA/RNA/ATP
Other nitrogen-containing metabolites are acceptable if verified.
- e. transported from roots to leaves (in xylem)

19c.

[4 marks]

Markscheme

- a. drawn in steps rather than triangle
- b. drawn to scale (should be at least 1/5 of the box below it)

OR

annotated with appropriate numeric values

- c. producer
- d. primary consumer
- e. secondary consumer

Award no marks if a drawing has not been made.

"Appropriate numeric values" should indicate scale so accept percentage or numbers.