MEGA LECTURE

AQA (GCSE Notes)

Chapter 1: Cell Biology

Q1. Describe the key differences between eukaryotic and prokaryotic cells.

Q2. What structures are found in both animal and plant cells?

Q3. Explain why bacterial cells are classified as prokaryotic.

Q4. Name the structure in plant cells that stores cell sap.

Q5. How does the genetic material in a bacterial cell differ from that in a plant cell?

Q6. What is the function of the mitochondria in animal cells?

Q7. Describe the role of the nucleus in a eukaryotic cell.

Q8. What is the function of plasmids in bacterial cells?

Q9. Explain why chloroplasts are only found in some plant cells and not in animal cells.

Q10. What is the purpose of the cell membrane in cells?

Q11. How is the function of a ribosome related to proteins?

Q12. Why do plant cells have a cell wall but animal cells do not?

Q13. What material is the plant cell wall made of?

Q14. Describe the structure and function of the cytoplasm in cells.

Q15. How does the presence of mitochondria benefit a cell?

Q16. What are the roles of sub-cellular structures in plant cells during photosynthesis?

Q17. How does a permanent vacuole support a plant cell?

Q18. Why is the genetic material in prokaryotic cells not found in a nucleus?

Q19. What are plasmids, and why are they important in bacteria?

Q20. Estimate the size of a bacterial cell and compare it with a typical animal cell.

Q21. Why is it important for students to understand the scale of sub-cellular structures?

Q22. How would you explain the use of prefixes like micro and nano in measuring cell sizes?

Q23. What is meant by a ‘loop of DNA’ in bacterial cells?

Q24. Why are standard form and order of magnitude calculations useful in cell biology?

Q25. Draw and label the main parts of a typical animal cell.

Q26. Draw and label the additional parts found in a plant cell that are not in animal cells.

Q27. How would you explain the function of the nucleus to a younger student?

Q28. In what way do the functions of chloroplasts differ from mitochondria?

Q29. Why is it helpful to compare drawings and micrographs when studying cells?

Q30. Describe a method to estimate the size of a sub-cellular structure in an image.

Q31. Explain the process of cell specialisation and its link to gene expression.

Q32. Why are stem cells considered valuable in medicine?

Q33. What must happen to a cell before it divides by mitosis?

Q34. How are new cells produced during growth?

Q35. Why are stem cells collected before they become too specialised?

Q36. What is meant by the term ‘cell differentiation’?

Q37. How does the nucleus control the function of a cell?

Q38. What happens during mitosis?

Q39. What is the importance of producing genetically identical cells in mitosis?

Q40. How is the function of a chloroplast linked to its internal structure?

Q41. Explain how cell structures enable plant cells to support the plant body.

Q42. Why is it useful for students to recognise sub-cellular structures in videos and images?

Q43. What are some practical ways to measure or estimate cell size in a classroom setting?

Q44. Why is understanding sub-cellular structure size important in biology?

Q45. Explain the structural advantage of the cellulose cell wall in plant cells.

Q46. How can observing real cell images help improve understanding of theoretical models?

Q47. What differences in sub-cellular structures would you expect to see between a leaf cell and a root cell?

Q48. Describe the function of ribosomes and where they are found in cells.

Q49. Why might a bacterial cell have multiple plasmids?

Q50. What features of a bacterial cell help it survive in different environments?

Q51. Why is cell differentiation important in multicellular organisms?

Q52. At what stage do most animal cells become specialised?

Q53. What does it mean when a cell becomes specialised?

Q54. Give one reason why mature animal cells do not differentiate as often as plant cells.

Q55. Why can many plant cells differentiate throughout life?

Q56. How does a sperm cell's structure help it to carry out its function?

Q57. What adaptations help a nerve cell transmit electrical signals?

Q58. Describe how muscle cells are specialised for contraction.

Q59. What structural features help root hair cells absorb water and minerals?

Q60. Explain how xylem cells are adapted to transport water.

Q61. What is the function of phloem cells, and how are they adapted for it?

Q62. How does cell specialisation help tissues and organs work effectively?

Q63. Describe what happens to sub-cellular structures during cell differentiation.

Q64. Explain the role of cell differentiation in forming organ systems.

Q65. What does it mean for a cell to acquire new sub-cellular structures?

Q66. Why is cell division mainly used for repair and replacement in mature animals?

Q67. What is a tissue and how does it relate to specialised cells?

Q68. Give an example of how a specialised plant cell contributes to the function of a plant organ.

Q69. How does a group of specialised cells form an organ?

Q70. Why is cell differentiation necessary in a developing embryo?

Q71. What does high magnification allow scientists to do when using microscopes?

Q72. How does an electron microscope differ from a light microscope in terms of magnification?

Q73. Why is higher resolution important in microscopy?

Q74. Explain how the electron microscope helped scientists understand cells better.

Q75. What is the benefit of being able to see smaller sub-cellular structures?

Q76. How has the development of microscopy affected biology?

Q77. Describe one advantage and one disadvantage of using an electron microscope.

Q78. Write the formula used to calculate magnification.

Q79. How would you rearrange the magnification formula to calculate the real size?

Q80. If the image size is 10 mm and magnification is ×1000, what is the real size?

Q81. If a real cell is 0.002 mm long and appears 4 mm in an image, what is the magnification?

Q82. Explain how to convert millimetres to micrometres.

Q83. What is the prefix used for one thousandth of a metre?

Q84. What does the prefix “nano” mean in terms of measurement?

Q85. A structure is 500 nm wide. Convert this to micrometres.

Q86. A real object is 0.01 mm long. Express this in standard form.

Q87. Why is it important to express microscope measurements in standard form?

Q88. A microscope image shows a bacterium as 2 mm long. The actual bacterium is 2 µm. What is the magnification?

Q89. A nucleus appears 3.6 mm in a micrograph. If the magnification is ×1800, what is the real size?

Q90. Convert 0.045 mm to micrometres.

Q91. Give one reason for using light microscopes in a school lab.

Q92. Why might a scientist choose an electron microscope instead of a light microscope?

Q93. What improvements in technology have made modern microscopes more effective?

Q94. Explain why resolving power is more important than magnification in some cases.

Q95. A student measures a cell image as 4.8 mm wide and the real cell is 12 µm wide. What is the magnification?

Q96. How has the use of electron microscopy helped identify parts of mitochondria?

Q97. What is one structural feature that can now be studied due to improved microscope resolution?

Q98. How can knowing real sizes of sub-cellular structures help in medical research?

Q99. A mitochondrion is measured at 1.5 µm. Write this in standard form.

Q100. Why do scientists need to know both the magnification and real size of a structure when studying cells?

Q101. What is the process called by which bacteria divide?

Q102. How often can bacteria divide under ideal conditions?

Q103. What two conditions are necessary for bacteria to multiply rapidly?

Q104. Describe how bacteria can be grown in a laboratory.

Q105. Why are uncontaminated cultures important in scientific investigations?

Q106. Explain how to prepare an uncontaminated culture of bacteria.

Q107. Why must Petri dishes and culture media be sterilised before use?

Q108. What is the purpose of passing an inoculating loop through a flame?

Q109. Why should Petri dish lids be secured with adhesive tape?

Q110. Why are Petri dishes stored upside down?

Q111. What is the maximum temperature at which cultures should be incubated in schools?

Q112. Why is a temperature of 25°C recommended for school incubations?

Q113. What is binary fission?

Q114. If one bacterium divides every 20 minutes, how many will there be after one hour?

Q115. How do you calculate the number of bacteria in a population given mean division time?

Q116. Why must cultures be kept free from contamination?

Q117. What is a nutrient broth?

Q118. What is an agar gel plate used for?

Q119. Why are clear areas around colonies measured in an antibiotic investigation?

Q120. How can you calculate the cross-sectional area of a bacterial colony?

Q121. What formula is used to calculate the area of a clear zone around a colony?

Q122. A clear zone has a radius of 7 mm. What is its cross-sectional area?

Q123. Why is it important to sterilise all equipment before use in microbiology?

Q124. What is the function of adhesive tape on a Petri dish?

Q125. Explain how bacterial colonies form on agar plates.

Q126. What factors can limit the growth of bacteria in a lab culture?

Q127. What are antiseptics used for in bacterial investigations?

Q128. What are antibiotics and how do they affect bacterial growth?

Q129. What is the zone of inhibition?

Q130. How can the effectiveness of different antibiotics be compared using agar plates?

Q131. What safety precautions must be followed during bacterial practicals?

Q132. A bacteria population doubles every 30 minutes. How many bacteria will there be after 3 hours?

Q133. If the initial number of bacteria is 200 and they double every 20 minutes, how many are there after 2 hours?

Q134. Why should you never fully seal a Petri dish?

Q135. What is meant by the term ‘mean division time’?

Q136. Why must care be taken not to incubate cultures above 25°C in schools?

Q137. How can you calculate the number of divisions in a certain time period?

Q138. Explain why high temperatures may be dangerous when growing microorganisms in schools.

Q139. What is the role of genes in chromosomes?

Q140. Where are chromosomes found in the cell?

Q141. How many chromosomes are normally found in human body cells?

Q142. What are chromosomes made of?

Q143. What is a gene?

Q144. Why are chromosomes important in cell division?

Q145. Describe the appearance of chromosomes during cell division.

Q146. Why do body cells have chromosomes in pairs?

Q147. How do chromosomes behave during the process of mitosis?

Q148. What is the relationship between DNA and chromosomes?

Q149. Explain how chromosomes ensure that new cells are identical to the parent cell.

Q150. Why is it useful to use models and analogies to understand chromosomes and cell division?

Q151. What is the purpose of the cell cycle in multicellular organisms?

Q152. Describe what happens to the genetic material during the cell cycle.

Q153. Before a cell divides, what sub-cellular structures must increase in number?

Q154. Why does DNA replicate before mitosis begins?

Q155. What is mitosis?

Q156. During mitosis, what happens to the chromosomes?

Q157. What happens to the nucleus during mitosis?

Q158. How does the cytoplasm and membrane change after mitosis?

Q159. What is the final result of mitosis?

Q160. How many cells are produced at the end of one full cell cycle?

Q161. What is meant by genetically identical cells?

Q162. How does mitosis help in the repair of damaged tissue?

Q163. Why is mitosis important during the early development of an organism?

Q164. In which parts of the body is mitosis most likely to occur regularly?

Q165. Give an example of a situation where mitosis is occurring in the human body.

Q166. Describe a situation in plants where mitosis would be occurring.

Q167. Why do cells need to grow before dividing?

Q168. What is the first stage of the cell cycle?

Q169. What happens during the second stage of the cell cycle?

Q170. What is the third and final stage of the cell cycle?

Q171. How is DNA organised in a cell before and after replication?

Q172. What happens to the two sets of chromosomes during mitosis?

Q173. What are stem cells?

Q174. Why are stem cells called "undifferentiated"?

Q175. What can stem cells become after differentiation?

Q176. Where can stem cells be found in the human body?

Q177. What is the role of stem cells in embryos?

Q178. How do stem cells in adult bone marrow help the body?

Q179. Where are meristem stem cells found in plants?

Q180. What is the function of meristem stem cells?

Q181. How can stem cells from embryos be used in medicine?

Q182. Why are embryonic stem cells useful in research?

Q183. What is therapeutic cloning?

Q184. Why is therapeutic cloning less likely to cause rejection?

Q185. Give one condition that stem cells could potentially treat.

Q186. What makes stem cells useful for treating paralysis?

Q187. What is one risk of using stem cells in treatment?

Q188. How might stem cell use lead to viral infection?

Q189. Why do some people object to using embryonic stem cells?

Q190. What ethical concerns are linked with stem cell research?

Q191. How can meristem stem cells help preserve rare plant species?

Q192. Why is it beneficial to clone crop plants with disease resistance?

Q193. How can stem cells reduce the need for organ donors?

Q194. Why might farmers prefer cloned plants over naturally grown ones?

Q195. What are the social benefits of using stem cells in medicine?

Q196. What are the potential disadvantages of stem cell treatments?

Q197. Why is it important to evaluate both the risks and benefits of using stem cells?

Q198. What does cloning mean in the context of stem cells?

Q199. How is stem cell use in plants different from that in animals?

Q200. Describe a medical situation where stem cells could be used.

Q201. What does it mean to clone a plant quickly and economically?

Q202. Why are stem cells more flexible when taken from embryos compared to adults?

Q203. In what way can stem cell therapy help people with diabetes?

Q204. How could stem cell research affect future generations?

Q205. Why is public opinion important when deciding laws about stem cell use?

Q206. What makes plant cloning a useful technique for agriculture?

Q207. How could stem cells help in treating injuries to the spinal cord?

Q208. Why is the use of standardised procedures important in stem cell research?

Q209. What challenges must scientists overcome to make stem cell therapy safe?

Q210. Explain how cloned plants from meristem cells are genetically identical.

Q211. What is meant by the term diffusion?

Q212. In which direction do particles move during diffusion?

Q213. Name one gas that enters cells by diffusion and one that leaves.

Q214. What happens to the rate of diffusion when the concentration gradient increases?

Q215. How does temperature affect the rate of diffusion?

Q216. What effect does a larger surface area have on diffusion?

Q217. Why is diffusion important for gas exchange in the lungs?

Q218. How does urea move from cells into the blood?

Q219. Explain why a thin membrane increases the rate of diffusion.

Q220. Why do single-celled organisms not need a transport system?

Q221. What is surface area to volume ratio?

Q222. Calculate the surface area to volume ratio of a cube with sides of 1 cm.

Q223. Why is a high surface area to volume ratio helpful for single-celled organisms?

Q224. Why do large multicellular organisms need exchange surfaces?

Q225. Explain how the lungs are adapted for efficient gas exchange.

Q226. Describe one feature of the small intestine that increases its surface area.

Q227. How are gills in fish adapted for exchanging gases?

Q228. What features of root hair cells help in absorbing water and minerals?

Q229. How does a leaf's structure help it with gas exchange?

Q230. Why is it important for exchange surfaces to be thin?

Q231. What role does blood supply play in increasing the rate of diffusion?

Q232. Why is ventilation important in the lungs?

Q233. What is the concentration gradient and how does it drive diffusion?

Q234. What substances are transported by diffusion in the small intestine?

Q235. How can you calculate the surface area of a cube?

Q236. What is the effect of a low surface area to volume ratio in large organisms?

Q237. Why is diffusion slower in colder temperatures?

Q238. What is one example of diffusion in plants?

Q239. Why do animals rely on diffusion for oxygen?

Q240. How does an efficient blood supply maintain a steep concentration gradient?

Q241. Describe how diffusion helps remove waste from cells.

Q242. What would happen to a cell if diffusion could not take place?

Q243. How does particle size affect diffusion rate?

Q244. What is the importance of the cell membrane in diffusion?

Q245. Why is the large surface area of alveoli important?

Q246. Give an example of a diagram that models diffusion.

Q247. How do isotonic drinks help during physical activity?

Q248. How does a steeper concentration gradient affect particle movement?

Q249. How does diffusion differ in gases and liquids?

Q250. Why does diffusion occur faster across shorter distances?

Q251. What is osmosis?

Q252. In which direction does water move during osmosis?

Q253. What is meant by a partially permeable membrane?

Q254. What is a dilute solution?

Q255. What is a concentrated solution?

Q256. How does osmosis differ from diffusion?

Q257. Describe a situation in a plant cell where osmosis would occur.

Q258. What happens to a plant cell in a concentrated solution?

Q259. What happens to a plant cell in a dilute solution?

Q260. How does osmosis affect animal cells differently from plant cells?

Q261. How can osmosis be shown in a diagram?

Q262. What is the purpose of the osmosis required practical?

Q263. Describe how to set up an experiment to test osmosis in potato chips.

Q264. What variable is measured in the osmosis practical?

Q265. How is percentage gain or loss of mass calculated?

Q266. What would a graph look like if osmosis is occurring in plant tissue?

Q267. Why do we use salt or sugar solutions in osmosis experiments?

Q268. How can you calculate the rate of water uptake?

Q269. What does it mean if a potato chip gains mass after being placed in a solution?

Q270. What does it mean if a potato chip loses mass after being placed in a solution?

Q271. Why do we blot potato chips dry before weighing them?

Q272. What is the independent variable in the osmosis practical?

Q273. What is the dependent variable in the osmosis practical?

Q274. Why do we use multiple concentrations in the osmosis experiment?

Q275. Why is it important to repeat the experiment?

Q276. What is active transport?

Q277. How is active transport different from diffusion?

Q278. What does active transport require to work?

Q279. Give an example of active transport in plants.

Q280. Why do root hair cells carry out active transport?

Q281. What is one example of active transport in the human body?

Q282. How are sugar molecules absorbed in the gut by active transport?

Q283. Why is active transport important for respiration?

Q284. What kind of energy does active transport use?

Q285. What would happen if active transport didn’t occur in root hair cells?

Q286. What role does active transport play in nutrient absorption?

Q287. Compare the concentration gradient in diffusion and active transport.

Q288. Why can't diffusion alone meet all the needs of cells?

Q289. What type of cells often carry out active transport?

Q290. What adaptations do root hair cells have for active transport?

Q291. How are villi in the small intestine adapted for active transport?

Q292. What does it mean to move substances "against the concentration gradient"?

Q293. What is the difference between passive and active transport?

Q294. What happens to energy use in a cell performing active transport?

Q295. Describe one experiment that could show active transport.

Q296. Why do active transport cells have many mitochondria?

Q297. What are the three main ways substances move into and out of cells?

Q298. Which transport process does not require energy?

Q299. Which process moves water only?

Q300. How can you tell if a cell is using active transport?