O Level Biology (5090)
Unit 8: The Continuity of Life - Reproduction

Recommended Prior Knowledge
The major part of this Unit stands alone. Helpful, but not essential, would be a knowledge of cell structure, enzymes, nutrition and excretion and bacteria.

Context
The general thread of reproduction runs throughout the Unit.

Outline
First, reproduction is considered in general terms, then sexual reproduction in both plants and animals is addressed. Sexually transmitted diseases are studied together with their control..

AO	Learning outcomes	Suggested activities and further guidance	Online resources	Other resources
16(a)	Define mitosis as cell division giving rise to genetically identical cells in which the chromosome number is maintained and state the role of mitosis in growth, repair of damaged tissues, replacement of worn-out cells and asexual reproduction.	The nucleus of a cell contains a number of chromosomes and that the number is fixed and constant for each species (46 in the human being). A new body cell must be an exact copy of the cell producing it. (Details of the stages in mitosis are **not** required.) Use the suggested online resource to guide pupils through the basic steps of the procedure and ask them to consider the genetic significance of each.	Mitosis: http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/celldivision/celldivision2.shtml	**Textbooks** M. & G. Jones – 8 Reproduction Mary Jones – Unit 18 Reproduction in Plants Ian J. Burton – Topic 20 Reproduction
16(b)	Define asexual reproduction as the process resulting in the production of genetically identical offspring from one parent and describe **one named**, commercially important application of asexual reproduction in plants.	For the chosen commercial application (e.g. a potato tuber) students should understand the benefits and the disadvantages of this method of reproduction. Students may produce a table comparing the benefits and disadvantages together with an outline of how the technique is used in a named commercially important application.		

16(c)	Define meiosis as a reduction division in which the chromosome number is halved from diploid to haploid.	Details of meiotic division are not required other than its halving of the chromosome number. The terms gamete, diploid and haploid should be explained. Use the suggested online resource to guide pupils through the basic steps of the procedure and ask them to consider the genetic significance of each. Compare the outcome and process with that of mitosis from 16(a).	Meiosis: http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/celldivision/celldivision4.shtml	
16(d)	State that gametes are the result of meiosis (reduction division).	Link this learning outcome with coverage of 16(c) above.		
16(e)	Define sexual reproduction as the process involving the fusion of haploid nuclei to form a diploid zygote and the production of genetically dissimilar offspring.	Students should appreciate that each parent therefore makes an equal contribution to the diploid cell from which an offspring will develop. Students may draw a flow chart showing gametes, zygote and embryo onto which they may annotate each stage to show the chromosome number (n or 2n) and type of cell division (mitosis or meiosis) involved.		
16(f)	Identify and draw, using a hand lens if necessary, the sepals, petals, stamens and carpels of **one**, locally available, **named**, insect-pollinated, dicotyledonous flower, and examine the pollen grains under a light microscope.	If possible a large, brightly-coloured, scented flower with visible nectar should be chosen. Ensure that students produce large drawings, with a sharp HB pencil, draw clean lines and give the magnification of their drawing (e.g. x3). Use the suggested online resources to assist students in their identification of the listed components.	Downloadable Powerpoint presentation covering all aspects of 16(f) to 16(p): http://www.clickbiology.com/wp-content/uploads/2010/01/plant-reproduction.ppt Components of flowering plant: http://www.bbc.co.uk/schools/ks2bitesize/science/living_things/life_cycles/read1.shtml Interactive flower activity: http://www.bbc.co.uk/schools/ks2bitesize/science/living_things/life_cycles/play_popup.shtml	

16(g)	State the functions of the sepals, petals, anthers and carpels.	It will be necessary to explain that carpels are made up of component parts – stigma, style, ovary and ovules. Also ensure that students are clear that pollen (grains) are not gametes but that they **contain** the gametes. Students may use information from a text book or from the suggested online resources to annotate their diagrams from 16(f) to show the functions of the components labelled.	See suggested resources listed above.	
16(h)	Use a hands lens to identify and describe the anthers and stigmas of **one**, locally available, **named**, wind-pollinated flower, and examine the pollen grains under a light microscope.	Note that a drawing is not required. Students may list any noticeable differences from the features seen in the insect-pollinated flower and attempt to account for each of the differences observed. Students may use their own observations and the suggested online resource to note differences in the amount and structure of pollen produced by insect and wind pollinated flowers and attempt to account for any differences.	Types of pollen: http://www.sciencephoto.com/features/1132-Pollen.pdf	
16(i)	Outline the process of pollination and distinguish between self-pollination and cross-pollination.	Students may describe the differences between the two processes and produce a list of the advantages and disadvantages of each method.		
16(j)	Compare, using fresh specimens, an insect-pollinated and a wind-pollinated flower.	See learning outcomes 16(f) to 16(h) above.		

16(k)	Describe the growth of the pollen tube and its entry into the ovule followed by fertilisation (production of endosperm and details of development are **not** required).	Use a diagram to show the path taken by the pollen tube. Students may use the suggested online animation to add annotations to a labelled diagram. Note, the level of detail in the animation is quite advanced yet provides a good link back to the nature of haploid and diploid cells. Students may attempt to grow pollen tubes using the practical technique outlined in the suggested online resource.	Pollen tube diagram: http://staff.tuhsd.k12.az.us/gfoster/standard/ovule.jpg Pollen tube growth practical: http://www-saps.plantsci.cam.ac.uk/worksheets/ssheets/ssheet4.htm Double fertilisation animation: http://www.emunix.emich.edu/~ghannan/systbot/doublefertanimation.html	
16(l)	Investigate and describe the structure of a non-endospermic seed in terms of the embryo (radicle, plumule and cotyledons) and testa, protected by the pericarp (fruit wall).	Pupils may dissect pea or large bean seeds, soaked for 24 hours before use, and make labelled drawings of the components identified using online and textbook references as a source of information.	See Powerpoint resource listed in 16(f).	
16(m)	State that seed and fruit dispersal by wind and by animals provides a means of colonising new areas.	The class may 'brainstorm' advantages of the ability of plants to colonise new areas.		
16(n)	Describe the external features of **one**, locally available, **named** example of a wind-dispersed fruit or seed and of one **named** example of an animal-dispersed fruit or seed.	Stress that fruit and seed dispersal by wind or animals can happen only after pollination (by wind or insects) and the two very different processes must not be confused. Although there are adaptations for different methods of animal dispersal, only one need be considered in detail. Students may research and produce large, annotated diagrams of each seed to explain how their features enable seed-dispersal by the relevant method.	Seed dispersal mechanisms: http://www.zephyrus.co.uk/seeddispersal.html Wind dispersal mechanisms: http://waynesword.palomar.edu/plfeb99.htm	

16(o)	Investigate and state the environmental conditions that affect germination of seeds: suitable temperature, water and oxygen.	Note that 'warmth' is scientifically vague and that seeds surrounded by 'moisture' rather than 'water' do not germinate. Containers of seeds may be set up, one lacking only a suitable temperature (placed in fridge at approx 4^{o}C), one lacking only water and one lacking only oxygen (sealed and containing alkaline pyrogallol). A control, with seeds exposed to all three conditions, should also be included. A hypothesis may be made for each set of seeds, following which the germination progress of each set should be noted following a period of time. The results may compared and explanations for any differences noticed may be suggested For reasons of safety and expense, the pyrogallol container might take the form of a teacher demonstration.	See Powerpoint resource listed in 16(f) for diagrams showing this experimental design.	
16(p)	Describe the uses of enzymes in the germination of seeds.	Cross reference with learning outcome 5(o) of Unit 3. The need to convert insoluble storage compounds into soluble ones which can be transported should be stressed. Students may use the appropriate section of the suggested online Powerpoint resource to gain an understanding of the process, following which they may produce a written or flow-chart summary of the key events.	See Powerpoint resource listed in 16(f) for animated content.	
16(q)	Identify on diagrams of the male reproductive system and give the functions of the testes, scrotum, sperm ducts, prostate gland, urethra and penis.	Students may use the suggested online or textbook resources to label a diagram of the components required.	Male reproductive anatomy: http://www.passmyexams.co.uk/GCSE/biology/images/reproductive_system_male.jpg	**Textbooks** Ian J. Burton – Topic 21 Sexual Reproduction in Human Beings Mary Jones – Unit 19 Reproduction in Humans

16(r)	Identify on diagrams of the female reproductive system and give the functions of the ovaries, oviducts, uterus, cervix and vagina.	Students may use the suggested online or textbook resources to label a diagram of the components required.	Female reproductive anatomy: http://www.passmyexams.co.uk/GCSE/biology/images/reproductive_system_female.jpg	
16(s)	Compare male and female gametes in terms of size, numbers and mobility.	Comparisons should be supported by reasons for the differences and may be presented in the form of a table. Use the stimulus photo to introduce difference in size.	Fertilisation stimulus photo: http://image3.examiner.com/images/blog/wysiwyg/image/Sperm-egg(1).jpg	
16(t)	Describe the menstrual cycle, with reference to the alternation of menstruation and ovulation, the natural variation in its length and the fertile and infertile phases of the cycle.	Annotated diagrams showing the cycle divided into days and showing the build-up and breakdown of the uterus lining are helpful. Students may use the suggested online resource to produce a timeline of the events comprising the menstrual cycle.	Events of the menstrual cycle: http://lgfl.skoool.co.uk/content/keystage3/biology/pc/learningsteps/MENLC/launch.html	
16(u)	Explain the role of hormones in controlling the menstrual cycle (including FSH, LH, progesterone and oestrogen).	Students may use the suggested online resource to understand the role of these hormones. This may be followed by students preparing a bullet-point list for each hormone to summarise their respective roles. Details of the level of each hormone may be added to the timeline produced by students in 16(t) above.	Menstrual cycle hormones: http://www.abpischools.org.uk/res/coResourceImport/modules/hormones/en-flash/menstrualCycle.cfm	
16(v)	Describe fertilisation and early development of the zygote simply in terms of the formation of a ball of cells that becomes implanted in the wall of the uterus.	The location of fertilisation should be clearly described. Division of the zygote by mitosis prior to implantation should be referred to. Students may watch the video accompanying the suggested online resource, following which they may produce a written commentary of the key events.	Fusion of gametes: http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/evolution/reproductionrev2.shtml	

16(w)	State the function of the amniotic sac and the amniotic fluid.	Ways in which the embryo is protected by the fluid (contained by the sac) should be listed by students.	Amniotic fluid function video: http://health.howstuffworks.com/pregnancy-and-parenting/pregnancy/labor-delivery/adam-200127.htm	
16(x)	Describe the function of the placenta and umbilical cord in relation to exchange of dissolved nutrients, gases and excretory products (**no** structural details are required).	Stress that maternal and fetal bloods do not mix. The content of this learning outcome may be linked to those covering diffusion and excretion in previous Units. Students may produce a list of the substances which cross the placenta and indicate the direction of movement of each.		
16(y)	Describe the special dietary needs of pregnant women.	Students may use the suggested online or textbook resources to produce a two column table listing the dietary needs and the importance of each.	Pregnancy dietary advice: http://www.eatwell.gov.uk/agesandstages/pregnancy/whenyrpregnant/	
16(z)	Describe the advantages of breast milk compared with bottle milk.	The advantages may be presented by students in the form of a bullet point list.	Breast and bottle feeding: http://kidshealth.org/parent/growth/feeding/breast_bottle_feeding.html#	
16(aa)	Describe the following methods of birth control - natural, chemical (spermicides), mechanical, hormonal and surgical.	Family planning clinics are often helpful in supplying information and exhibits. Students may use the suggested online resource to research information on specific examples and present their findings in a variety of formats.	Birth-control methods: http://www.clearblue.com/uk/contraception.php	
16(bb)	Explain that syphilis is caused by a bacterium that is transmitted during sexual intercourse.	The potentially severe nature of syphilis should be mentioned, together with concern that AIDS has diverted attention away from other STDs. The need for early treatment should be stressed.		

16(cc)	Describe the symptoms, signs, effects and treatment of syphilis.	Students may research the specified aspects of the disease and present their findings in the form of a 'spider-diagram'.	Syphilis: http://herpes-coldsores.com/std/syphilis.htm	
16(dd)	Discuss the spread of human immunodeficiency virus (HIV) and methods by which it may be controlled.	Ensure that students are aware that no cure is yet available yet with care the spread of HIV may be restricted. Students construct a two column table showing the ways in which HIV is spread and, for each, the methods by which its spread may be controlled.	How HIV is spread: http://www.sfaf.org/aids101/transmission.html#transmitted	