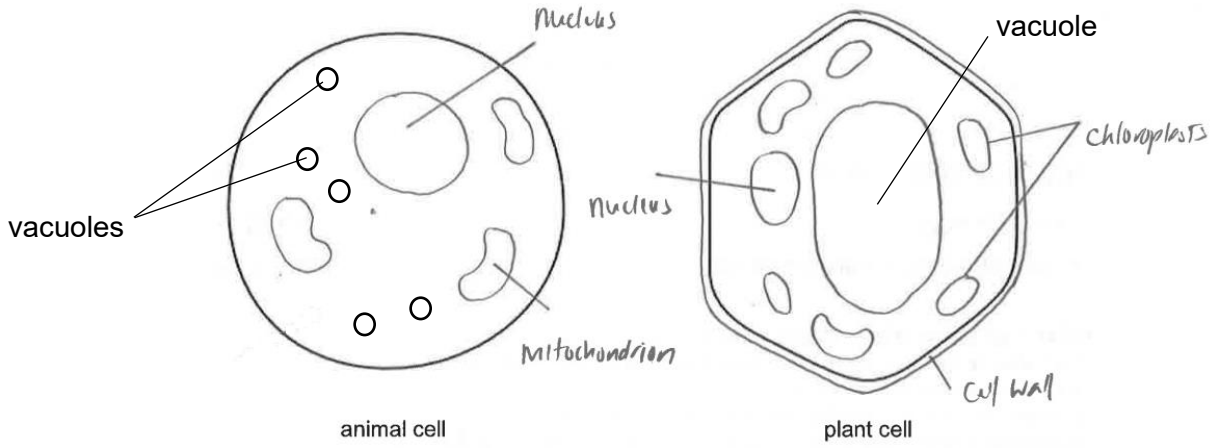
Preliminary Examination 2025 (Term 3)
Secondary 4 Express & 5 Normal Academic
Science Biology 5088

Qn	Answer		Marks	Remarks	Learning Outcome
1(a)		mark awarded only if structure is in a plausible position		nucleus: large, round mitochondrion: bean-shaped	**1 Cell** (c) compare the
	(i)	nucleus / mitochondrion / vacuole (shown in both cells);	1	ignore: size of organelles	structure of typical animal and plant
		Ignore: cytoplasm	1		cells
	(ii)	Any 2 from: chloroplast / cell wall / <u>one large</u> central vacuole in plant cell + many small vacuoles in animal cell;		cell wall: even thickness around cell membrane	

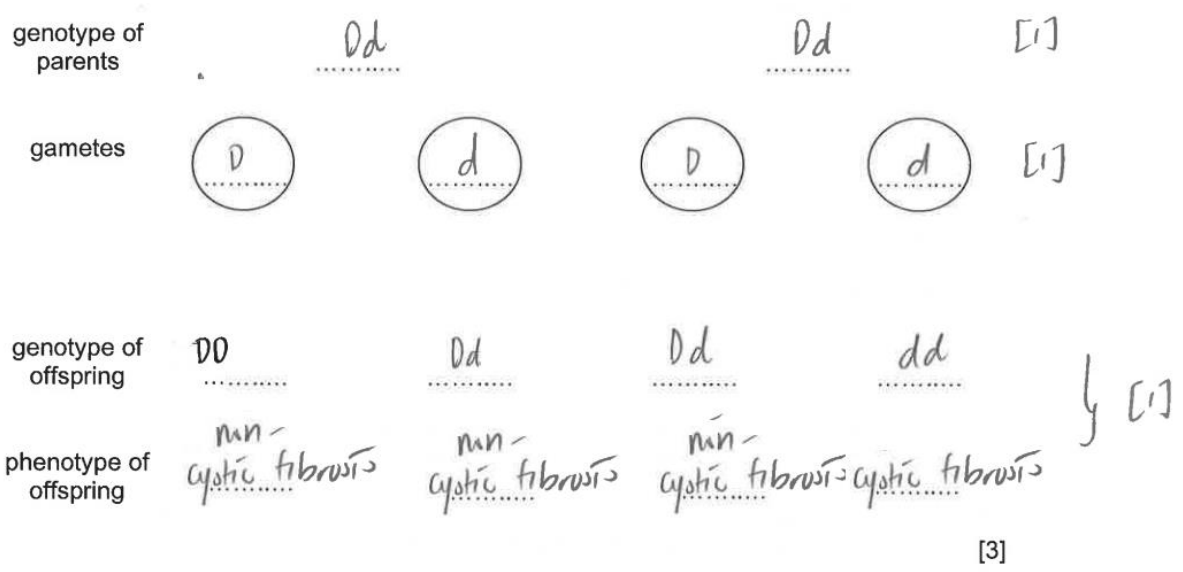


1(b)	**(i)**	(some plant tissues) carry out photosynthesis + produces / manufactures glucose **[or]** excess glucose is converted to starch for storage / starch storage **[or]** presence of cellulose in the cell wall;	1		
	(ii)	1. liver / muscles; 2. storage of glycogen;	2		
	(iii)	Any 1 from (*proteins*): 1. to synthesize new cytoplasm; 2. to build and repair tissues; 3. to synthesize enzymes; 4. to synthesize hormones; ignore: to synthesize antibodies (antibodies are only found in animal cells, not in plant tissues) Any 1 from (*fats*) 5. energy storage; 6. component of cell membrane; 7. to reduce water loss (e.g: oily substance found on the skin surface / waxy layer on the epidermis of leaves) ignore: insulation (less relevant in plant tissues)	max: 2	MP5: seeds contain fats	**3 Biological Molecules:** (a) state the main roles of carbohydrates, fats and proteins in living organisms.
					[Total: 7 marks]

<table>
<tr><td>2(a)</td><td colspan="2">Any 2 from:
1. net movement of water molecules;
2. from a region of high water potential to a region of low water potential
3. across a partially permeable membrane;</td><td>2</td><td></td><td rowspan="4">2 Movement of Substances
(b) define osmosis, investigate and describe the effects of osmosis on plant and animal tissues</td></tr>
<tr><td>2(b)</td><td colspan="2">1. (water molecules) move by osmosis;
2. from large intestine, higher water potential + to blood plasma, lower water potential + down the water potential gradient;
3. large intestine membrane is a partially permeable membrane;</td><td>3</td><td></td></tr>
<tr><td>2(c)</td><td>(i)</td><td><table><tr><th>length</th><th>time</th><th>surface area</th><th>volume</th><th>sa to volume ratio</th></tr><tr><td>2</td><td>41</td><td>24</td><td>8</td><td>3:1 ;</td></tr><tr><td>3</td><td>76</td><td>54</td><td>27</td><td>2:1 ;</td></tr></table></td><td>2</td><td>1 mark for each correct line;</td></tr>
<tr><td>2(c)</td><td>(ii)</td><td>as surface area to volume ratio decreases + time taken for diffusion increases + rate of diffusion decreases;</td><td>1</td><td></td><td></td></tr>
</table>

2(d)	Any 2 from: 1. many / numerous alveoli + to increase surface area; 2. surrounded by many blood capillaries + to maintain diffusion gradient + to remove absorbed materials; 3. one-cell thick alveolar wall and blood capillary wall + to shorten the diffusion distance;	max: 2		**6 Respiration in humans** (b) explain how the structure of an alveolus is suited for its function of gaseous exchange
				[Total: 10 marks]

3(a)	nucleus / chromosomes;		1		
3(b)	**(i)**	1. Dd + Dd; 2. correctly shown gametes; 3. correctly shown gamete linkage + offspring genotype and offspring phenotype;	3		**12 Inheritance** (d) predict the results of simple crosses with expected ratio of 3 :1 and 1:1, using the terms homozygous, heterozygous, F_1 generation and F_2 generation
	(ii)	Non- cystic fibrosis: cystic fibrosis 3:1 phenotype ratio correctly expressed and identified; Accept: 75% non-cystic fibrosis and 25% cystic fibrosis ¼ cystic fibrosis + ¾ non-cystic fibrosis	1		



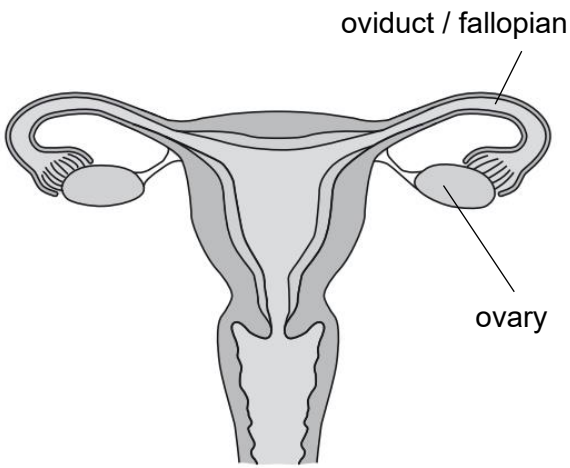
[3]

3(c)	**(i)**	duodenum / small intestine;	1		**4 Nutrition in humans** (a) describe the functions of the various parts of the digestive system, in relation to ingestion, digestion, absorption, assimilation and egestion of food, as appropriate
	(ii)	Any 3 from: 1. reduction in enzyme lipase in pancreatic juice entering duodenum; 2. reduction of bile (from gall bladder) entering duodenum; 3. less emulsification of fat + slower / reduced digestion of fats; [or] fat droplets remain large [or] fat droplets has small surface area to volume ratio; correct ref. to reduce bile action 4. fewer fatty acids and glycerol absorbed into the bloodstream + lower assimilation into large molecules; 5. e.g. of assimilation: ref. less fat molecules can be used in growth; ref. less fat stored, e.g. less excess fats can be stored as adipose tissues;	max: 3		
					[Total: 9 marks]

4(a)	**(i)**	bacteria;	1		
	(ii)	Human immunodeficiency virus; Accept: HIV	1		
4(b)	**1.** From 2000 to <u>2012</u>, percentage of pathogens sampled that show resistance to all three antibiotics is increasing; 2. In 2000, percentage of pathogens sampled that show resistance to antibiotics **A** and **B** starts at 0%; + percentage of pathogens sampled that show resistance to antibiotic **C** starts at 5.5%; 3. From 2012 to 2013, percentage of pathogens sampled that show resistance to antibiotic **C** decreases + from 17% to 16.5% / decreases by 0.5%; 4. Between 2009 and 2012, percentage of pathogens sampled that show resistance to antibiotics **B** and **C** are the <u>same</u> + increases from 13.5% to 17%; 5. Between 2000 and 2001, percentage of pathogens sampled that show resistance to antibiotics **A** rises <u>very steeply</u> + from 0% to 9%; 6. From 2001 to 2013, the percentage of pathogens sampled that show resistance to antibiotic **A** is always higher than antibiotics **B** and **C**; Accept: from second half of 2000 to 2013		max:3		

4(c)	Any 1 from: 1. did not complete the full course of antibiotics prescribed by doctors + not all the bacterial are killed; 2. misusing or overusing antibiotics / or described Accept: alternative wordings	max: 1		**7 Infectious Diseases in Humans** (f) state that antibiotics kill bacteria and are ineffective against viruses/
4(d)	(antibiotics are ineffective against viruses) because viruses do not have cell walls, cell membranes or ribosomes;	1		**7 Infectious Diseases in Humans** (g) explain that the misuse and overuse of antibiotics may accelerate the emergence of antibiotic – resistant bacteria
				[Total: 7 marks]

5(a)	**(i)**	(oak) tree / primrose	1		**9 Organisms and their Environment** (b) describe the toles of producers, consumers and decomposers in food chains and food webs.
	(ii)	oak tree → flies → spiders → blue tits → owl;	1		
5(b)	**(i)**	group of organisms of the same species + living in the same area at the same time;	1		
	(ii)	position of an organism in a food chain / food web + example from food web in Fig. 5.1 e.g. flies ate at <u>second trophic level</u>	1		
5(c)	**(i)**	decomposers / bacteria / fungi;	1		
	(ii)	Any 2 from: 1. releases minerals from leaves; ignore: nutrients 2. minerals absorbed into plant from soil; 3. (decomposers) carry out respiration / decomposition + releases carbon dioxide; 4. carbon dioxide absorbed by leaves from photosynthesis;	max: 2		
					[Total: 7 marks]

6(a)	**(i)** **(ii)**	Label line + fallopian tube / oviduct Label line + ovary  	1 1		**11 Reproduction in Humans** (c) identify the female reproductive system and state the functions of: ovaries, oviduct, uterus, cervix and vagina

6(b)	**(i)**	7 days; Accept: 6.8 / 7.2	1		**11 Reproduction in Humans** (d) outline the menstrual cycle with reference to the alteration of menstruation and ovulation, the natural length in its length, and the fertile and infertile phases of the cycle with reference to the effects of progesterone and oestrogen only
	(ii)	Straight line drawn horizontally on the graph grid between day 16 and day 28 as a continuation of the existing line;	1		
	(iii)	14; Accept: 13 / 15	1		
					[Tota: 5 marks]

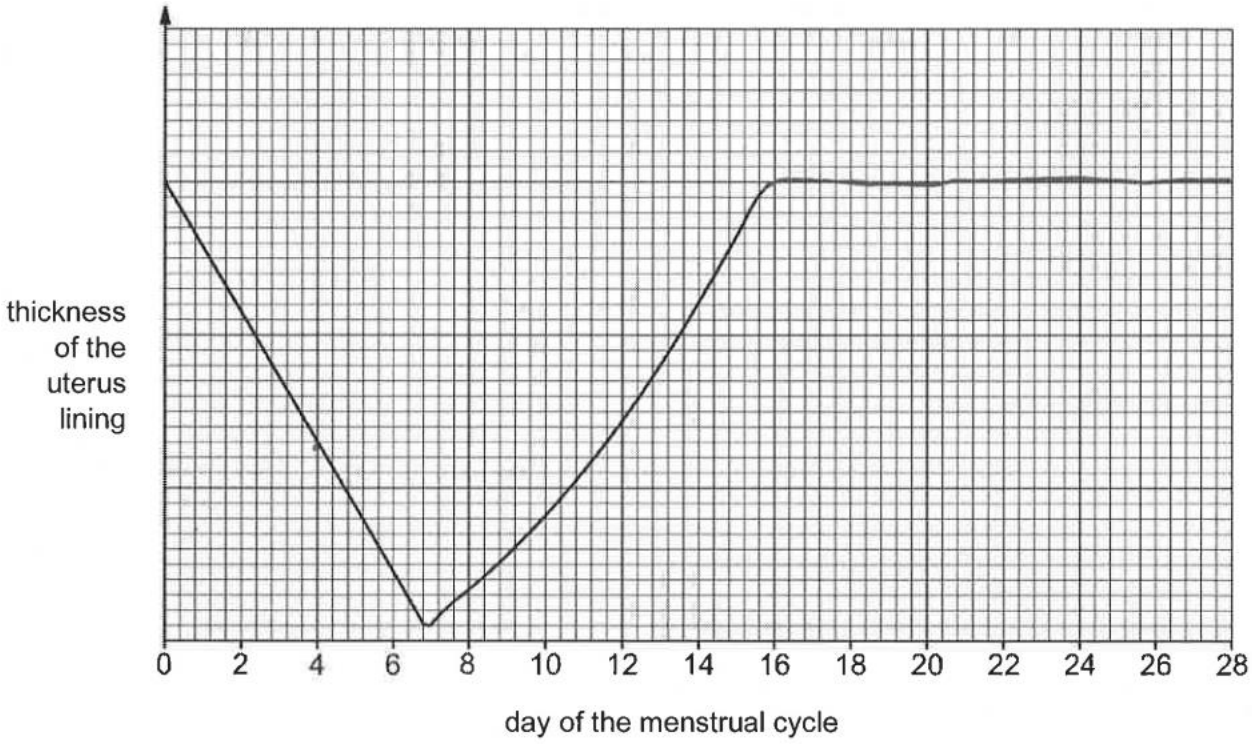

thickness of the uterus lining
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
day of the menstrual cycle

Fig. 6.2

7(a)	oxygen + glucose; carbon dioxide + water;	1 1		**6 Respiration in Humans** (d) define *aerobic respiration* in human cells as the release of energy by the breakdown of glucose in the presence of oxygen and state the word equation
7(b)	0.2 (arbitrary units);	1		

7(c)	**(i)**	Minimum 2 from: 1. as metabolic rate increases from 0.2a.u. to 1.6a.u + pulse rate increases from 70 beats per minute to 110 beats per minute; 2. as metabolic rate increases from 1.6 a.u to 2.4a.u + pulse rate increases from 110 beats per minute to 170 beats per minute; 3. during exercise / as metabolic rate increases from 0.2a.u. to 2.4a.u + pulse rate increases from 70 beats per minute to 170 beats per minute; Minimum 2 from: 1. (during exercise) higher muscle contractions + more energy is needed; 2. higher rate of respiration + required more oxygen and glucose; 3. delivered / transported to muscle tissues + by blood; 4. (higher rate of respiration) more carbon dioxide / more heat removed by blood 5. rate of heart beat increases;	max: 4		**6 Respiration in Humans** (f) explain why cells respire anaerobically during vigorous exercise resulting in an oxygen debt that is removed by rapid, deep breathing after exercise

	(ii)	1. <u>do not</u> fall immediately / fall straight away; 2. ref. continuation of high pulse rate to pay off oxygen debt; 3. ref. continuation of high pulse rate to transport lactic acid from muscle tissues to the liver; 4. ref. continuation of high pulse rate to transport oxygen to the liver + to breakdown lactic acid; 5. (pulse rate) falls / decreases / returns to normal + to 70 beats per minute;	3		**6 Respiration in Humans** (f) explain why cells respire anaerobically during vigorous exercise resulting in an oxygen debt that is removed by rapid, deep breathing after exercise
					[Total: 10 marks]

Section B

8(a)	Any 2 from: 1. biological + protein; 2. that functions as a catalyst / speeds up a chemical reaction; 3. remains chemically unchanged at the end of reaction;	max: 2		

8(b)	Any 5 from: 1. as temperature increases from 0°C to 35°C + number of bubbles produced increases, from 2 bubbles per minute to 60 bubbles per minute; 2. (explanation) as temperature increases + enzymes and substrates gain kinetic energy + rate of effective collisions increases / rate of enzyme-substrate formation increases + rate of reaction increases; 3. as temperature increases from 35°C to 60°C + number of bubbles produced decreases, from 60 bubbles per minute to 0 bubbles per minute; 4. above 35°C, enzymes start to lose the <u>shape</u> of active site + shape of active site and shape of substrate are no longer <u>complementary</u> + rate of reaction starts to decrease; Accept: ref. to denaturation of enzymes 5. optimum temperature 35°C + enzymes are most active + maximum rate of reaction; 6. at 60°C, <u>no</u> reaction takes place + <u>no</u> bubble is produced + all enzymes have been denatured;	max: 5		**3 Biological Molecules** (e) investigate and explain the effects of temperature and pH on the rate of enzyme catalysed reaction

8(c)	1 (observations) slices **B** and **C** <u>turn white</u>; 2 (slice **B**) acidic pH / pH 2 + enzymes denatured; 3 (slice **C**) temperature 4°C + enzymes are inactive at low temperature;	3		**3 Biological Molecules** (e) investigate and explain the effects of temperature and pH on the rate of enzyme catalysed reaction

9(a)	1. *process*: photosynthesis; Any 2 *explanation* from: 2. leaves flat + facing the sun horizontally + area + to trap / absorb maximum amount of light energy; 3. large / maximum / increased surface area + to trap / absorb maximum amount of light energy; 4. reference to stomata + for carbon dioxide diffusion / absorption; 5. presence of chlorophyll + to trap light energy; Accept: to trap sunlight 6. reference to transparent cuticle / epidermis / thin leaves + to allow light energy to reach mesophyll cells / inner cells; 7. reference to intercellular air spaces + for rapid diffusion of gases into and out of mesophyll cells; 8. reference to xylem to transport water and dissolved mineral salts to cells / reference to phloem to remove manufactured food, i.e. sucrose / amino acids away;	max: 3		**8 Nutrition and Transport in Flowering Plants** (a) identify the cellular and tissue structure of a dicotyledonous leaf, as seen in transverse section using the light microscope and describe the significance of these features in terms of their functions.

9(b)	1. *effect*: <u>reduces water loss / reduced rate of transpiration</u> Ignore: wilting Any 2 *explanation* from: 2. Any 2 from (reference to folding of leaves): • Humidity build up + reduced water vapour concentration gradient / reduced rate of evaporation; • Protection from breeze / wind + increased accumulation of water vapour outside stomata; • Reduced surface area + reduced rate of evaporation;	max: 3		**8 Nutrition and Transport in Flowering Plants** (f) investigate and explain: - the effects of variation of air movement, temperature, humidity and light intensity on transpiration rate; - how wilting occurs;

9(c)	**(i)**	Any 2 from: 1. (from noon to 1800) high light level + maximum rate of photosynthesis; 2. rate of photosynthesis is higher than rate of respiration; 3. net production of oxygen + diffusion of oxygen from plant to the atmosphere + net loss of oxygen;	max: 2		
	(i)	Any 2 from 1. plant carries out respiration continuously / during the day and night; 2. (from 1800 to 2200) reduced light levels + rate of photosynthesis decrease; 3. less oxygen produced through photosynthesis + uptake of oxygen from the atmosphere increases; 4. stomata closing / closed;	max: 2		
					[Total: 10 marks]