

NANYANG GIRLS' HIGH SCHOOL

End-of-Year Examination 2016

Secondary Three

BIOLOGY

Paper 1

1	D	7	D	13	C	19	C	25	B
2	B	8	A	14	B	20	D	26	A
3	A	9	C	15	D	21	A	27	D
4	B	10	A	16	C	22	D	28	B
5	C	11	A	17	D	23	D	29	C
6	D	12	D	18	B	24	B	30	B

Qn	Ans	Explanation
1	D	Ribosome makes protein and rough endoplasmic reticulum transports protein. Mitochondrion releases energy by respiration. Vacuole stores substances in the cell.
2	B	Xylem vessels on the right are younger and broader to transport more water so option D is wrong and option B is correct. Lignin deposit has nothing to do with xylem vessels dying or losing water.
3	A	At 50% plasmolysed cells, water potential inside and outside the cell are the same hence no net gain or loss in water molecules. Reject: option B and option D because if concentration inside all the cells are greater than sucrose concentration outside then water will enter cells. Reject: option C because 100% of plasmolysed cells does not mean cells are at equilibrium with solution outside cell
4	B	Once the HIV bind to the receptor on the cell membrane, endocytosis takes place.
5	C	The number of denatured enzyme molecules will increased after optimum temperature X °C so option C is correct. Option A is wrong, as activation energy should be at minimum with the help of enzyme. Option B is wrong, as kinetic energy will still increase with increase in temperature. Option D is wrong, as number of E-S complex is increasing.
6	D	Only option D is an observation hence correct. The other 3 options are all inferences and there is not enough information for such inferences.
7	D	Amino acids are linked by peptide bond to form a linear chain in the primary structure instead of hydrogen bond. Option A is wrong as hydrolysis reactions break bonds and not link amino acids
8	A	Hydrocarbon chains of molecule X may be from saturated or unsaturated fatty acids hence any option with statement 3 will be wrong.
9	C	Only amino acid contains nitrogen so only option C is correct.
10	A	Chlorophyll absorbs blue and red regions of the light spectrum so only option A is correct.

11	A	Hydrogen ions will reduce carbon dioxide into carbohydrates during the light independent stage.
12	D	Excess glucose will be converted to amino acids and transported out of the leaf via phloem as shown in option D.
13	C	Option C is the independent variable and not a controlled variable so it is wrong.
14	B	Photolysis of water takes place in the granum which is option B.
15	D	Only option D shows correct sequence.
16	C	Option C shows the endodermis with Casparian strip hence is able to regulate ions entry.
17	D	Option D refers to the capillary action that draws water up the xylem during transpiration. Option A is wrong, as osmosis is involved. Option B is wrong, as water remains as liquid at 4 degree Celsius at the bottom of the lake and is not due to the adhesive and cohesive property of water. Option C is wrong, as the property of water as solvent is used here.
18	B	When transpiration exceeds water uptake, as seen at noon, plant cells will be flaccid hence option B is wrong. Option A is a correct fact BASED on graph as rate of water uptake is more than rate of transpiration
19	C	Structure R shows the pancreas. The pancreatic juice contains amylase, trypsin and lipase. At the same time, islets of Langerhans in the pancreas produces the hormone insulin.
20	D	The peak concentration of the drug in the blood was achieved at about 1 hour, after which the concentration drops rapidly. As food usually stays in the stomach for about 2 to 4 hours after consumption, it is highly unlikely that the drug would have entered the ileum within the first 2 hours after consumption. This means that the drug must have been absorbed by the stomach, before it had the opportunity to reach the ileum. Absorption does not take place in the oesophagus.
21	A	For drug W to be absorbed into the bloodstream without its properties changing, it must be resistant to action of pepsin or the enzyme in the stomach will cause the drug to be altered. Option B is wrong because if drug is broken down by acid then it will not be useful as a drug. If the drug is made up of large, insoluble molecules, it would not be able to be absorbed. If the drug is coated with a chemical that sticks to the mucus, it is highly likely that the chemical will not be absorbed but instead remain trapped in the mucus lining.
22	D	This experiment shows the test for starch, so solution X must be iodine solution.
23	D	This experiment shows the test for starch, where solution X is iodine solution. The area surrounding well 2 shows that the iodine solution remained brown, indicating the absence of starch. Starch must thus have been digested in the presence of amylase. Options 1 and 2 are incorrect as amylase is not present (option 1 and option 2). Amylase can be found in both pancreatic juice and saliva, thus options 3 and 4 are correct.
24	B	J shows a red blood cell (erythrocyte). K is a platelet while L shows a white blood cell (leucocyte). This particular type of leucocyte is known as a neutrophil.

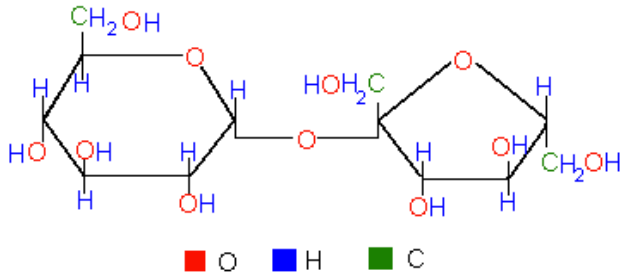
25	B	Soluble protein S is cleaved then combined to form insoluble threads T – this indicates that fibrin threads are formed (T). S must thus be fibrinogen. Chemical U is the enzyme that catalyses this cleavage, and is therefore thrombin.
26	A	The pulmonary artery carries deoxygenated blood from the right ventricle to the lungs, and must thus carry the lowest concentration of oxygen as compared to other blood vessels.
27	D	The volume of blood pumped per minute during rest is $60 \times 50 = 3000 \text{ cm}^3/\text{min}$ The volume of blood pumped per minute during vigorous exercise is $200 \times 75 = 15000 \text{ cm}^3/\text{min}$ So there was an increase in $15000 \text{ cm}^3 / 3000 \text{ cm}^3 = 5.0$ times volume. Option A $75/50 = 1.5$ times has error in calculation since only raw vol of blood per beat was used Option C is also wrong as Q asked for comparison between volume of blood at rest and during exercise. Q did not ask to compare 'difference' so cannot use $15000 - 3000$.
28	B	The semi-lunar valve between the aorta and left ventricle closes when the pressure in the aorta is higher than that of the ventricle. This occurs at times 0.24 seconds and 0.70 seconds, thus the semi-lunar valve is closed for $0.70 - 0.24 = 0.46$ seconds.
29	C	P represents the trachea, which then leads to the 2 bronchi (plural form of bronchus). The bell represents the rib cage, while the rubber sheet represents the diaphragm. The balloon represents the lungs.
30	B	The rate of anaerobic respiration must increase in order to increase rate of ethanol production. This can be done by increasing the concentration of substrate available, in this case, glucose. Adding of oxygen into the mixture will prevent anaerobic respiration from taking place. Solution N is used to detect the presence of carbon dioxide and will not affect the rate of ethanol production, while maintaining the temperature at 85°C would probably cause the yeast to die as the temperature is too high.

Paper 2 Section A

- 1 (a) (i) During (aerobic) respiration in mitochondrion; [2]
energy is released;
Max 2
Accept: This energy may be used by the cell to perform cell activities such as growth / reproduction / active transport
- (ii) Marker's comment: 'Compare' type of Q needs the answers to be done factor by factor. Do not write two separate sentences or paragraphs and then expect your marker to sieve out the comparisons. [2]
Y is highly folded but X is not folded;
Y increased surface area to volume ratio as compared to X;
Y functions for attachment of enzymes but X functions as a barrier;
Max 2
Reject: X is outer membrane but Y is inner membrane / cristae (Q did not ask for location)
Reject: X is selectively permeable but Y is not permeable (all membranes are selectively permeable)
Accept: X encloses contents of mitochondrion but Y is the site for oxidative phosphorylation and electron transport chain
- (b) Cell membrane on left / all around; [3]
RER on right;
Arrows from right to left;
- 2 (a) Glucose is a polar / water-soluble / hydrophilic molecule; [2]
Reject: Glucose does not dissolve (false)
Reject: Glucose is too large (monosaccharide, basic building block of carbohydrate)
Reason: Cell membrane has a hydrophobic core (made of hydrophobic tails) and will not allow hydrophilic substances to move through it;
Reject: stating that phospholipids has a hydrophilic head and hydrophobic tail without making clear that it is the hydrophobic region (of two layers of hydrophobic tails) that is responsible for preventing glucose movement.
- (b) Marker's comment: A lot of the students have a misconception that active [2]
transport can only work if it is against concentration gradient.
Truth: Active transport works independently of the concentration.
Process = active transport;
Reject: Facilitated diffusion (Q stated 'independent' of concentration but diffusion is from high to low concentration)
Conditions = ANY TWO ONE MARK oxygen / (ATP) energy / respiration / glucose complementary shape to carrier protein;
Reject: need membrane / glucose / carrier protein (already given in Q)

- 3 (a) Carry out Benedict's test; (reject: incorrect spelling, no CAPS for surname) [3]
 add 2 cm³ of Benedict's solution to 2 cm³ of Fructose solution + into boiling
 water bath;
 mixture turned from blue to green/yellow/orange/brick-red with precipitate;
 Reject: Precipitation (different meaning), ppt (must spell out in full)
 Reject: any annotations NOT in proper answer space provided

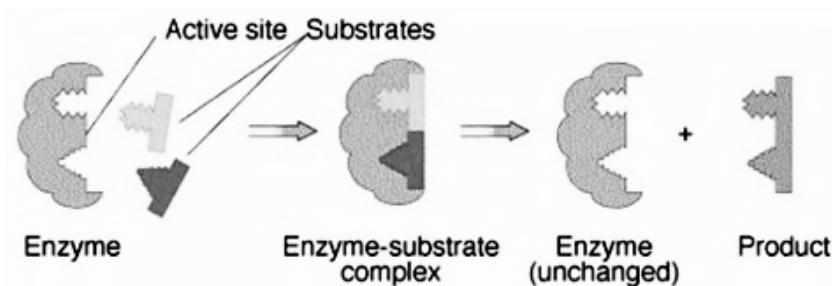
- (b) [2]



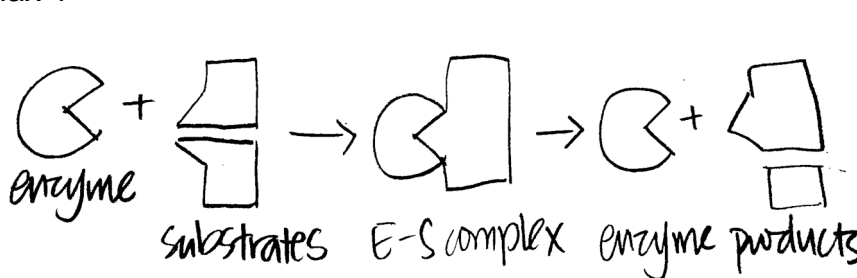
1 mark; H₂O 1 mark

- 4 (a) Light energy is used to split water molecules into oxygen and hydrogen ions / [1]
 photolysis of water;
 Reject: Just stating 'stage one' or 'light dependent stage' without describing
 Reject: dependant (different meaning)
 Reject: hydrolysis / reduction of water

- (b) [4]



Enzyme labelled;
 TWO substrates labelled and drawn as complementary shapes for enzyme;
Enzyme-substrate complex labelled;
 If ONE product drawn it should be labeled product / carbohydrate;
 If TWO products drawn, they should be labeled products/ carb AND water;
 Enzyme drawn as unchanged at end of reaction;
 Max 4



Reject: if products do not follow overall outline shape of initial substrate
 Reject: if product is exactly same shape and size of substrate (i.e. no change)

Reject: if difference between substrate and product is just shading

Reject: enzyme labeled as H^+ ion

- (c) Predict = Rate of photosynthesis is slower / stopped; [2]
Explain = (Photosynthetic) enzymes are inactive at low temperature;
Reject: enzymes are denatured at low temp (false)

- 5 (a) Process X = Translocation; **Reject:** 'transport of ...' without naming [2]
Process Y = Transpiration/root pressure/capillary action/uptake of water;
Reject: 'transport of ...' without naming

- (b) Marker's comment: Students did not read Q asking for 'cell' and just gave leaf or fruit which are not cell. [2]
Source cell = Mesophyll cell / guard cell; **Reject:** leaf cell as one example of leaf cell i.e. epidermal cell not able to conduct photosynthesis
Sink cell = Actively dividing cell / apical cell / root tip cell / storage cell / fruit cell / flower cell; **Reject:** stem cell (too vague, need storage stem cell)

- (c) Must state the two activities at companion cell that support process X: [5]
(SI) Loading sucrose/sugars into phloem sieve tube;
(SII) Unloading sucrose/sugars out of phloem sieve tube;
Max 2

Reject: sugars unloaded into the sink (from diagram, sugars are unloaded into companion cell)

Function (F):

Many mitochondria in companion cell;

to provide the energy (for companion cell);

needed for active transport of sucrose/sugars into / out of phloem sieve tube;

Sucrose/sugar in phloem will draw water from xylem by osmosis;

Creating a mass flow / bulk flow along or down the phloem/ increase

hydrostatic pressure/ creating positive pressure;

From the source to sink; (A: to sink if source was mentioned earlier)

Max 3

Accept: thin-walled companion cell (stated in TB)

Accept: produce/ generate energy (but pls note that energy cannot be produced or destroyed)

Accept: from leaves to roots

Reject: phloem cell (no such thing)

Reject: sucrose diffuses (error) into phloem to be transported from source to sink

Reject: loading and unloading of sugars at the source and sink (both loading and unloading are taking place at both source and sink?)
 Reject: energy needed for Process X (X is translocation, energy not required)
 Reject: provide energy for sieve tube cells/phloem to load sugars (energy needed for the companion cells to load sugars, not STC)

- 6 (a)** A damaged blood vessel/tissue and platelets in the blood release thrombokinase, [3]
 which convert prothrombin to thrombin;
 together with calcium ions;
 Thrombin catalyses soluble fibrinogen into insoluble fibrin, which combine to form
 fibrin threads;
 Fibrin threads entangle/trap/form a mesh with blood cells to form a clot/scab to
 stop bleeding;

Accept: fibrin threads block blood cells

Reject: damaged blood cells/ damaged platelets

Reject: entangle blood/ blood vessels/ form mesh to clot the cut/form mesh to
 cover and seal the wound

Reject: agglutination

- (b) (i)** 1. Group A rats had a higher mean heart rate/min of 730 while group B rats [2]
 had a lower mean heart rate/min below 400/ Group A had mean heart rate
 ~400bpm more than Group B;
 2. Group A rats had a constant mean heart rate/min of 730 while group B
rats had a range of mean heart rate/min fluctuating between 320 and 380;

Accept: both differences stated, with at least one of the differences
supported with relevant data

Reject: simply describing the graphs without stating clearly the differences.

Reject: quoting data that is obviously wrong (e.g 710 bpm instead of 730)

Max 1m:

- General descriptions of two differences without relevant quotes.

- (ii) Describe: There was an increase in mean heart rate/min from 430 to 730/ [3]
there was an increase by about 290-300 bpm;
Max 1m

AND any 2:

Explain:

From day 0 to 20:

- body mass/ size increased resulted in increase in heart rate to increase rate of blood flow to the body during growth;
- As the heart (muscles) developed/increased in size, there was an increase in its ability to contract faster;

Days 0-15:

- heart (muscles) still underdeveloped/ weak, thus beat at lower rate;

Days 15-20:

- heart muscles had developed larger/ grown stronger thus rate stabilised
- heart muscles become conditioned/accustomed/adapted/resistant/got used to the shocks thus rate stabilised;

Max 2m

Accept: heart stopped developing (BOD)

Reject: Days 15-20, heart rate has reached its limit/ maximum (this is just describing "plateau" in other words, not explaining)

Reject: electric shocks stimulated heart muscle to contract/pump/beat faster/caused an increase in heart rate (this is an explanation for difference between Group A and B)

Reject: heart muscle builds up / rat's body got used to the electric shocks

Reject: electric shocks caused blood to flow faster

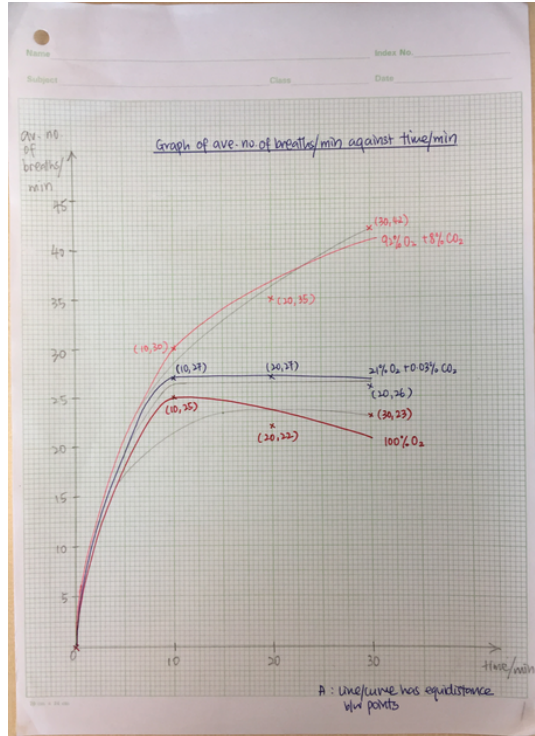
Reject: electric shocks caused heart to weaken, causing heart to pump faster to compensate (if heart is weakened, it will pump slower, not faster)

Marker's comment:

- Several students misread the question as a comparison between Days 0-15 between Group A and B.

Section B

- 7 (a) S – Appropriate scale, at least $\frac{3}{4}$ size (Reject: OS - odd scale) [5]
 P – Accurate plotting of points for all three graphs
 L – Best fit line/curve for all three graphs
 A – x and y axes correctly labelled with appropriate units (y: ave no. of breaths/min + x: time/min)
 T – Title with units (Graph of ave no. of breaths/min against time/min)



- (b) Comparison [1m]: [2]

- Breathing rate is highest for 92% oxygen & 8% CO₂, while lowest for 100% oxygen;
- For the 21% / 100% oxygen, there is no significant change in the average number of bpm as compared to 92% oxygen which showed an increase;

Quote relevant data to support comparison [1m]

(graph + time + no. of breaths):

- At 30th min, breathing rate for 92% oxygen at 42 bpm while at 21% oxygen it was 26 bpm/ 100% oxygen it was 23 bpm;
- For 92% oxygen with 8% CO₂, the average number of bpm increased significantly with 42 bpm versus 26 and 23 bpm at the 30th min / 8% CO₂ increased ave no of bpm from 30 to 42 or $\frac{12}{30} \times 100\% = 40\%$ more

Accept: any other logical quotes

Max 1m:

- if only describing the 3 graphs with no clear comparison shown [NAQ]
- Irrelevant quotes [IQ] / No quotes [NQ]

- 7 (c) (I) Room full of people will have decreased oxygen concentration / increased CO₂ concentration [3]
(II) When a person finds it hard to breathe, the person will have a faster breathing rate/ take in more breaths per minute;
(III) no. of breaths per minute increased when there is 8% CO₂ as compared to atmospheric air / 100% oxygen, thus showing that the stimulus for breathing is CO₂ and not oxygen / increase CO₂ leads to increase rate of breathing/ Showing that drop in O₂ is not the factor to cause increase in breathing rate;

Accept: comparing 21% O₂ to 100% O₂ graph (note that this is a weak comparison)

Reject: Agreeing with statement but goes on to state that increase in CO₂ concentration causes increase in breathing rate (SOG)

Reject: no marks [NMP] given for simply comparing 92% oxygen graph to other graphs as this has been asked in (b).

Concept Error: since CO₂ is stimulus for breathing, the people in the room will not find it hard to breathe. (If CO₂ is stimulus, it will trigger higher rate of breathing, which is an indication that it is harder to breath. See point (II).)

Marker's comment: many students simply stated CO₂ as stimulus for breathing with no reference to the graphs. Stating "as seen from the graphs" is insufficient.

- 8 (a) Liver distributes glucose and amino acids to the rest of the body; [4]
(Insulin secreted by pancreas stimulates) liver to convert the excess glucose into glycogen;
(glucagon secreted by pancreas stimulates) liver to convert glycogen to glucose;
Amino acids used in protein synthesis (e.g. fibrinogen);
Excess amino acids deaminated (to form glucose)(and urea);
Excess glucose are converted to fats and stored in the liver (and other adipose tissues);
If glycogen stores are depleted during starvation, fats are oxidized to produce energy (and ketone bodies);

Marker's comment: Accept conversion of lactic acid back to glucose, any points relating the secretion of bile to emulsify fats. Reject any functions of liver not relating to metabolism of nutrients listed in the question.

Wrong concept in same sentences will render the whole sentence without marks. Common mistake is liver secrete insulin/glucagon or conversion of glucagon to glucose.

Max 4

- 8 (b) (i) $15/100 \times 3 \text{ glasses} \times 190\text{cm}^3 = 85.5 \text{ cm}^3$ [2]
 $85.5 \text{ cm}^3 / 10 \text{ units} = 8.55 \text{ units}$
 Accept: 8.5 or 8.6

Accept:

Total vol = $190 \times 3 = 570 \text{ cm}^3$

1AU – 10 cm^3 of 100% alcohol

? AU – 570 cm^3 of 15% alcohol

- $570 \times (15/100) = 85.5 \text{ cm}^3$ of 100% alcohol
 = divide by 10 = 8.55AU

Accept:

1 AU – 10 cm^3 100% alcohol

1 x 0.15 – 10 cm^3 15% alcohol

$0.15 \times 19 \times 3 = 190 \text{ cm}^3 \times 3 \text{ glasses} \times 15\% \text{ alcohol}$

8.55 AU

Marker's comments: Only accept AU and also 1 mark for working if working is correct but answers is wrong eventually.

- (ii) 1 AU needs 1 hr so 8.55 AU needs 8.55 hours; [1]
 Accept: 8.5 or 8.6 hours

Marker's comments: ECF is given only to wrong answer in part (i) but reasoning/working correct at part (ii).

- (c) (i) Medical condition: fatty liver/ liver cirrhosis/liver damage/liver failure; [1]

- (ii) [2]
 Treatment for liver cirrhosis:
 Liver transplant; if liver stopped functioning;

Accept Suggest & explain treatment for fatty liver:

Increase exercise; to convert fats to glucose to decrease fat deposits;

Control diet; to decrease possibility of formation of fats in liver;

Marker's comments: Reject alcoholism, ulcers and other non-liver related diseases. No ECF when disease is stated wrongly. Reject vague answers.

9 Either

- (a) At light intensity beyond 200 units; [4]

Rate of photosynthesis is already at 30 arbitrary units maximum;

It grows in shady condition (in the forest);

Suggestion: Plant may be very small so may have less leaf surface area to trap light;

Accept: It may have less chloroplasts

Reject: It is adapted (too vague)

Reject: Light intensity is not a limiting factor (cos happen to both plants, Q asked for why J has lower plateau than T)

- (b) Light intensity from 0 to 600 units; [6]

the increase in light intensity increases the rate of photosynthesis from 0 to 205 units;

Reason: Photolysis stage of photosynthesis / light is used to break water into oxygen and hydrogen ions;

Accept: Increase size of stoma so faster rate of carbon dioxide diffusing in for photosynthesis

Beyond 600 units light intensity;

the rate of photosynthesis remains constant / at 205 units;

Reason: Light is no longer the limiting factor but carbon dioxide concentration / temperature becomes the limiting factor that causes the leveling off of the graph;

Marker's comment: Students did not quote data.

- (a) Marker's comment: Q is **not** about the functions of the LV & 3 blood vessels. [4]

Students were expected to read the pattern in the graph and EXPLAIN the change in pressure

LV = Large fluctuation in pressure (from 0 to 120 mmHg) because (muscular wall) of LV contracts and relaxes; MAX 1

Accept: Ventricular systole and diastole

Arteries = Rhythmic pulsing (from 80 to 120 mmHg) due to recoiling of (thick muscular and elastic) wall; MAX 1

Accept: decreasing pressure due to further distance away from heart;

Accept: strong pressure due to aorta receiving blood directly from LV

Capillaries = decreasing pressure (from 20 to 5 mmHg) due to branching of artery into smaller capillaries; MAX 1

Reject: decreasing pressure so that enough time for exchange of substances / capillary one cell thick so need low pressure in order not to burst it (not answering question, Q is not on function of capillary)

Reject: low pressure due to deoxygenated blood (concept error)

Veins = Focus is on why constant pressure (at 5 mmHg) so reason is that the blood flow is due to skeletal muscles massaging the veins; MAX 1

Reject: Vein is furthest from heart (then pressure should keep dropping)

Accept: Lowest pressure due to large lumen to diameter ratio so least resistance to blood flow

- (b) Marker's comment: Q asked for 'describe' the preventive measure but students only 'list' e.g. stop smoking. [6]

List factor = Diet rich in cholesterol / saturated animal fats;

Reject: Diet high in fats (not all fats are bad, some needed for cell membrane)

Describe prevention = Polyunsaturated plant fats should substitute animal fats as they do not stick to the inner wall of the coronary arteries / may lower the cholesterol level in the blood;

List factor = Emotional stress;

Describe prevention = regular physical exercise strengthens the heart and maintains the elasticity of the arterial walls / the risk of high blood pressure or hypertension can be greatly reduced;

Accept: Proper stress management (textbook p169)

List factor = Smoking;

Describe prevention = Stop smoking as nicotine increases heartbeat rate and blood pressure / increases risk of blood clots in arteries which leads to increased risk of coronary heart disease

OR carbon monoxide narrows the lumen of arteries and leads to increase in

blood pressure

List factor = Sedentary life style / lack exercises / obesity;

Describe prevention = exercise regularly to strengthen heart / maintain elasticity of arterial wall;

List factor = Age / genetic predisposition;

Describe prevention = regular checkup to detect early symptoms of heart disease;