QUESTION 1

(a) Golgi apparatus *Jasad Golgi*

(b) P : Transport vesicle from the endoplasmic reticulum
: *Vesikle pengangkutan dari retikulum endoplasma*

Q : Transport vesicle which leaves the Golgi apparatus
: *Vesikel pengangkutan yang meninggalkan jasad Golgi*

Y : Plasma membrane *Membran plasma*

(c)
1. The Golgi apparatus modifies the proteins and lipids it receives from the endoplasmic reticulum before packaging them into vesicles and transporting them to their destinations.
Jasad Golgi mengubahsuaikan protein dan liptd yang diterimanya dari retikulum endoplasma sebelum membungkusnya ke dalant vesikel dun mengangkutnya kepada destinasinya.

2. The Golgi apparatus is some plant cells manufactures certain macromolecules such as pectins and non-cellulose polysaccharides.
Jasad Golgi dalam sesetengah sel tumbuhan menghasilkan makromolekul tetentu seperti pektin dan polisakarida yang bukan selulosa.

(d) R: Lysosome / *Lisosom*

(e) Animal cell : A goblet cell in the epithelium of the intestine which secretes mucus.
Sel haiwan : *Sel goblet dalam epitelum usus yang merembeskan mukus.*
Plant cell : A cell in the root cap which secretes a slimy lubricant.
Sel tumbuhan : *Sel dalam penutup akar yang merembeskan pelincir bertendir.*

(f) The transport vesicle. P, which carries proteins and lipids from the endoplasmic reticulum fuses with the membranes of the Golgi apparatus and empties its contents into the space between the membranes. The enzymes in the Golgi apparatus modify these proteins and lipids. The Golgi apparatus then package these products into vesicles (Q) which are pinched off then fuse with the plasma membrane (Y) before their contents are released outside the cell.
Vesikel pengangkuian P, yang mengangkut protein dan lipid dari retikulum endoplasma mencantum dengaa membran jasad Golgi dan membebaskan kandungannya ke dalam ruang di antara membran. Eniim dalam jasad Golgi mtngubahsuaikan protein dan lipid int. Jasad Golgi kemudian membungkuskan hasil ini ke dalam vesikel (Q) yang dipicit keluar dan kemudian mencamum dengan membran plasma (Y) sebelum kandungannya dibebaskan ke luar sel

QUESTION 2

(a) Monosaccharides (simple sugar) *Monosakarida (gula ringkas)*

(b) A brick-red *precipaaie/Mendakan merah bata*

(c) (i) Sucrose: The blue solution remains unchanged,
(ii) Fructose: A brick-red precipitate is formed.
Fruktosa: Sualu mendakan merah bata terbentuk,
(iii) Galactose: A brick-red precipitate is formed.
Galakiosa; Sualu mendakan merah bata terbentuk.

(d) Sucrose is not a reducing sugar but fructose and galactosc are reducing sugars.
Sukrosa bukan merupukan gula penurun tetapi fruktosa dan gaiaklosa adalah gula penurun.

(e) Disaccharide

(f) Sucrose can be converted to a monosaccharide by adding dilute hydrochloric acid to it and then heating it.
Sukrosa boleh ditukar menjadi monosakarida dengan menambah acid hidroklorik ke dalamnya dan kemudian memanaskannya.

(g) In the ileum (small intestine)
Di dalam ileum usus kecil

(h) Sucrose + water $\rightarrow$ glucose + fructose
Sukrosa + air $\rightarrow$ glukos + fruktosa

(i) Hormone: Insulin / *Insulin*
Organ: Pancrcas / *Pankreas*

QUESTION 3

(a) Involvement of the synthesis and secretion of extracellular enzymes:
Penglihalan organel-arganei dalam sintesis dan rembesan enzim luar sel:
- Mitochondria generate ATP needed for the synthesis process.
Mitokondrion menjana ATP vang diperlukan unltik proses sinlesis.
- Nucleus contains DMA or genetic information to **code** for synthesis of specific proteins. The genetic information is transcribed from DNA to RNA in the nucleus.
Nukletis mengandungi DNA atau maklumar genetik yang dikod untuk sinfests protein yang spexifik. Makluntat genetik dirranskrip dari DNA ke RNA datam nukttm.

- The RNA/messenger RNA leaves the nucleus and attaches to ribosomes on the rough endoplasmic reticutum.
  RNA/mRNA meninggalkan nukleus dan melekat pada ribosnm pada falinan endoplastma kasar.
- Proteins synthesised by ribosomes are transported in the rough endoplasmic reticulum. Transport vesicles containing proteins are budded off from the rough endoplasmic reticulum.
  Protein yang disinfesis oleh ribosom diangkul dalamjalina, endoplasma kasar, Vesikel pembawa yang mengandungi protein terronjol keluar dari jalinan endoplasma kasar.
- The transport vesicles fuse with the Golgi body. The proteins are modified, carbohydrate chains are added to some proteins to form glycoproteins.
  Vesikel pembawa hergabung dengan josad Golgi. Protein itu diubah suai, rantai karbahidrat ditambah kepada sesetengah protein unluk membentuk glikoprotein.
- Secretory vesicles containing inactive enzymes are budded off from the Golgi apparatus. *Vesikel pembawa bergantung menganJungi enzim tak aktif berlonjol keluar dari jasad Golgi.*
- The inactive enzymes are activated by external environment.
  Enzim yang tak aktif diaktifkan oleh persekitaran luaran.
- Differences between extracellular and intracellular enzymes:
  Perbezaan antara enzim luar sel
- Extracellular enzymes are produced in the cell and are secreted outside the cells to function externally.
  Enzim luar sel dihasilkan di dalam sel dan dirembes ke luar sel untuk berfungsi secara luaran.
- Intracellular enzymes function inside the cells.
  Enzim dalam sel berfungsidi dalam sel

(b) P: Substrate *Substra*
  Q: Active site of enzyme / *Taptik aktif enzim*
  R: Enzyme *Enzim*
  S: Product *Hasil*
  Lock-and-key hypothesis:
  Hipotesis mangga dan kunci:
  * The substrate has a shape that is complementary to the active site of the enzyme.
  Substrat mempunyai bentuk yang melengkapkan tapak aktif enzim.
  • The shape of the substrate acts as a key which fits exactly into the active site of the enzyme (lock).
  Bentuk substrat bertindak sebagai kunci yang berpadanan dengan tapak aktif enzim mangga
  • Reaction occurs and the products formed are released.

Tindak balas berlaku dan hasil yang terbentuk dibebaskan.
• The enzyme remains unchanged at the end of the reaction.
Enzim yang tertinggal tidak berubah pada akhir tindak balas.

QUESTION 4
(a) - Mitosis occurs in the apical meristem.
  Mitosis berlaku dalam meristem apeks.
- Before mitosis begins, the cells are in the interphase stage.
  Sebelum mitosis bermula, sel-sel berada dalam peringkat interfasa.
- The chromosomes undergo replication through a series of
  Kromosom-kromosom mengalami replikasi secara berperingkat
- At the prophase stage, the chromosome thickens, shortens and can be seen as identical chromatids.
  Pada peringkat profasa, kromosom menebal, memendek dan boleh dilihat
- The nuclear membrane disintegrates and the spindle fibre forms.
  Membran nukleus mengurai akan gentian gelendong terbentuk.
- At the metaphase stage, the chromosomes line up at the equator and are held by spindle fibres at the centromere.
  Pada peringkat metafasa, kromosom-kromosom tersusun pada satah khatulistiwa akan dipegang oleh gentian gelendong pada semtromer.
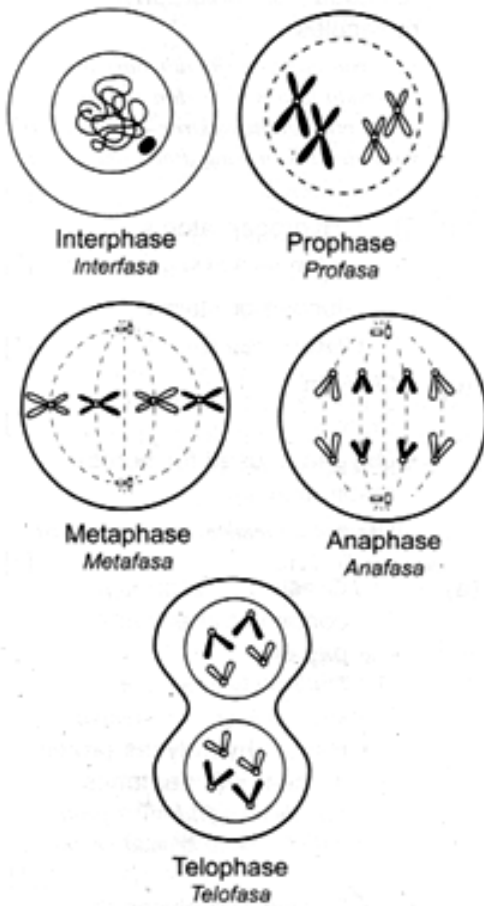- At the anaphase stage, each chromatid pair separates at the centromere and moves towards the opposite poles.
  Pada peringkat anafasa, setiap pasang kromatid berpisah pada sentromer dan bergerak ke arah kutub-kutub bertentangan.
- At telopase stage, the nuclear membrane is formed again.
  Pada peringkat telofasa, membran nukleus terbentuk semula.
- Cytoplasmic division (in animal cells) and formation of the cell plate (in plant cells) complete the division thus producing two diploid daughter cells.
  Pembahagian sitoplasm (dalam sel haiwan) dan pcmbentukan pada sel (dalam sel tumbuhan) melengkapkan pembahagian lalu menghasilkan dua sel anak diploid.
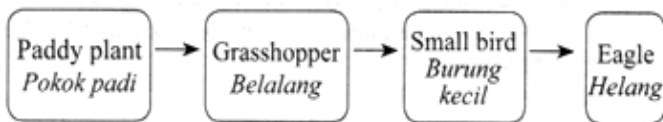
Interphase
Interfasa

Prophase
Profasa

Metaphase
Metafasa

Anaphase
Anafasa

Telophase
Telofasa

[5]

(b)

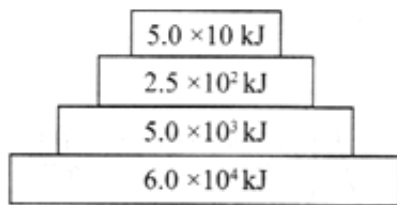| Mitosis	Meiosis
Occurs in somatic cells. *Berlaku dalam sel*	Occurs in gonad cells. *Berlaku dalam sel gonad.*
Divides only once. *Membahagi hanya sekali*	Divides twice. *Membahagi dua kali.*
Two daughter cells are produced. *Duo sel onak dihasilkan.*	Four daughter cells are produced. *Empat sel anak dihasilkan.*
The number of chromosomes in the daughter cells is the same as the number of chromosomes in the parent cell. *Bilangan kromosom dalam sel anak adalah sama dengan bilangan kromosom dalam sel induk.*	The number of chromosomes in the daughter cells is half the number of chromosomes in the parent cell. *Bilangan kromosom dalam set anak adalah separuh daripada bilangan kromosom dalam sel induk.*
The genetic constitution of daughter cells is the same as the parent cell. *Kandungan genetik sel-sel anak adalah sama dengan sel induk.*	The genetic constitution of daughter cells is different from the parent cell. *Kandungan genetic sel-sel anak adalah berbeza daripada sel induk.*
Synapsis and crossing over does not occur. *Sinapsis dan pindah silang tidak berlaku.*	Synapsis of homologous chromosomes occur during prophase 1. Crossing over occurs. *Sinapsis kromosom homolog berlaku semasa Profasa 1. Pindah silang berlaku.*

QUESTION 5

(a) (i) Organism L / *Organisma L*

(ii) Organism L has the highest energy compared to other organisms.
Organisms L mempunyai tenaga yang paling tinggi berbanding dengan organisma yang lain.

(b) (i) Organism M / *Organisma M*

(ii) Organism M has the lowest energy compared to other organisms.
Organisma M mempunyai tenaga yang paling rendah berbanding dengan organisma yang lain.

(c) (i)

(ii)

Eagle- the 4th trophic level
Helang- aras tropik keempat
Small bird- the 3rd trophic level
Burung kecil- aras tropik ketiga
Grasshopper- the 2nd trophic level
Belalang- aras tropik kedua
Paddy plant- the 1st trophic level
Pokokpadi- aras tropik pertama

(iii) Some energy are lost during respiration / metabolism/ growth.
Sesetengah tenaga hilang semasa respirasi / metabolisms/ pertumbuhan.

(d) The population of L will increase. The population of M will decrease.
Populasi L akan bertambah. Populasi M akan berkurang.

QUESTION 6

(a) • His sitting posture is correct.
Postur duduk adalah betul. [1]

• When he sits upright with the back against the back of the chair, the weight of the body is on the thigh muscles.
Apabila dia duduk tegak dengan bahagian belakang badan bersandar pada kerusi, berat badan menumpu pada otot paha. [2]

• Slouching puts the body weight on the hips and cramps internal organs, disturbs blood circulation and sending of nerve impulses.
Duduk membongkok menyebabkan berat badan ditekan pada bahagian punggung dan menganggu fungsi organ dalaman, peredaran darah dan penghantaran impuls saraf. [2]

• His standing posture is not correct as he hunches when he stands.
Postur berdiri adalah tidak betul kerana badannya membongkok. [1]

• He should stand with the head, vertebral column, hips and legs aligned at a centre line.
Dia patut berdiri dengan kepala, turus vertebra, punggung dan kaki berada pada satu garisan tegak yang lurus. [1]

• The body weight will then be on the feet.
Berat badan akan menumpu pada kaki. [1]

• He would cramp his internal organs, resulting in backaches and shoulder aches.
Organ dalaman akan dimampatkan lalu menyebabkan sakit belakang dan sakit bahu. [1]

• Walking posture is not correct.
Postur berjalan adalah tidak betul. [1]

• Body should be upright with head held high as walking with a hunch tires our body easily.
Badan patut tegak dengan kepala terangkat ke atas ketika berjalan. Badan akan cepat letih jika berjalan dengan badan yang membongkok. [1]

Maximum / Maksimum: 10

(b) Ageing may cause osteoporosis and arthritis.
Pertambahan usia boleh menyebabkan osteoporosis dan artritis. [1]
- Osteoporosis / *Osteoporosis*
  - Bones become brittle, porous, lighter
    Tulang menjadi rapuh, poros dan lebih ringan [1]
  - Usually affects menopausal women
    Biasanya berlaku di kalangan wanita yang putus haid [1]
  - Reduce oestrogen levels and bone strength
    Mengurangkan aras estrogen dan kekuatan tulang [1]
  - Bones may fracture easily
    Tulang mudah patah [1]
- Arthritis / *Artritis*
  - Inflammation of the joint causes the joint to be swollen, stiff and painful.
    Keradangan (inflamasi) pada sendi menyebabkan sendi menjadi bengkok, kaku dan sakit. [1]
  - Osteoarthritis occurs when the cartilage wears off due to excessive wear and tear.
    Osteoartritis berlaku apabila rawan menjadi haus disebabkan penggunaan yang berlebihan. [1]
- Rheumatoid arthritis is the inflammation of the synovial membrane at the joints.
  Reumatoid artritis ialah inflamasi membran sinovia pada sendi. [1]
- Gout is due to deposition of uric acid in the joints.
  Gout disebabkan pengumpulan asid urik pada sendi. [1]
- Uric acid is a waste product of protein and is excreted in the urine.
  Asid urik ialah bahan buangan protein dan dikumuhkan dalam air kencing. [1]
- Ageing may cause less synovial fluid to be produced.
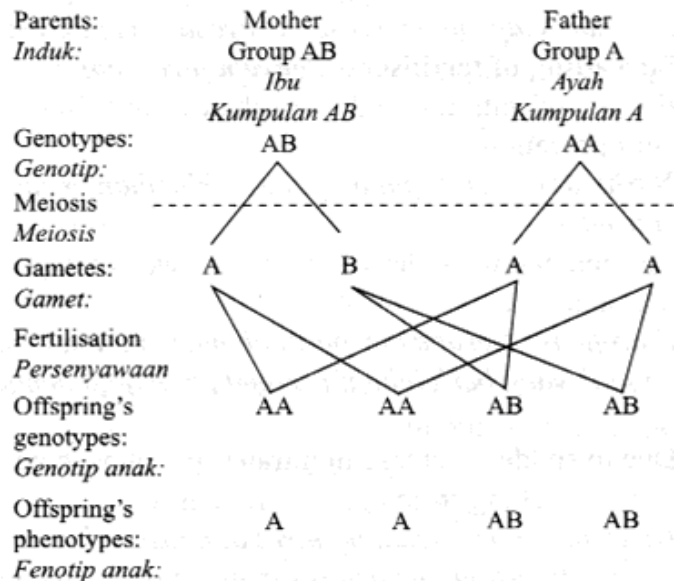 *Peningkatan usia boleh menyebabkan pengurangan cecair sinovia yang dihasilkan.* [1]
- Joints may be painful when there is less synovial fluid to lubricate the joint.
  Sendi menjadi sakit apabila terdapat kurang cecair sinovia untuk mengurangkan geseran pada sendi. [1]
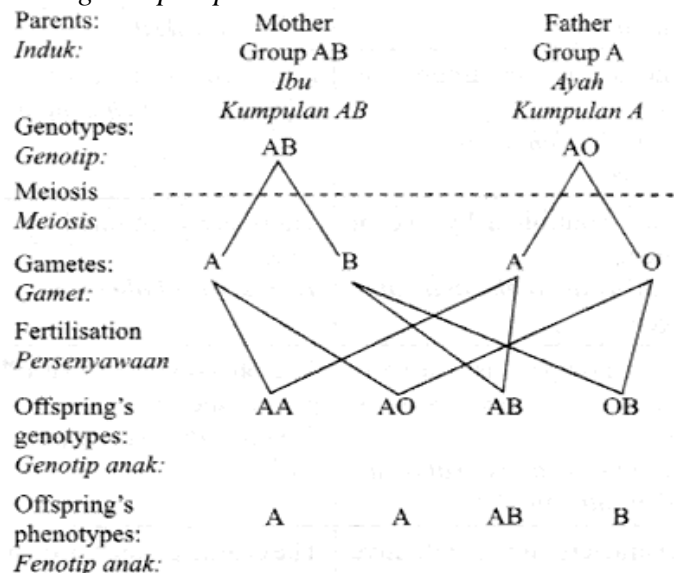
Maximum / *Maksimum*: $\underline{10}$

QUESTION 7

(a) - There are two possibilities, depending on whether the father has the AA or AO genotype.
   Terdapat dua kemungkinan, berganlung sama ada bapa yang mempunyai genotip AA atau AO.
   - If the father has the AA genotype:
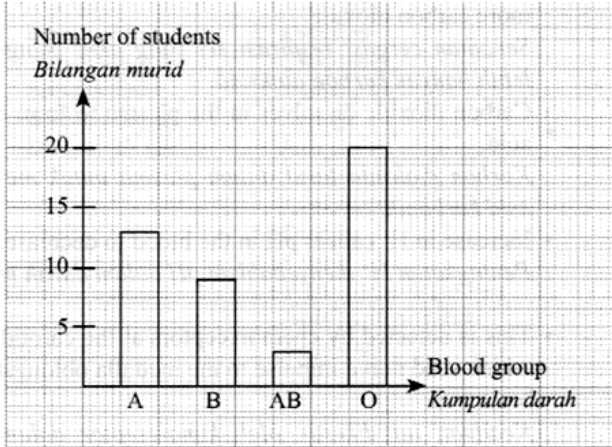   *Jika genotip bapa ialah AA:*

- 50% of the offspring have blood group A and 50% of the offspring have blood group AB. *50% anak memiliki ialah kumpulan darah A dan 50% anak memiliki kumpulan darah AB.* [1]
- If the father has the AO genotype:
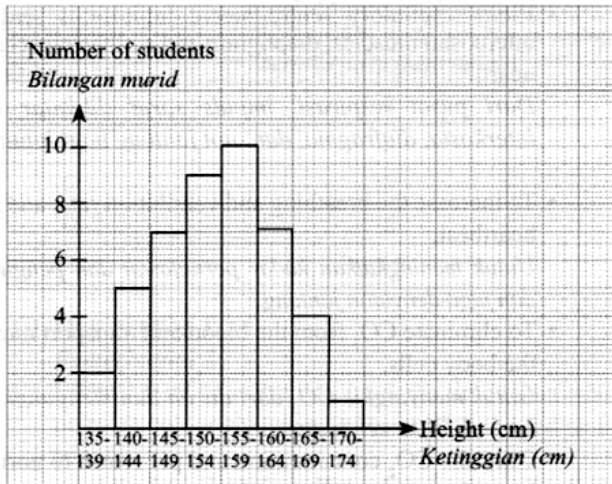 *Jika genotip bapa ialah AO:*

- 50% of the offspring have blood group A and 25% of the offspring have blood groups AB and B respectively.
  50% anak memiliki kumpulan darah A dan 25% anak masing-masing memiliki kumpulan darah AB dan B.

(b)

[2]

[2]

Similarities: Both types of variations exhibit differences among members of a same species.
Persamaan: Kedua-dua jenis variasi menunjukkan perbezaan antara ahli bagi spesies yang sama. [1]

Differences/ *Perbezaan*:

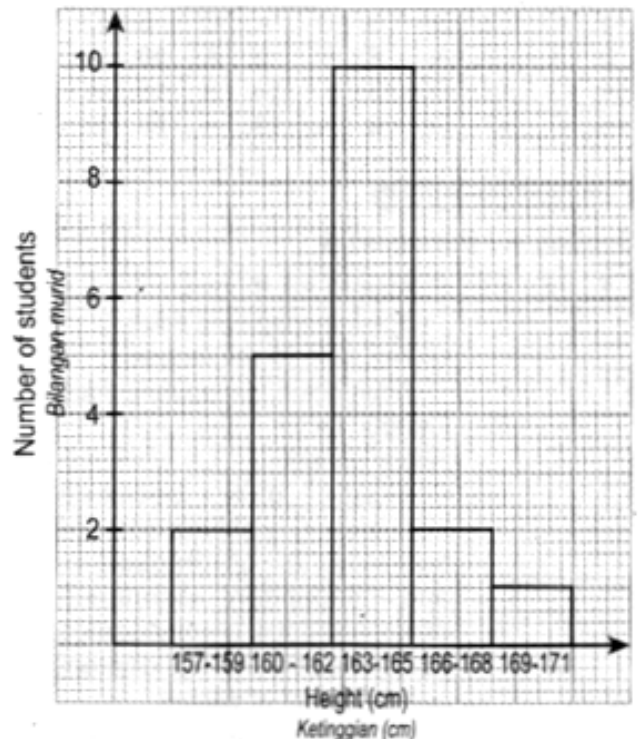| Height *Ketinggian*	Blood group *Kumpulan darah*
Continuous variation *Variasi selanjar*	Discontinuous variation *Variasi tak selanjar*
Normal distribution *Taburan normal*	Discrete distribution *Taburan diskrit*
Influenced by environmental factors *Dipengaruhi oleh faktor persekitaran*	Influenced by genetics *Dipengaruhi oleh genetik*

Traits are controlled by two or more genes. *Trait dikawal oleh dua atau lebih gen.*	Traits are controlled by a single gene. *Trait dikawal oleh gen tunggal.*
The phenotype is usually controlled by many pairs of alleles. *Fenotip biasanya dikawal oleh banyak pasangan alel.*	The phenotype is controlled by a pair of alleles. *Fenotip dikawal oleh sepasang alel.*
The characters are quantitative or measurable. *Ciri-ciri adalah kuantitatif atau boleh diukur.*	The characters are not quantitative. *Ciri-ciri bukan kuantitatif.*

QUESTION 8

(a)(i)

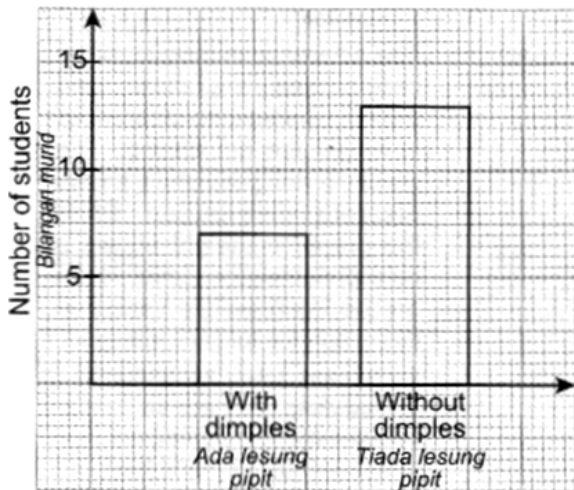| Height *Ketinggian* (cm)	Number of students *Bilangan murid*
157 – 159	2
160 – 162	5
163 – 165	10
166 – 168	2
169 – 171	1

(ii)

(b)(i) Continuous variation / *Vanasi seianjar*
  (ii) There are no distinct differences OR There are intermediate values OR The graph follows a normal distribution curve.

6

Tidak ada perbezaan yang ketara ATAU Terdapat nilai perantaraan ATAU Graf menunjukkan taburan normal.

(c)(i)

(ii) There are no intermediate values OR the graph shows discrete distribution.
Tidak ada nitai perantaraan ATAU Graf menunjukkan taburan diskrit.

(d) Identical twins have the same genotypes. Both girls have dimples as having dimples is a trait controlled by a pair of alleles. Having dimples is an example of discontinuous variation and is not affected by environmental factors Height is an example of continuous variation which is influenced by environmental factors such as diet and exercise.
Kembar seiras mempunyai genotip yang sama. Kedua-dua gadis itu mempunyai lesung pipit kerana kehadtran lesung pipit dikawa! oleh sepasang ate/ Kehadtran lesung pipit lalah contoh variasi tak selanjar dan tidak dipenganihi oleh faktor persekitaran Ketinggian ialah vanasi selanjar dan dipengaruhl oleh faktor persekitaran seperti gizi dan senaman.

Paper 3

QUESTION 1

(a)

Type of activity *Jenis aktiviti*	Length of air column (cm) *Panjang turus udara (cm)*	
	Before treatment *Sebe'um rawatan*	After treatment *Selepas rawatan*
A	6.4	6.2
B	6.4	6.0
C	6.4	5.7

(b) (i) 1. For activity A the length of air column after treatment with potassium hydroxide is 6.2 cm.
Bagi aktiviti A, panjang turus udara selepas rawatan dengan kalium hidroksida ialah 6.2 cm.

2. For activity C the length of air column after treatment with potassium hydroxide is 5.7 cm.
Bagi aktiviti C, panjang turus udara selepas rawatan dengan kalium hidroksida ialah 5.7 cm.

(ii) 1. The length of air column for activity A is the longest because it contains the least carbon dioxide.
Panjang turus udara bagi aktiviti A adalah paling panjang kerana ia mengandungi paling sedikit karbon dioksida.

2. The length of air column for activity C is the shortest because it contains the most carbon dioxide.
Panjang turus udara bagi aktiviti C adalah paling pendek kerana ia mengandungi paling banyak karbon dioksida. -

(c)

Variable *Pembolehubah*	Method to handle the variable *Cara mengendali pembolehubah*
Manipulated variable *Pembolehubah dimanipulasikan* Type of activity *Jenis aktiviti*	Change the type of activity *Menukar jenis aktiviti*
Responding variable *Pembolehubah bergerak balas* Final length of air column *Panjang akhir turus udara*	Measure and record the length of air column using the (scales) on the J-tube *Ukur dan rekod panjang turus udara menggunakan skala pada tiub-{*
Constant variable *Pembolehubah dimalarkan* Duration of activity *Tempoh aktiviti*	Fix duration of activity for 30 minutes *Menetapkan tempoh aktiviti selama 30 minit.*

(d) The more vigorous the activity, the shorter the air column after treatment with potassium hydroxide, the more carbon dioxide is produced.
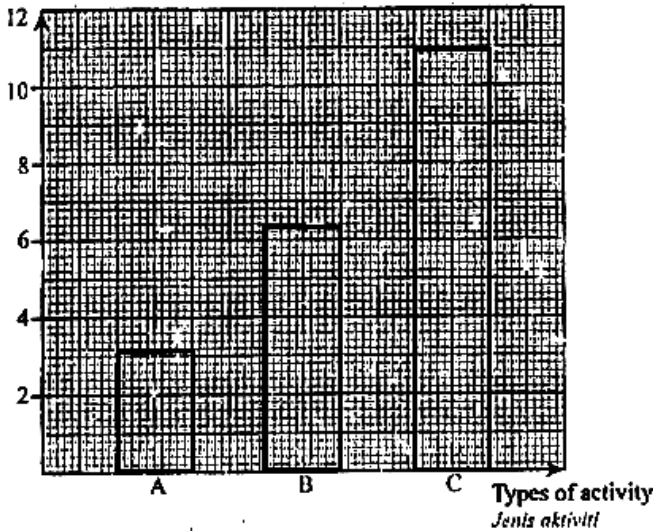*Semakin cergas sesuatu aktiviti, semakin pendek turus udara selepas rawatan dengan kalium hidroksida, lebih banyak karbon dioksida dihasilkan.*

(e) (i)

Type of activity *Jenis aktiviti*	Change in length of air column (cm) *Perubahan panjang turus udara (cm)*	Percentage of carbon dioxide (%) *Peratus karbon dioksida (%)*
A	0.2	3.13
B	0.4	6.25
C	0.7	10.94

(ii)
Percentage of carbon dioxide (%)
Peratusan karbon dioksida (%)

(f) When the activity is more vigorous, the higher the percentage of carbon dioxide produced because the respiration rate / metabolic rate is higher and more glucose is oxidized.
Apabila aktiviti bertambah cergas, semakin tinggi kepekatan karbon dioksida yang dihasilkan kerana kadar respirasi/ kadar metabolisme lebih tinggi dan lebih banyak glukosa dioksidakan.

(g) The air column is shorter, less than 6.2 cm because more carbon dioxide is produced due to the increase in respiration rate.
Turus udara menjadi lebih pendek, kurang dari 6.2 cm kerana lebih banyak karbon dioksida dihasilkan akibat peningkatan kadar respirasi.

(h) Exhaled air contains carbon dioxide. The amount of carbon dioxide produced caused the length of air column to change after treatment with potassium hydroxide. More carbon dioxide is produced with more vigorous activity.
Udara hembusan mengandungi karbon dioksida. Jumlah karbon dioksida terhasil menyebabkan panjang turus udara berubah selepas rawatan dengan kalium hidroksida. Lebih banyak karbon dioksida dihasilkan melalui aktiviti yang lebih cergas.

(i)

Type of activity *Jenis aktiviti*	Rate of respiration *Kadar respirasi*
A	Low *Rendah*
B	Medium *Sederhana*
C	High *Tinggi*

(h)

QUESTION 2

(a)

Numbers of laps *Bilangan pusingan*	Time taken to obtain 30 heartbeats *Masa memperoleh untuk 30 kali denyutan jantung* (s)
1	20
2	12
3	10

(b)
Observation 1: *Pemehatian 1:*
The time taken to obtain 30 heartbeats after running one round is 20 seconds.
Masa yang diarabil bagi 30 kali denyutan jantung selepas berlari salu pusingan ialah 20 saat.
Or/*Atau*
The time taken to obtain 30 heartbeats after running one lap is the longest compared to after running two and three laps.

Masa yang diambil bagi 30 kali denyuian jantung selepas berlari salu pusingan ialah yang paling lama/panjang berbanding selepas berlari dua dan tiga puxingan.
Observation2: *Pemerhatian 2:*
The time taken to obtain 30 heartbeats after running two rounds is 12 seconds.
Masa vang diambil bagi 30 kali denyuian jantung xelepus hertari dua pusingan ialah 12.saat.
Or */ Atau*

The time taken to obtain 30 heartbeats after running three rounds is 10 seconds.
Masa yang diambil bagi 30 kali denyulan janiung selepas berlari tiga pusingan ialah 10 saat.

(ii) **Inference for** observation1:
  Inferens untuk pemerharian 1:
When the athlete runs one lap, the time taken to obtain 30 heartbeats is the longest, because the rate of heartbeats is decreases/lower due to muscle cells needs a small amount of oxygen.
Apabila ailei itu berlari salu pusingan, masa yang diambil untuk 30 kali denyutan jantung ialah yang paling lama/panjang kerana kadar denyutan jantung rendah/menurun disebabkan sel-sel oiot memerlukan jumlah oksigen yang sedikit/rendah.

Inference for observation 2:
Inferens untuk pemerhatian 2:

The time taken to obtain 30 heartbeats after running two lap is longer because the cells need small amount of oxygen compared to three laps.
Masa vang diambil untuk 30 kali denyutan jantung selepas berlari dua pusingan lebih panjang/lama kerana set
memerlukan jumlah oksigen yang sedikil berhanding liga pusingan.

Or / Atau
When the athlete runs three laps, the time taken to obtain 30 heartbeats is shortest because the rate of heartbeats is increases/higher due to muscle cells needs a large amount of oxygen.
Apabila allet itu berlari liga pusingan, masa yang diambil untuk 30 kali denyutan jantung ialah yang paling cepat/pendek, kerana kadar denyutan jantung tinggi/meningkat disebabkan sel-sel otot memerlukan jumlah oksigen yang banyak/tinggi.

(c)

Variables / Pemboleh ubah	Method to handle the variables / Cara mengendali pemboleh ubah
The number of laps / Bilangan pusingan	The athlete runs at different number of laps in the school field;1 lap, 2 laps, and 3 laps / *Atlet berlari dalam pusingan yang berbeza di padang sekolah; 1, 2, dan 3 pusingan*
time taken to obtain 30 heartbeats// rate of heartbeats / *Masa yang diambil untuk 30 kali denyutan jantung//kadar denyutan jantung*	• Measure and record the time taken to obtain 30 heartbeats by using a stopwatch / *Mengukur dan merekod masa yang diambil untuk 30 kali denyutan jantung dengan menggunakan jam randik* • Calculate and record the rate of heartbeat by using formula: / *Kira dan rekod kadar denyutan jantung menggunakan formula :* Rate of heartbeat/*Kadar denyutan jantung*: $= \dfrac{\text{Number of heartbeat/}bilangan\ denyutan\ jantung}{\text{time/}masa}$

(d) 1. As the number of laps increases, the time taken to obtain 30 heartbeats decreases. *Semakin banyak bilangan pusingan, masa yang diambil untuk 30 kali dentutan jantung semakin menurun.*
 2. The more the number of laps, the shorter the time taken to obtain 30 heartbeats (vice versa).
  Apabila bilangan pusingan semakin banyak. masa yang diambil untuk 30 kali dentutan jantung semakin pendek (dari sebaliknya).
 3. As the number of laps increases, the rate of heartbeat also increases (vice versa).
  Semakin meningkat biiangan pusingan, kadar dentutan jantung semakin meningkat dan sebaliknya.

(e) (i)

Number of laps / Bilangan pusingan	Time taken to obtain 30 heartbeats / *Masa yang diambil untuk memperoleh 30 kali denyutan jantung* (s)	Rate of the heartbeat / *Kadar denyutan jantung* (s⁻¹)
1	20	1.5
2	12	2.5
3	10	3.0