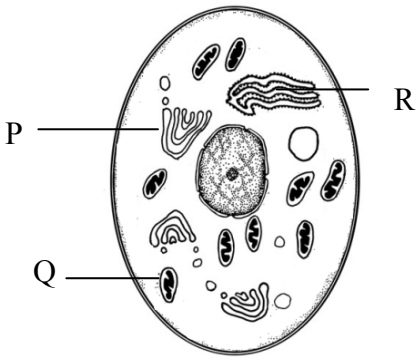
STUDENT'S COPY

SECTION A

1. Rajah 1 menunjukkan satu sel haiwan.
Diagram 1 shows an animal cell.

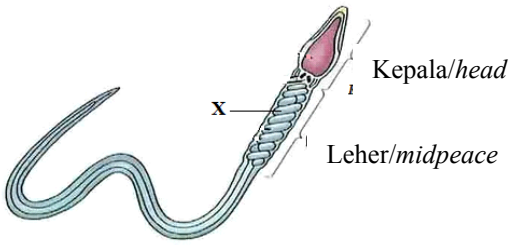


Rajah 1/*Diagram 1*

Apakah P, Q dan R?
What are P, Q, R?

	P	Q	R
A	Jasad Golgi */Golgi Apparatus*	Lisosom/*Lysosome*	Jalinan endoplasma kasar *Rough Endoplasmic Reticulum*
B	Jalinan endoplasma licin/ *Smooth Endoplasmic reticulum*	Lisosom/*Lysosome*	Jasad Golgi */Golgi Apparatus*
C	Jasad Golgi */Golgi Apparatus*	Mitokondria *Mitochondria*	Jalinan endoplasma kasar/ *Rough Endoplasmic Reticulum*
D	Jalinan endoplasma kasar/ *Rough Endoplasmic Reticulum*	Mitokondria *Mitochondria*	Jasad Golgi */Golgi Apparatus*

.2. Rajah 2 menunjukkan sel yang terlibat di dalam pembiakan manusia.
Diagram 2 shows a cell that is involved in human reproduction.



Rajah 2/*Diagram 2*

Mengapa organel X terdapat banyak di dalam sel tersebut?
Why is organelle X found abundantly in that cell?

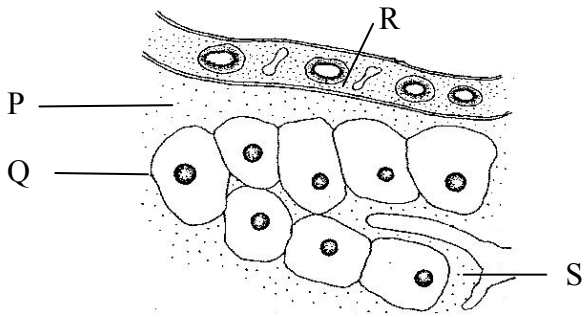
A Untuk mengawal semua aktiviti sel
To control all cell activities

B Untuk membekal nutrien kepada sel
To supply nutrient to the cell

C Untuk mengendalikan proses pembahagian sel
To conduct a cell division process

D Untuk menghasilkan tenaga bagi aktiviti sel yang aktif
To generate energy for actively cell activities

3. Rajah 3 menunjukkan komposisi bendalir di dalam badan haiwan.
Diagram 3 shows the liquid composition of the animal body.

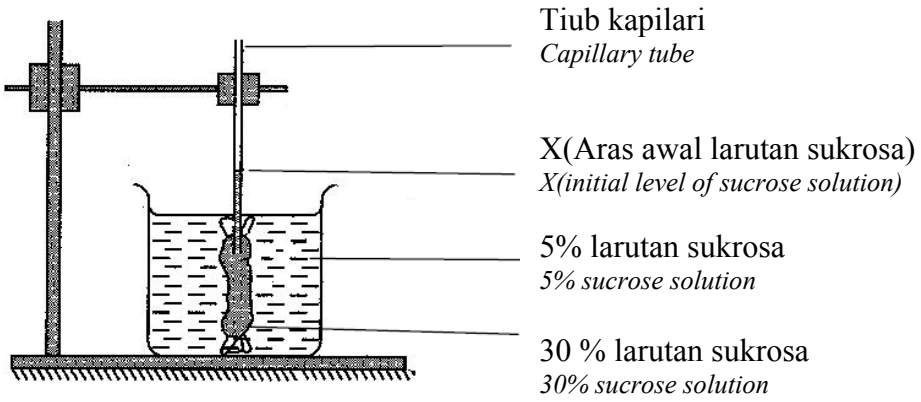


Rajah 3/ *Diagram 3*

Antara berikut yang manakah membentuk persekitaran dalaman?
Which of the following form the internal environment?

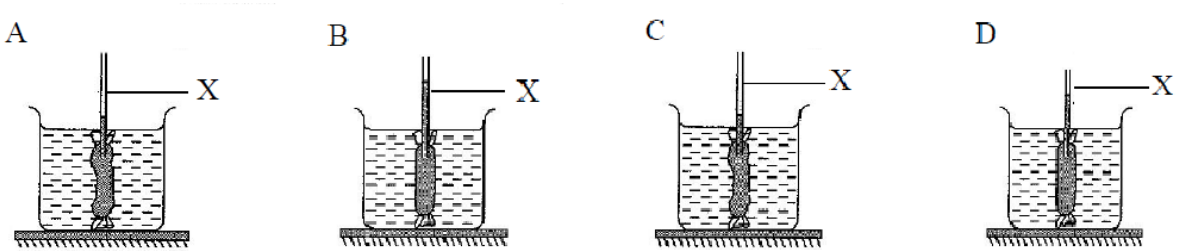
A P, Q, R B P, R, S C Q, R, S D P, Q, S

4. Rajah 4 menunjukkan susunan radas untuk mengkaji osmosis.
Diagram 4 shows the apparatus set-up to investigate osmosis

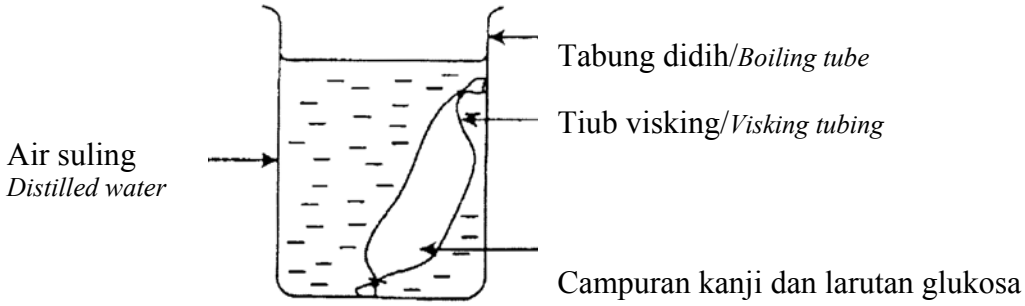


Rajah 4/*Diagram 4*

Antara yang berikut yang manakah dapat diperhatikan selepas 1 jam?
Which of the following will be observed after 1 hour?



5. Rajah 5 menunjukkan pergerakan bahan merentas tiub visking.
Diagram 5 shows the movement of substances across visking tubing.

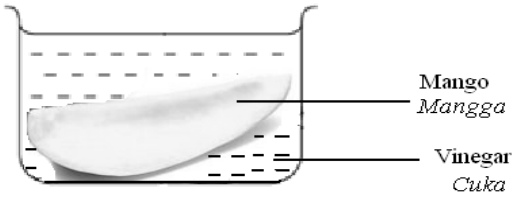


Rajah 5 /*Diagram 5*

Selepas 30 minit, dua sampel air suling dikeluarkan untuk Ujian Iodin dan Ujian Benedict. Manakah antara berikut keputusan yang dijangkakan?
After 30 minutes, two samples of distilled water were removed for iodine test and Benedict`s test. Which of the following are the expected result?

	Ujian Iodin/*Iodine Test*	Ujian Benedict /*Benedict Test*
A	Biru gelap/*Blue black*	Larutan biru/ *Blue solution*
B	Kuning keperangan/ *Brownish –yellow*	Larutan biru/ *Blue solution*
C	Biru gelap/*Blue black*	Mendakan merah bata/*Brick –red precipitate*
D	Kuning keperangan/ *Brownish –yellow*	Mendakan merah bata/*Brick –red precipitate*

6. Rajah 6 menunjukkan satu cara mengawet buah mangga
Diagram 6 shows one way of preserving mango.



Rajah 6/*Diagram 6*

Antara berikut yang manakah menerangkan mengapa mangga boleh tahan lama?
Which of the following explain why the mango can last longer?

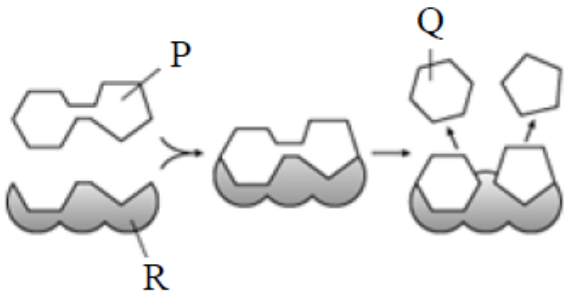
A pH yang rendah adalah tidak kondusif untuk pertumbuhan bakteria
The low pH is not conducive for bacterial growth

B Cuka tersebut menyebabkan mangga bertukar menjadi alkali
The vinegar causes the mango to turn alkaline

C Molekul air meresap masuk ke dalam mangga
The water molecules diffuse into the mango

D Bakteria telah mengalami deplasmolisis
The bacteria are deplasmolysed

7. Rajah 7 menunjukkan mekanisma tindakbalas enzim.
Diagram 7 shows the mechanism of an enzymatic reaction.

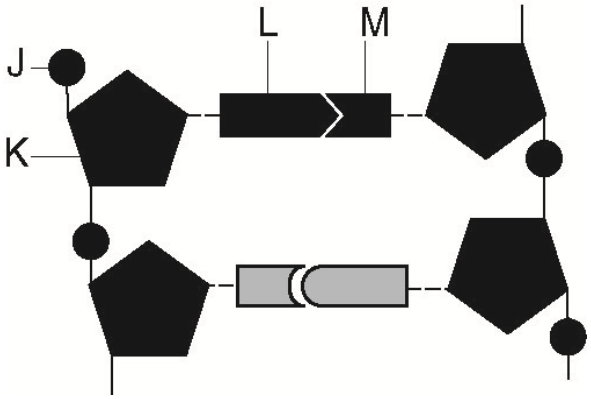


Rajah 7/*Diagram 7*

Apakah P, Q dan R?
What are P, Q and R?

	P	Q	R
A	Enzim /*Enzyme*	Substrat /*Substrate*	Produk/*Products*
B	Substrat /*Substrate*	Enzim /*Enzyme*	Produk/*Products*
C	Produk/*Products*	Enzim /*Enzyme*	Substrate *Substrat*
D	Substrat /*Substrate*	Produk/*Products*	Enzim /*Enzyme*

8. Rajah 8 menunjukkan bahagian struktur molekul DNA. J, K, L dan M adalah asas dalam molekul DNA.
Diagram 8 shows a part of the DNA molecular structure. J, K, L and M are the basic units in the DNA molecule.

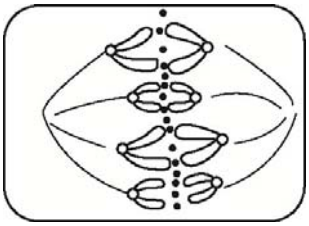


Rajah 8/*Diagram 8*

Manakah antara berikut diwakili oleh J, K, L dan M?
Which of the following is represented by J, K, L and M?

J	K	L	M
Gula/*Sugar*	Bes/*Base*	Fosfat/*Phosphate*	Fosfat/*Phosphate*
Fosfat/*Phosphate*	Bes/*Base*	Gula/*Sugar*	Fosfat/*Phosphate*
Bes/*Base*	Gula/*Sugar*	Bes/*Base*	Fosfat/*Phosphate*
Fosfat/*Phosphate*	Gula/*Sugar*	Bes/*Base*	Bes/*Base*

9. Rajah 9 menunjukkan satu sel haiwan dalam peringkat mitosis.
Diagram 9 shows an animal cell in a mitosis phase.

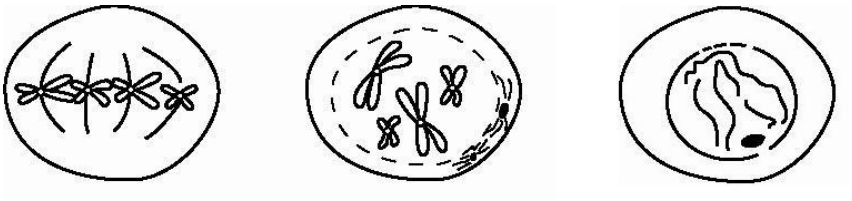


Rajah 9/*Diagram 9*

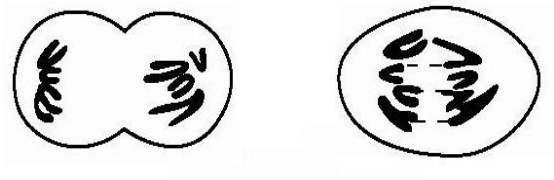
Berapakah bilangan kromosom yang boleh dijumpai dalam sel hati haiwan itu?
What is the number of chromosomes that can be found in the animal's liver cell?

A 16 **B** 8 **C** 4 **D** 2

10. Rajah 10 menunjukkan peringkat-peringkat dalam mitosis.
Diagram 10 shows the stages of mitosis.



I II III



IV V

Rajah 10/*Diagram 10*

Pilih turutan yang betul untuk proses mitosis ini.
Choose the correct sequence for this mitosis process.

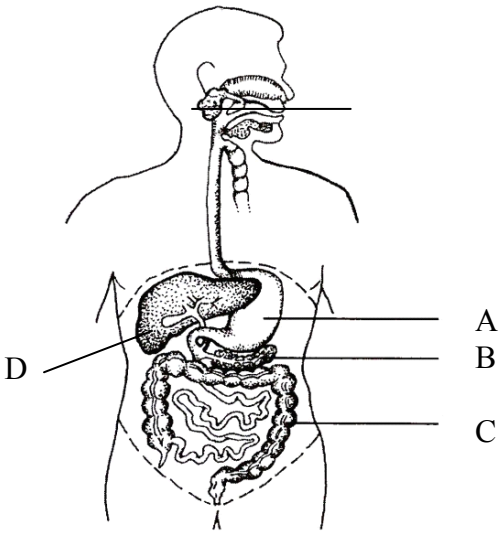
A I → II → III → IV → V
B II → III → I → V → IV
C III → II → I → V → IV
D III → IV → V → II → I

11. Manakah antara berikut, pernyataan yang **benar** tentang meiosis?
*Which of the following statements is **true** about meiosis?*

I Meiosis berlaku semasa pembentukan gamet
Meiosis occurs during the formation of gametes
II Konstitusi gen pada sel anak adalah sama dengan sel induk
The genetic constitution of the daughter cells is the same as parent cell
III Bilangan kromosom dalam sel anak dikurangkan menjadi separuh
The number of chromosomes in daughter cell is reduced by half
IV Dua sel anak dihasilkan di akhir proses meiosis
Two daughter cells are formed at the end of the meiosis process

A I,II dan III sahaja/ *I, II and III only*
B I dan III sahaja/ *I and III only*
C II dan IV sahaja/*II and IV only*
D IV sahaja/*IV only*

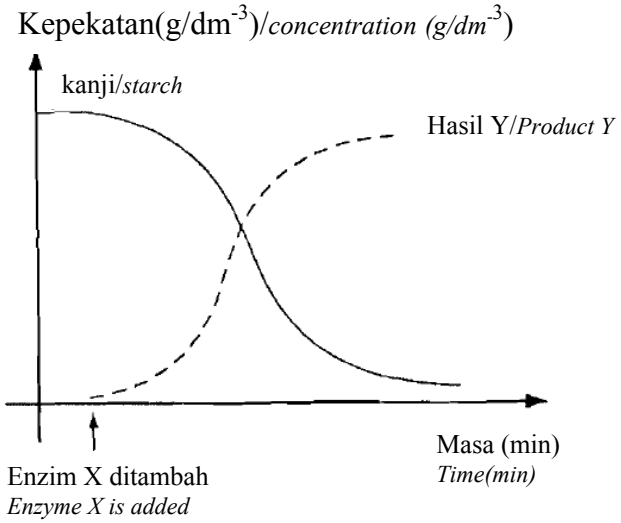
12. Rajah 11 menunjukkan sistem pencernaan manusia.
Diagram 11 shows the digestive system in human.



Rajah 11/*Diagram 11*

Bahagian berlabel A, B, C dan D yang manakah merupakan tempat pertama berlakunya pencernaan ke atas protein ?
Which of the labeled parts A, B, C and D is the first part where protein is digested?

13. Rajah 12 menunjukkan kesan enzim X ke atas kanji.
Diagram 12 shows the effect of enzyme X on starch.



Rajah 12 /*Diagram 12*

Apakah enzim X dan hasil Y?
What is enzyme X and product Y?

	Enzim X /*Enzyme X*	Hasil Y/ *Product Y*
A	Amilase/*Amylase*	Gula penurun /*Reducing sugar*
B	Amilase/*Amylase*	Gula bukan penurun/*Non-reducing sugar*
C	Maltase/ *Maltase*	Gula penurun /*Reducing sugar*
D	Maltase/ *Maltase*	Gula bukan penurun/*Non-reducing sugar*

14. Jadual 1 menunjukkan eksperimen bagi menentukan kandungan vitamin C dalam jus limau.
Table 1 shows an experiment to determine the content of vitamin C in lime juice

Sampel/*Sample*	Isipadu yang diperlukan untuk melunturkan 1.0 cm^3 larutan DCPIP 0.1% *Volume required to decolourise 1.0 cm^3 of 0.1% DCPIP solution*
Asid askorbik 0.1% *0.1% ascorbic acid*	0.3
Jus limau *Lime juice*	1.5

Jadual 1/*Table 1*

Apakah jumlah Vitamin C dalam jus limau?
What is the amount of vitamin C in lime juice?

A 0.2 rng/cm^3 C 0.3 mg/cm^3
B 0.5 mg/cm^3 D 5.0 mg/cm^3

15. Antara berikut yang manakah dihasilkan semasa tindakbalas cahaya dalam fotosíntesis?.
Which of the following is produced during the light reaction of photosynthesis?

A ATP C Oksigen / *oxygen*
B Tenaga / *energy* D Glukosa / *glucose*

16. Rajah 13 menunjukkan keratan rentas melalui sebahagian daripada peparu.
Diagram 13 shows a cross section through a part of a lung.

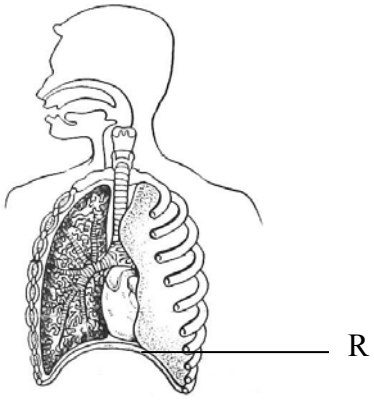
Rajah 13/*Diagram 13*

Apakah penyesuaian pada alveolus yang dapat menambahkan kadar pertukaran gas ?
What are the adaptations of alveolus which increase the rate of gaseous exchange?

I Boleh mengembang dan menguncup
Able to expand and contract
II Luas permukaan yang kecil
Small surface area
III Terletak berdekatan dengan kapilari darah
Located close to blood capillaries
IV Diliputi oleh satu lapisan nipis kelembapan
Covered by a thin film of moisture

A I dan II / *I and II*
B I dan IV/ *I and IV*
C II dan III / *II and III*
D III dan IV/ *III and IV*

17. Rajah 14 menunjukkan sistem respirasi manusia.
Diagram 14 shows a human respiratory system.

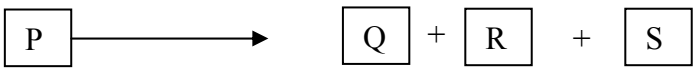


Rajah 14/*Diagram 14*

Apakah yang berlaku ke atas struktur R semasa tarik nafas?
What happen to structure R during inhalation?

A Mengendur dan mendatar/ *Contract and become flatten*
B Mengecut dan melengkung */Contract and become doom shape*
C Mengecut dan mendatar/ *Relax and become flatten*
D Mengendur dan melengkung/*Relax and become doom shape*

18. Rajah 15 menunjukkan satu persamaan bagi respirasi anaerob yis.
Diagram 15 shows an equation for an anaerobic respiration in yeast.



Rajah 15/ *Diagram 15*

Apakah P, Q, R dan S?
What are P, Q, R and S?

	P	Q	R	S
A	Etanol *Ethanol*	Asid laktik *Lactic acid*	Glukosa *Glucose*	Karbon dioksida *Carbon dioxide*
B	Glukosa *Glucose*	Etanol *Ethanol*	Karbon dioksida *Carbon dioxide*	Tenaga *Energy*
C	Asid laktik *Lactic acid*	Oksigen *Oxygen*	Air *Water*	Etanol *Ethanol*
D	Glukosa *Glucose*	Air *Water*	Etanol *Ethanol*	Tenaga *Energy*

19. Seorang murid menjalankan kajian populasi sejenis rumput P di padang sekolahnya. Dia menggunakan teknik persampelan kuadrat dalam kajiannya. Luas kuadrat ialah 1 m^2.
A student carried out a study on the population of grass P in the school's field. He used the quadrat sampling technique in the study. The area of each quadrat is 1 m^2.
Jadual 2 menunjukkan keputusan kajian tersebut.
Table 2 shows the result of the study.

Kuadrat *Quadrat*	Keluasan litupan rumput P / m^2 *Area covered by grass P / m^2*
1	0.32
2	0.78
3	0.18
4	0.64
5	0.20
6	0.15

Jadual 2 / *Table 2*

Berapakah peratus litupan rumput P di padang sekolah itu ?

A 37.8 % B 35.6 % C 38.9 % D 39.5 %

20. Rajah 16 menunjukkan satu interaksi antara dua organisma.
Diagram 16 shows an interaction between two organisms.

Rafflesia sp

Rajah 16/*Diagram 16*

Apakah jenis interaksi ini?
What type of interaction is this?

A Komensalisme/ *Commensalism*

B Mutualisme/ *Mutualism*

C Parasitisme/ *Parasitism*

D Saprofitisme/ *Saprophytism*

21. Antara berikut yang manakah betul bagi proses sesaran tumbuhan di kawasan paya bakau?
Which of the following is the correct sequence in the process of plant succession in a mangrove swamp?

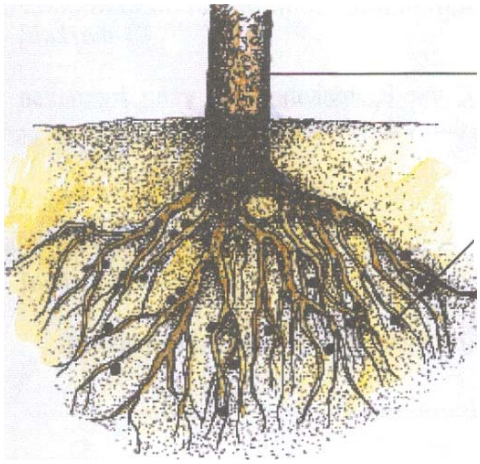
A *Avicennia* sp. → *Sonneratia* sp. → *Rhizophora* sp.

B *Avicennia* sp. → *Rhizophora* sp. → *Bruguiera* sp.

C *Sonneratia* sp. → *Bruguiera* sp. → *Rhizophora* sp.

D *Bruguiera* sp. → *Rhizophora* sp. → *Avicennia* sp.

22. Rajah 17 menunjukkan struktur X pada pokok kekacang.
Diagram 17 shows structure N on legume plant.



Rajah 17/*Diagram 17*

Antara yang berikut, yang manakah peranan bakteria yang hidup dalam X dalam kitar nitrogen?
Which of the following is the function of bacteria which live in X in the nitrogen cycle?

A Mengikat nitrit kepada sebatian ammonia/ *Fix nitrite to ammonium compound*
B Mengikat nitrogen di udara kepada nitrat /*Fix atmospheric nitrogen to nitrate*
C Mengikat sebatian ammonia kepada nitrit /*Fix ammonium compound to nitrite*
D Mengikat nitrit kepada nitrat /*Fix nitrite to nitrate*

23. Manakah antara berikut adalah vector dan pathogen bagi demam denggi?
Which of the following is the vector and pathogen for dengue?

A	Nyamuk Aedes/*Aedes mosquito*	Virus
B	Nyamuk Anopheles/*Anopheles mosquito*	Protozoa
C	Nyamuk Culex */Culex mosquito*	Virus
D	Nyamuk Mansonia */ Mansonia mosquito*	Protozoa

24. Jadual 3 menunjukkan kandungan bahan cemar di tiga kawasan J,K dan L
Table 3 shows the pollutant content in three areas, namely areas J,K and L.

Bahan cemar/*Pollutant*	**Kawasan/*Area***		
	J	**K**	**L**
Debu(g/m^2/tahun) *Dust (g/m^2/year)*	200 – 400	80 – 160	20
Sulfur dioksida(ppm/isipadu) *Sulphur dioxide (ppm/volume)*	0.10 - 0.15	0.10	0.01
Asap(mg/ m$^{3)}$ *Smoke (mg/ m^3)*	0.50	0.20 – 0.50	0.01

Jadual 3/*Table 3*

Kawasan manakah yang tidak sesuai bagi penempatan pesakit yang mempunyai masalah pernafasan?
Which area is not suitable to be inhabited by patients suffering from breathing problems ?

A J **B** K **C** L **D** K dan L/*K and L*

25. Sampel air dari sebuah tasik menunjukkan Keperluan Oksigen Secara Biokimia (BOD) yang rendah. Ini menunjukkan yang:
A lake water sample shows a low Biochemical Oxygen Demand (B.O.D) value. This shows that :

A Air tasik itu tercemar
The lake water is polluted

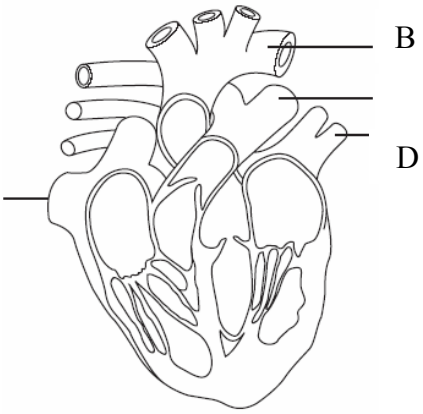
B Kuantiti oksigen yang larut dalam air tasik adalah tinggi
The oxygen quantity that is dissolved in the lake water is high

C Terdapat peningkatan aktiviti bakteria dalam air tasik

There is an increase in bacterial activity in the lake water

D Suhu air tasik telah meningkat.
The lake water temperature has increased

26. Rajah 18 menunjukkan keratan rentas jantung dan kaitannya dengan salur darah.
Diagram 18 shows a section through the heart and its associated blood vessels.



Rajah 18/*Diagram 18*

Manakah antara A, B, C dan D adalah vena pulmonari?
Which of the following A,B,C and D is the pulmonary vein?

27. Apakah fungsi perentak jantung dalam jantung?
What is the role of the pacemaker in the heart?

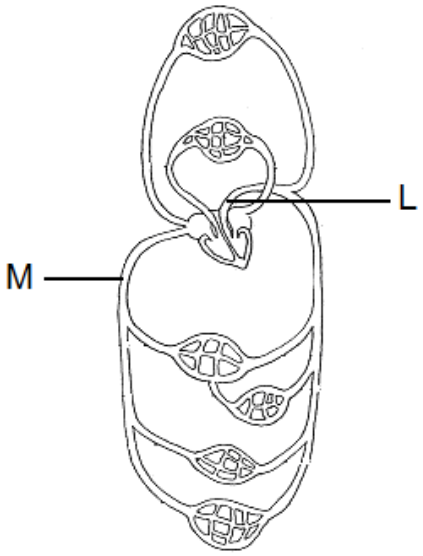
A Ia menurunkan tekanan dalam ventrikel
It decreases pressure in the ventricles.

B Ia menghalang darah berpatah balik ke jantung
It stops the back flow of blood in the heart.

C Ia meningkatkan pengaliran darah merentasi arteri koronari
It increases the blood flow through the coronary arteries.

D Ia mengawalatur kadar pengecutan otot jantung
It regulates the rate of contraction of the heart muscle.

28. Rajah 19 menunjukkan sistem peredaran darah dalam manusia.
Diagram 19 shows a blood circulatory system in human.

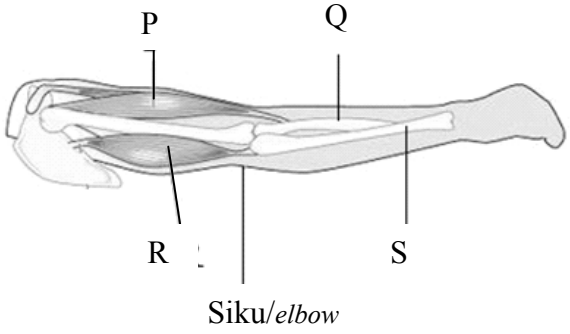


Rajah 19/*Diagram 19*

Antara berikut manakah yang **benar** tentang peredaran darah dan tekanan darah pada L dan M?
*Which of the following is **TRUE** about blood flow and blood pressure at L and M?*

	L		M	
	Pengaliran darah *Blood flow*	Tekanan darah *Blood pressure*	Pengaliran darah *Blood flow*	Tekanan darah *Blood pressure*
A	Cepat */Fast*	Tinggi/*High*	Perlahan */Slow*	Rendah */Low*
B	Cepat */Fast*	Rendah */Low*	Perlahan */Slow*	Rendah */Low*
C	Perlahan */Slow*	Tinggi/*High*	Tinggi/*High*	Tinggi/*High*
D	Perlahan */Slow*	Rendah */Low*	Tinggi/*High*	Tinggi/*High*

29. Rajah 20 menunjukkan struktur lengan manusia.
Diagram 20 shows the structure of a human forearm.

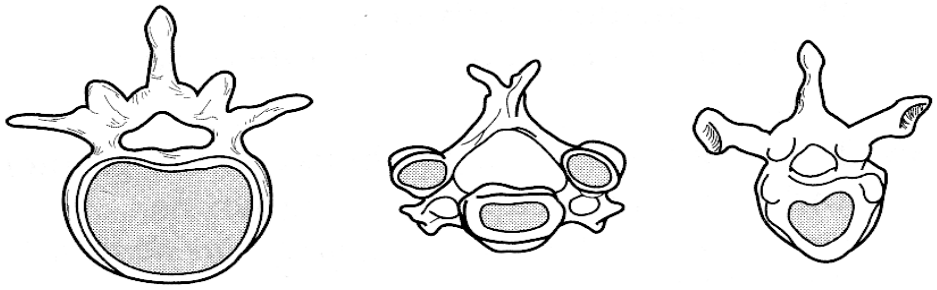


Rajah 20/*Diagram 20*

Apakah yang berlaku pada bahagian P, Q, R dan S yang menyebabkan lengan di dalam posisi yang ditunjukkan pada rajah?
What happens to the parts P, Q, R and S which cause the arm to be in the position as shown in the diagram?

	P	Q	R	S
A	Mengendur *Relaxes*	Is pushed downwards *Ditolak ke bawah*	Mengecut *Contracts*	Is pushed downwards *Ditolak ke bawah*
B	Mengecut *Contracts*	Is pushed downwards *Ditolak ke bawah*	Mengecut *Contracts*	Is pushed downwards *Ditolak ke bawah*
C	Mengendur *Relaxes*	Is pulled upwards *Ditarik ke atas*	Contracts *Mengecut*	Is pulled upwards *Ditarik ke atas*
D	Contracts *Mengecut*	Is pulled upwards *Ditarik ke atas*	Mengecut *Contracts*	Is pulled upwards *Ditarik ke atas*

30. Rajah 21 menunjukkan tiga jenis tulang vertebra pada tulang belakang manusia.
Diagram 21 shows three types of vertebrae in the human backbone.



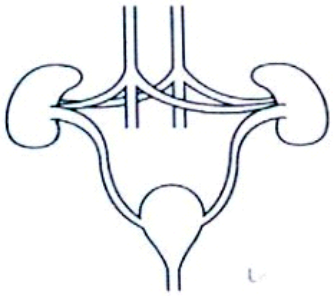
X Y Z

Rajah 21/*Diagram 21*

Antara berikut yang manakah menunjukkan turutan vertebra yang **betul**?
Which of the following shows the correct sequence of the vertebrae?

A X, Y, Z
B Z, Y, X
C Y, Z, X
D Y, X, Z

31. Rajah 22 menunjukkan sistem organ.
Diagram 22 below shows an organ system.



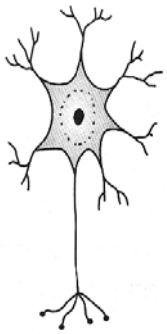
Rajah 22/*Diagram 22*

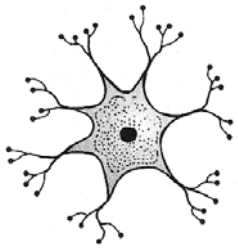
Apakah fungsi sistem organ yang ditunjukkan dalam Rajah 22?
What are the functions of the organ system shown in diagram 22?

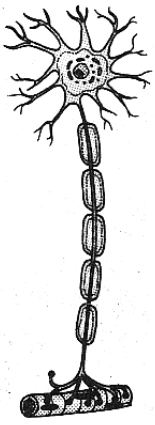
I Untuk menyingkirkan bahan buangan metabolisme
To remove metabolic wastes
II Untuk mempertahankan badan daripada penyakit
To defend the body against diseases
III Untuk mengangkut oksigen kepada sel-sel badan
To transport oxygen to the body cells
IV Untuk mengawalatur isipadu dan komposisi darah
To help regulate the volume and composition of blood

A I dan II / *I and II*
B I dan IV/ *I and IV*
C II dan IV/ *II and IV*
D III dan IV/ *III and IV*

32. Antara neuron berikut, yang manakah menghantar impuls dari sistem saraf pusat ke efektor?
Which of the following neurons transmits the impulse from central nervous system to effector?

A


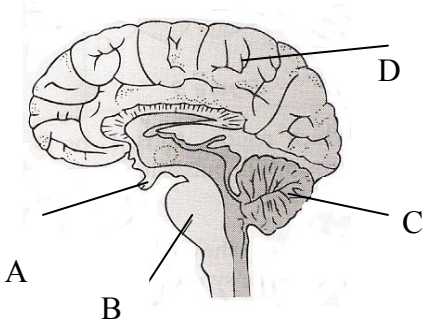
C


B


D


33. Rajah 23 menunjukkan otak manusia
Diagram 23 shows a human brain.

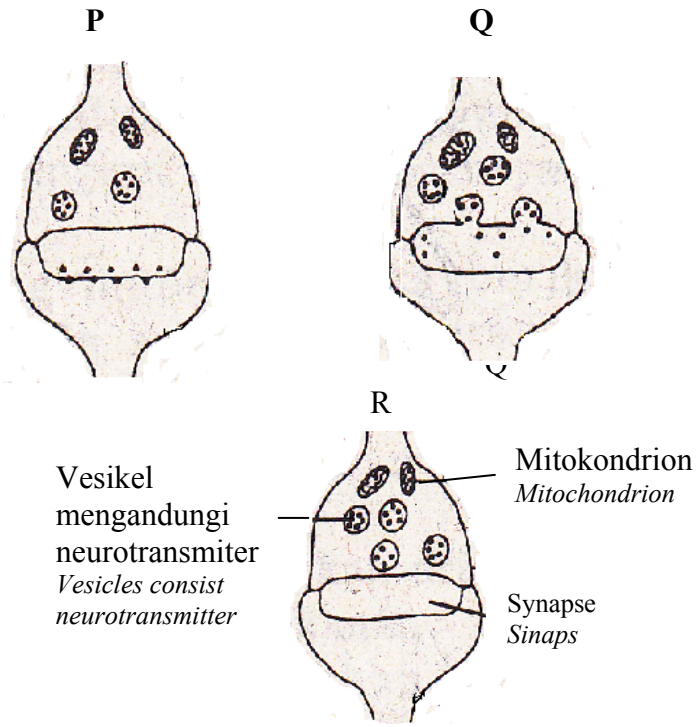
.



Rajah 23/*Diagram 23*

Antara bahagian berlabel **A, B, C dan D**, yang manakah mengawal keseimbangan badan?
*Which of the following parts labelled **A, B, C** and **D** control body balance?*

34. Diagram 24 shows the transmission of neurotransmitter across a synapse.
Rajah 24 menunjukkan pemindahan neurotransmitter merentasi sinaps.



Rajah 24/ *Diagram 24*

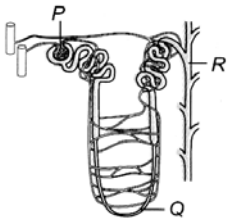
Antara berikut, yang manakah urutan yang **betul** tentang pemindahan neurotransmitter tersebut?
*Which of the following shows the **correct** sequence of transmission of the neurotransmitter?*

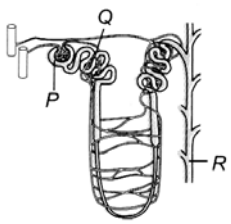
A Q, R, P
B Q, P , R
C P, R, Q
D R, Q, P

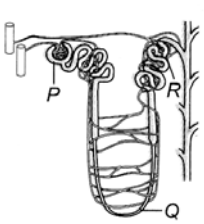
35. Ujian berikut telah dijalankan ke atas bendalir yang diambil daripada tiga bahagian nefron.
The following tests are carried out on fluids taken from three different parts of a nephron.

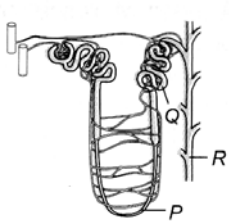
Bendalir/*Fluid*	Ujian positif untuk/ *Tested positive for*
P	Glukosa/*glucose*
Q	Asid amino/*Amino acids*
R	Ion klorida/*Chloride ions*

Rajah yang manakah menunjukkan lokasi yang betul untuk bendalir tersebut?
Which diagram shows the correct locations of the fluids?

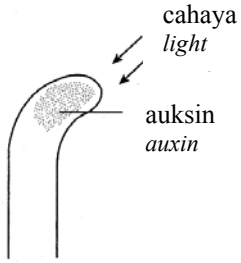
A 

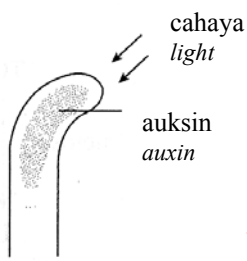
B 

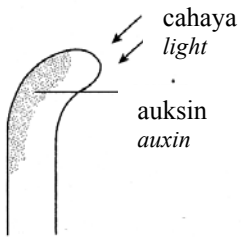
C 

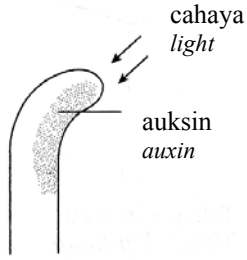
D 

36. Antara rajah berikut, yang manakah merupakan taburan auksin yang **betul** dalam pucuk tumbuhan selepas terdedah kepada cahaya matahari?
Which of the following diagrams shows the correct distribution of auxin in a plant shoot which has been exposed to sunlight?

A 

B 

C 

D 

37. Manakah antara berikut menunjukkan turutan yang **betul** bagi pembentukan sperma?
Which of the following shows the correct sequence of sperm formation?

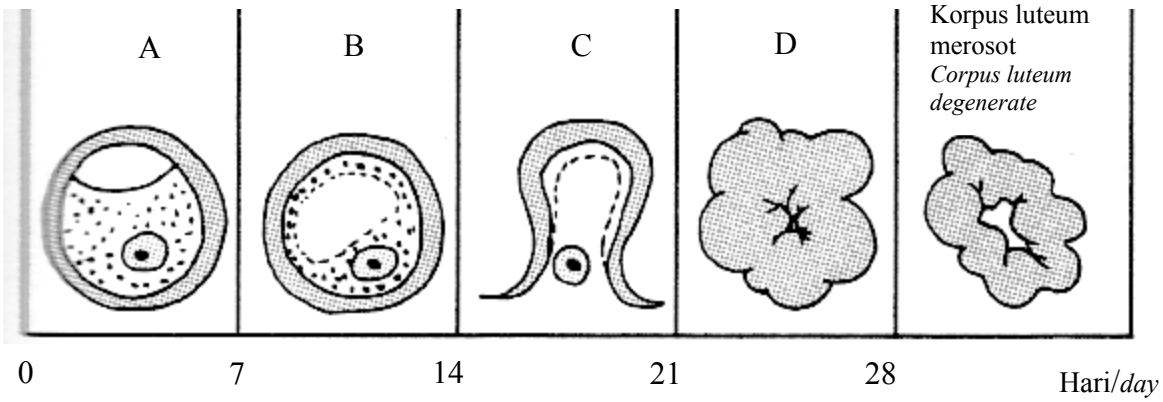
A Spermatogonium → spermatosit → sperma
Spermatogonium → spermatocyte → sperm

B Spermatosit → spermatogonium → sperma
Spermatocyte → spermatogonium → sperm

C Spermatogonium → spermatid → sperma
Spermatogonium → spermatid → sperm

D Spermatosit → spermatid → sperma
Spermatocyte → spermatid → sperm

38. Rajah 25 menunjukkan perubahan dalam folikel semasa pengovulan.
Diagram 25 shows the changes in a follicle during ovulation.



Rajah 25/*Diagram 25*

Pada peringkat manakah aras progesteron paling tinggi?
At which stage is the level progesterone the highest?

39. Apakah yang dimaksudkan dengan permanian beradas?
What is the meaning of artificial insemination?

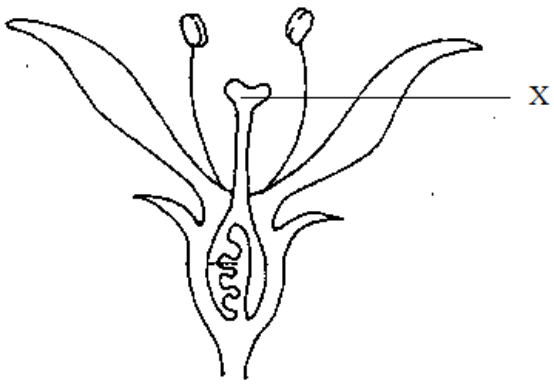
A Pemindahan gamet ke dalam tiub falopio.
The transfer of gametes into the fallopian tube

B Pemindahan zigot ke dalam uterus melalaui serviks
The transfer of zygote into the uterus via the cervix

C Pemindahan sperma ke dalam uterus isteri ketika tempoh pengovulan
The transfer of sperms into the wife's uterus during her ovulation period

D Pemindahan embrio daripada seorang wanita ke dalam uterus wanita mandul
The transfer of embryo from another woman into the uterus of a sterile woman

40. Rajah 26 menunjukkan keratan memanjang bunga. Bunga dipotong pada X.
Diagram 26 shows a longitudinal section of a flower. The flower is cut at X.



Rajah 26/*Diagram 26*

Kenyataan manakah menerangkan mengapa ovari tidak berkembang menjadi buah?
Which statement explains why the ovary does not develop into a fruit?

A Ovul gagal untuk menghasilkan pundi embrio/ *The ovules fail to produce embryo sacs*
B Ovul tidak disenyawakan/ *The ovules are not fertilised*
C Ovul tidak menerima nutrien */The ovules do not receive nutrient*
D Ovul gagal memperoleh oksigen dari udara/ *The ovules fail to obtain oxygen from the air*

41. Apakah genotip anak pada generasi F1 dalam kacukan monohibrid antara BB x bb?
What is the genotype of the offspring in the F1 generation in a monohybrid cross between BB x bb?

A 100% ialah bb
100% are bb

C 100% ialah Bb
100% are Bb

B 100% ialah BB
100% are BB

D 75% ialah Bb dan 25% ialah bb
75% are Bb and 25% are bb

42. Satu pasangan mempunyai empat anak dengan kumpulan darah O, A, B dan AB .
A couple has four children with blood groups O, A, B and AB.

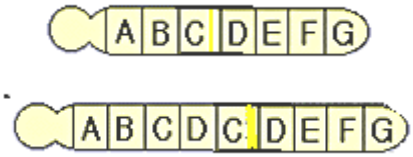
Apakah kemungkinan kumpulan darah sampel tersebut?
What are the the possible blood groups of the sample?

	Suami */Husband*	Isteri */Wife*
A	A	B
B	B	AB
C	AB	O
D	AB	AB

43. Maria adalah pembawa bagi buta warna berkahwin dengan Aroon yang mempunyai penglihatan warna normal.
Apakah kemungkinan anak lelaki mereka adalah buta warna ?
Maria who is a carrier for colour blindness married to Aron a normal colour vision.
What is the probability that their son is colour blind?

A 0% B 25% C 50% D 100%

44. Rajah 27 menunjukkan sejenis mutasi kromosom.
Diagram 27 shows a type of chromosomal mutation.



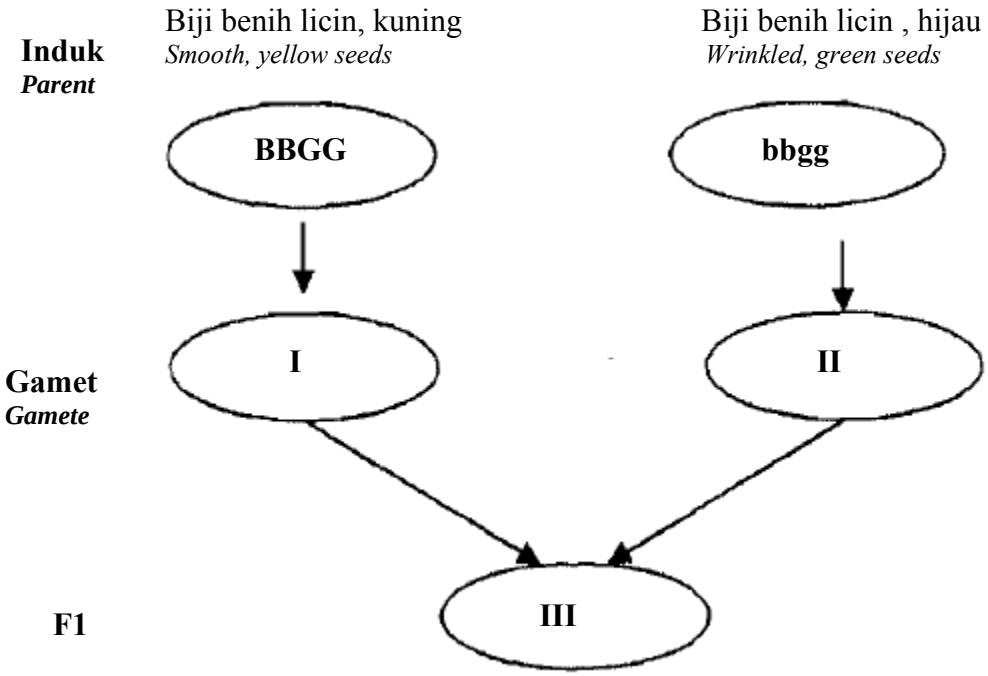
Rajah 27/*Diagram 27*

Apakah jenis mutasi ini?
What type of mutation is this?

A Penggandaan/ *Duplication* C Penyongsangan/ *Inversion*

B Pelenyapan/ *Deletion* D Translokasi/ *Translocation*

45. Rajah 28 menunjukkan kacukan dihibrid antara dua pokok kacang pea.
Diagram 28 shows a dihybrid cross between two pea plant.

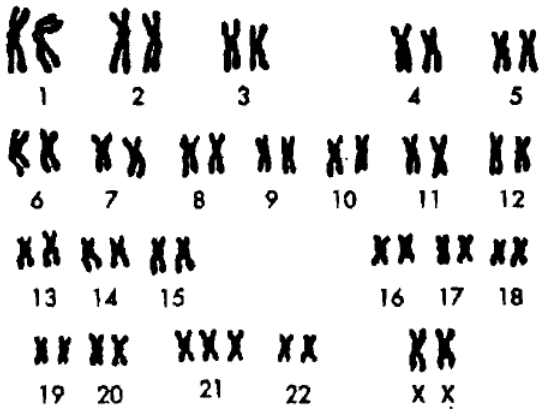


Rajah 28/*Diagram 30*

Manakah antara berikut menunjukkan **genotip** yang betul bagi I, II dan III?
Which of the following shows the correct genotypes for 1, 11 and 111 ?

	I	II	III
A	BG	bg	BbGg
B	BB	Gg	BBgg
C	GG	Bb	bbGG
D	BG	Bg	BBGg

46. Rajah 29 menunjukkan kariotip seorang indidvidu.
Diagram 29shows the karyotype of an individual



Rajah 29/*Diagram 29*

Manakah antara berikut mempunyai kariotip seperti ditunjukkan dalam Rajah 31?
Which of the following has the karyotype shown in Diagram 31?

A Lelaki dengan Sindrom Down
A male with Down's syndrome
B Perempuan dengan Sindrom Down
A female with Down's syndrome
C Lelaki dengan Klinefelter Sindrom
A male with Klinefelter`s Syndrom
D Perempuan dengan Sindrom Turner
A female with Turner`s Syndrom

47. Rajah 30 menunjukkan sepasang kembar seiras.
Diagram 30 shows a pair of identical twins.

Rajah 30/*Diagram 30*

Manakah antara berikut menyebabkan perbezaan dalam ketinggian mereka?
Which of the following caused the difference in their heights ?

A Faktor genetik
Genetic factors

B Persenyawaan secara rawak
Random fertilization

C Faktor persekitaran
Environmental factors

D Pindah silang semasa meiosis
Crossing over during meiosis

48. Manakah antara bahan berikut yang dapat bergerak merentasi plasenta?
Which of the following substances can move across the placenta?

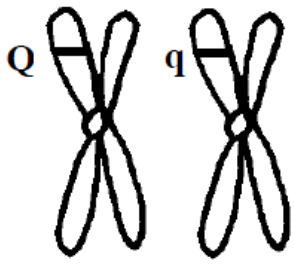
	Asid lemak *Fatty acids*	Urea	Sel darah merah *Red blood cells*
A	√	√	X
B	X	X	√
C	√	X	√
D	X	√	X

Kekunci/*Key*
√=boleh merentasi plasenta/
can move across the placenta

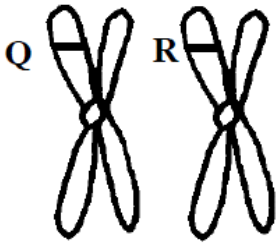
X = tidak boleh merentasi plasenta
cannot move across the placenta

49. Manakah antara berikut merupakan alel?
Which of the following represents an allele?

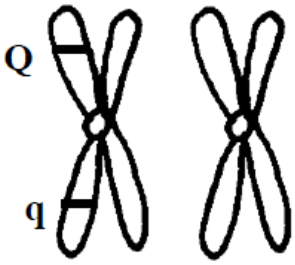
A



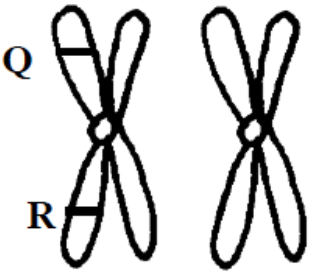
C



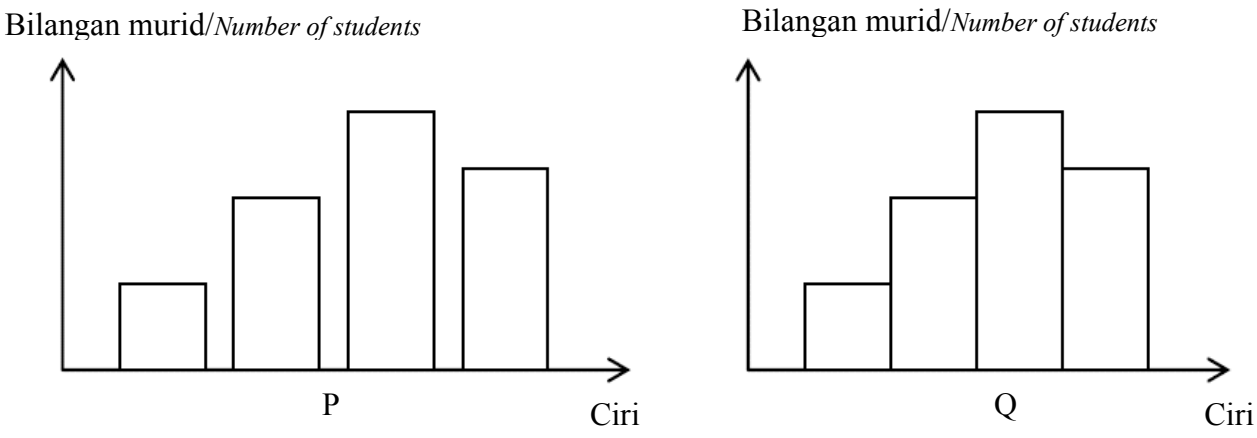
B



D



50. Rajah 31 menunjukkan gaf variasi P dan Q.
Diagram 31 shows graphs of variation P and Q.



Rajah 31/*Diagram 31*

Manakah antara yang berikut adalah **betul** bagi menerangkan tentang P dan Q?
Which of the following correctly describes K and L?

	P	Q
A	Dikawal oleh beberapa gen daripada beberapa pasangan gen *Controlled by several genes with several pairs of alleles*	Dikawal oleh gen tunggal Dengan dua atau lebih alel *Controlled by single gene with two or more alleles*
B	Cap ibu jari dan kumpulan darah *Type of fingerprint and blood group*	Berat badan dan ketinggian *Weight and height*
C	Variasi kuantitatif *Quantitative variation*	Variasi kualitatif *Qualitative variation*
D	Taburan normal *Normal distribution*	Taburan diskrit *Discrete distribution*

SECTION B

1 Diagram 1 shows an animal cell and a plant cell.
Rajah 1 menunjukkan suatu sel haiwan dan suatu sel tumbuhan.

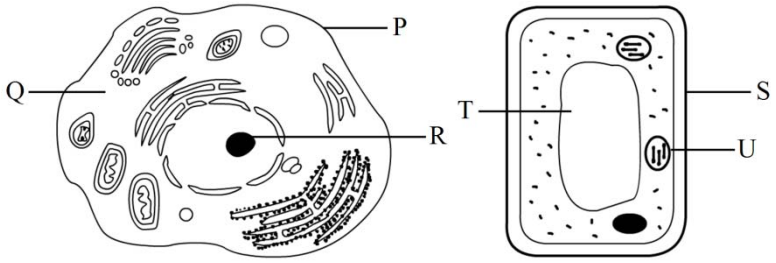


Diagram 1
Rajah 1

a) Name the parts labelled P, Q, R and S.
Namakan bahagian-bahagian berlabel P, Q, R dan S.

P: _____

Q: _____

R: _____

S: _____

[4 marks]
[4 markah]

b) Give **three** differences between an animal cell and a plant cell.
*Berikan **tiga** perbezaan antara sel haiwan dan sel tumbuhan.*

_____

_____

_____

[3 marks]
[3 markah]

c) State **two** main components of the protoplasm.
*Nyatakan **dua** komponen utama protoplasma.*

_____

_____

[2 marks]
[2 markah]

d) What is the function of the part labelled P?
Apakah fungsi bahagian berlabel P?

_____

[1 mark]
[1 markah]

e) (i) Name the membrane that surrounds the structure labelled T.
Namakan membran yang mengelilingi struktur yang berlabel T.

_____

[1 mark]
[1 markah]

(ii) State the function of the part labelled U.
Nyatakan fungsi bahagian yang berlabel U.

_____

[1 mark]
[1 markah]

2 Diagram 2 shows a cross section of organ P in the human body.
Rajah 2 menunjukkan satu keratan rentas bagi organ P dalam bahan manusia.

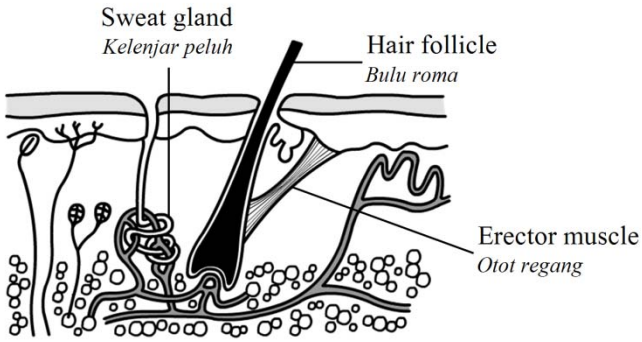


Diagram 2
Rajah 2

a) (i) What is organ P?
Apakah organ P tersebut?

_____

(ii) State **three** functions of organ P.
*Nyatakan **tiga** fungsi organ P.*

_____

_____

_____

b) Explain why P is classified as an organ and erector muscle is classified as a tissue.
Jelaskan mengapa P dikelaskan sebagai organ dan otot regang dikelaskan sebagai tisu.

_____

_____

c) State **two** systems which contain organ P.
*Nyatakan **dua** sistem yang mengandungi organ P.*

_____

_____

d) Explain the roles of the erector muscle, hair follicle and sweat gland in maintaining the body temperature on a hot day.
Jelaskan peranan otot regang, bulu roma dan kelenjar peluh dalam mengekalkan suhu badan pada hari yang panas.

_____

_____

_____

3 Diagram 3 shows an organelle found in muscle cells.
Rajah 3 menunjukkan satu organel yang terdapat dalam sel otot.

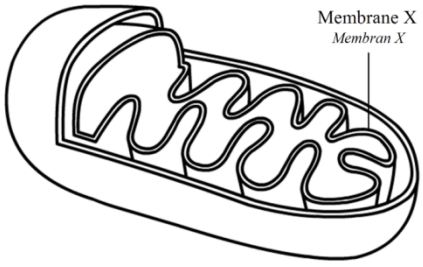


Diagram 3
Rajah 3

a) (i) What is the organelle?
Apakah organel tersebut?

_____

(ii) Explain why membrane X is in the form of numerous folded layers.
Jelaskan mengapa membran X adalah dalam bentuk lapisan yangm berlipat-lipat.

_____

_____

b) The following equation summarises a biochemical reaction that occurs in the organelle.
Persamaan yang berikut meringkaskan suatu tindak balas biokimia yang berlaku dalam organel tersebut.

X + Oxygen → Y + Carbon dioxide + Energy *X + Oksigen → Y + Karbon dioksida + Tenaga*

(i) Name X and Y.
Namakan X dan Y.

X: _____

Y: _____

(ii) Explain how the biochemical reaction can still occur if the blood sugar level is lower
than the normal range.
Jelaskan bagaimana tindak balas biokimia tersebut masih boleh berlaku jika aras gula dalam darah adalah rendah daripada julat normal.

_____

_____

_____

c) State **two** differences on the biochemical reaction occuring between muscle cell and yeast cell in the absence of oxygen.
*Nyatakan **dua** perbezaan ke atas tindak balas biokimia yang berlaku antara sel otot dan sel yis tanpa kehadiran oksigen.*

Muscle cell ***Sel otot***	**Yeast cell** ***Sel yis***

4 Diagram 4.1 shows a green mustard stem is cut into two equal strips and placed in solution X and Y respectively.
Rajah 4.1 menunjukkan batang sawi dipotong kepada dua jalur yang sama saiz dan diletakkan di dalam larutan X dan Y masing-masing.

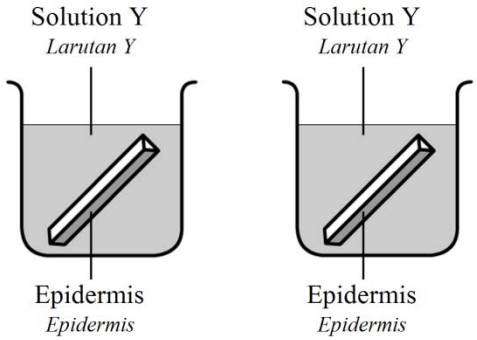


Diagram 4.1
Rajah 4.1

Diagram 4.2 shows the results obtained from this experiment.
Rajah 4.2 menunjukkan keputusan yang diperolehi daripada eksperimen tersebut.

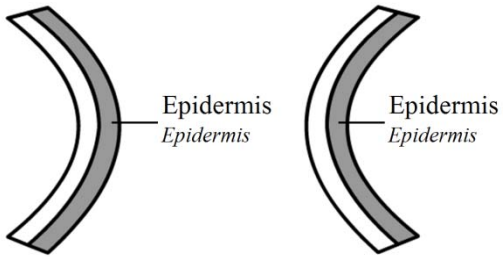


Diagram 4.2
Rajah 4.2

a) What are solution X and Y used in this experiment?
Apakah larutan X dan Y yang digunakan dalam eksperimen tersebut?

X : _____

Y : _____

[2 marks]
[2 markah]

b) Identify solution X and Y.
Kenal pastikan larutan X dan Y.

X : _____

Y : _____

[2 marks]
[2 markah]

c) Describe the condition of the strips that are immersed in solution X and Y.
Terangkan keadaan jalur yang direndam di dalam larutan X dan Y.

X : _____

Y : _____

[2 marks]
[2 markah]

d) Diagram 4.3 shows the condition of two plants P and Q which are added with fertilizer. Plant Q is added with excess fertilizer.
Rajah 4.3 menunjukkan keadaan dua tumbuhan P dan Q yang diberi baja. Tumbuhan Q diberi baja secara berlebihan.

Plant P
Tumbuhan P

Plant Q
Tumbuhan Q

Diagram 4.3
Rajah 4.3

Explain the condition of plant Q in Diagram 4.3.
Jelaskan keadaan tumbuhan Q dalam Rajah 4.3.

[3 marks]
[3 markah]

e) A woman makes mango pickles by immersing mango slices in a concentrated sugar solution.
Seorang perempuan membuat jeruk mangga dengan merendam kepingan buah mangga dalam larutan gula yang pekat.

State **one** advantage and **two** disadvantages of the method used, compared to storing fresh mangoes.
*Nyatakan **satu** kebaikan dan **dua** keburukan kaedah yang digunakan berbanding dengan menyimpan mangga segar.*

Advantage:
Kebaikan:

Disadvantages:
Keburukan:

[3 marks]
[3 markah]

5 Diagram 5 shows the structure of the plasma membrane.
Rajah 5 menunjukkan struktur membran plasma.

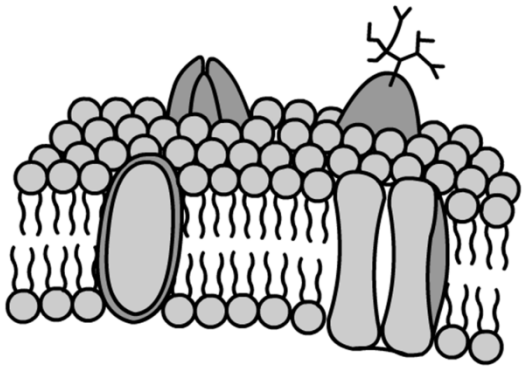


Diagram 5
Rajah 5

a) Label the following parts of the plasma membrane on Diagram 5.
Labelkan bahagian-bahagian membran plasma yang berikut pada Rajah 5.

i) Carrier protein
Protein pembawa

ii) Phospholipid bilayer
Dwilapisan fosfolipid

iii) Pore protein
Protein liang

[3 marks]
[3 markah]

b) State **two** characteristics of the phospholipid bilayer.
*Nyatakan **dua** ciri dwilapisan fosfolipid.*

_____

_____

[2 marks]
[2 markah]

c) (i) Glucose molecules are transported across the plasma membrane into the cell through facilitated diffusion. Explain why.
Molekul-molekul glukosa diangkut ke sel merentasi membran plasma melalui resapan berbantu. Jelaskan mengapa.

_____

_____

[2 marks]
[2 markah]

(ii) Describe how calcium ions are transported into the cell.
Terangkan bagaimana ion kalsium diangkut ke dalam sel.

_____

_____

_____

[3 marks]
[3 markah]

d) Give **two** factors that affect the permeability of the plasma membrane.
*Berikan **dua** faktor yang mempengaruhi ketelapan membran plasma.*

_____

_____

[2 marks]
[2 markah]

6 Diagram 6 shows a pair of homologous chromosomes.
Rajah 6 menunjukkan sepasang kromosom homolog.

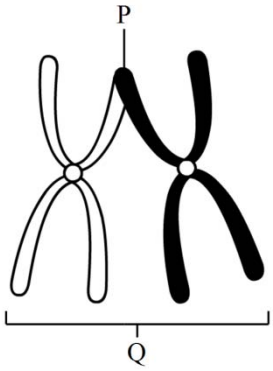


Diagram 6
Rajah 6

a) Name the parts labelled P and Q.
Namakan bahagian yang berlabel P dan Q.
P
: _____
Q
: _____
[2 marks]
[2 markah]

b) Name the process of the pairing of homologous choromosomes as shown in Diagram 6.
Namakan proses di mana kromosom homolog berpasangan seperti yang ditunjukkan dalam Rajah 6.

_____
[1 mark]
[1 markah]

c Name the process where P is formed.
) *Namakan proses di mana P terbentuk.*

_____
[1 mark]
[1 markah]

d) Give **two** results of the process named in **6**(c).
*Berikan **dua** hasil daripada proses yang dinamakan di 6(c).*
1. _____
2. _____
[2 marks]
[2 markah]

e) Cancerous cells are formed after the normal cells are exposed to factor Y.
Sel kanser terbentuk selepas sel-sel normal terdedah kepada faktor Y.

i) Give **two** examples of factor Y.
*Berikan **dua** contoh faktor Y.*

1. _____

2. _____

[2 marks]
[2 markah]

ii) Explain the formation of cancerous cells.
Jelaskan pembentukan sel kanser.

_____

_____

[2 marks]
[2 markah]

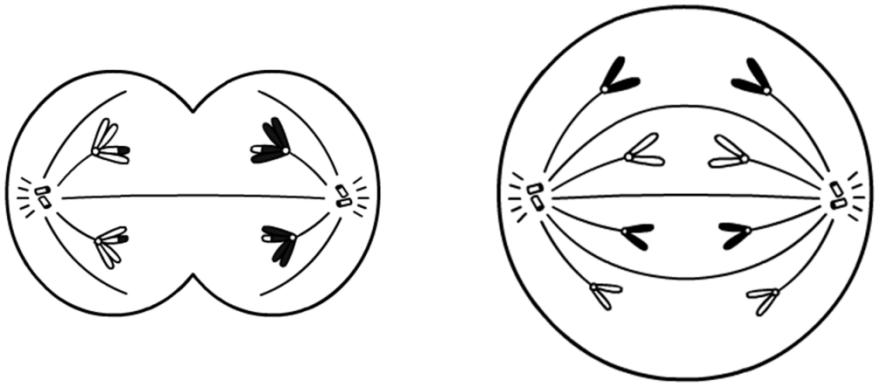
iii) State **two** ways to prevent the development of cancerous cells.
*Nyatakan **dua** cara untuk mengelakkan perkembangan sel kanser.*

1. _____

2. _____

[2 marks]
[2 markah]

7 Diagram 7 shows cell X and cell Y undergo two different types of cell division.
Rajah 7 menunjukkan sel X dan sel Y mengalami dua jenis pembahagian sel yang berlainan.



Cell X
Sel X

Cell Y
Sel Y

Diagram 7
Rajah 7

a) Complete Table 3 by filling in the following aspects of cell X and cell Y.
Lengkapkan Jadual 3 dengan mengisi aspek-aspek berikut bagi sel X dan sel Y.

Aspect ***Aspek***	Cell X *Sel X*	Cell Y *Sel Y*
Types of cell division ***Jenis pembahagian sel***		
Stage of cell division ***Peringkat pembahagian sel***		
Chromosomal behaviour ***Perlakuan kromosom***		

Table 3
Jadual 3

[6 marks]
[6 markah]

b) A female has sex chromosome of 45 + XX. This genetic disorder is due to the failure of sex chromosome to separate completely during meiosis.
Seorang perempuan mempunyai kromosom seks 45 + XX. Kecacatan genetik tersebut disebabkan oleh kegagalan kromosom seks untuk berpisah dengan lengkap semasa meiosis.

(i) State the number of chromosome in the female.
Nyatakan bilangan kromosom bagi perempuan tersebut.

_____

[1 mark]
[1 markah]

(ii) Name the genetic disorder.
Namakan kecacatan genetik tersebut.

_____

[1 mark]
[1 markah]

(iii) Give **one** characteristics of the genetic disorder.
*Berikan **satu** ciri kecacatan genetik tersebut.*

_____

[1 mark]

[1 markah]

c) (i) State **one** factor that causes the genetic disorder in 8(b)(ii).
*Nyatakan **satu** faktor yang menyebabkan kecacatan genetik pada **3**(b)(ii).*

_____

[1 mark]
[1 markah]

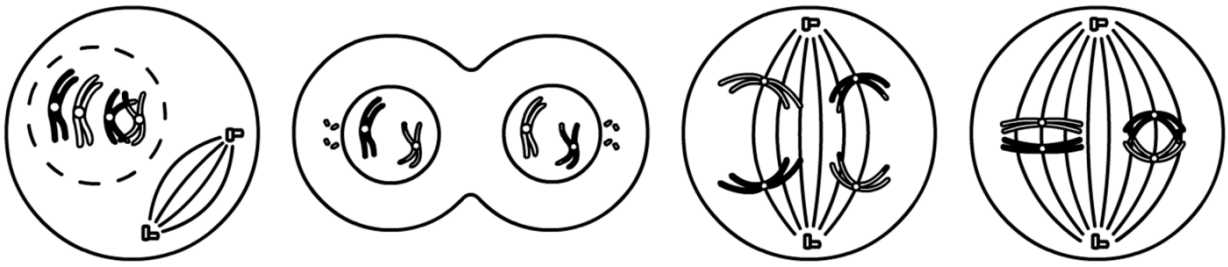
(ii) Explain how the factor stated in 8(c)(i) causes the genetic disorder.
*Jelaskan bagaimana faktor yang dinyatakan dalam **3**(c)(i) menyebabkan kecacatan genetik tersebut.*

_____

_____

[2 marks]
[2 markah]

8 Diagram 8.1 shows shows the different stages in a cell division.
Rajah 8.1 menunjukkan peringkat-peringkat yag berbeza dalam suatu pembahagian sel.



P Q R S

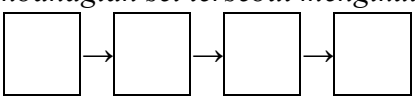
Diagram 8.1
Rajah 8.1

a) (i) State the type of cell division.
Nyatakan jenis pembahagian sel tersebut.

_____

[1 mark]
[1 markah]

(ii) Arrange the stages of cell division in the correct sequence.
Susun peringkat-peringkat pembahagian sel tersebut mengikut urutan yang betul.



[1 mark]
[1 markah]

b) (i) Explain the chromosomal behaviour in stage P.
Jelaskan perlakuan kromosom dalam peringkat P.

_____

_____

[2 marks]
[2 markah]

(ii) State **one** importance of the chromosomal behaviour in 8(b)(i).
*Nyatakan **satu** kepentingan perlakuan kromosom dalam 8(b)(i).*

_____

_____

[1 mark]
[1 markah]

c) Diagram 8.2 shows the formation of zygote which involves the cells produced by this type of cell division.
Rajah 8.2 menunjukkan pembentukan zigot yang melibatkan sel yang dihasilkan dengan jenis pembahagian sel tersebut.

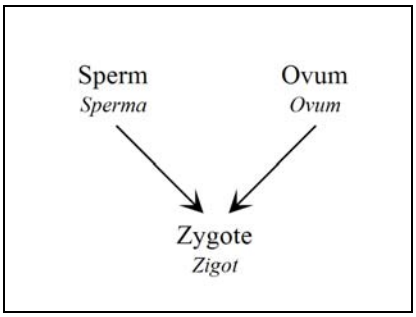


Diagram 8.2
Rajah 8.2

Explain how zygote is formed.
Jelaskan bagaimana zigot terbentuk.

_____

_____

[2 marks]
[2 markah]

d) Diagram 8.3 shows the karyotype of an offspring produced.
Rajah 8.3 menunjukkan kariotip seorang anak yang dihasilkan.

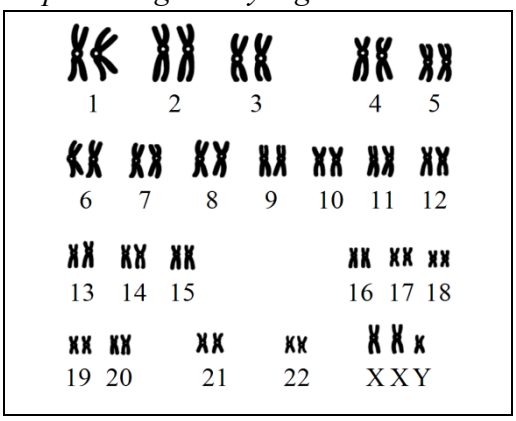


Diagram 8.3
Rajah 8.3

i) State the number of chromosomes in the offspring.
Nyatakan bilangan kromosom anak tersebut.

_____

[1 mark]
[1 markah]

ii) What is the genetic disease suffered by the offspring?
Apakah penyakit genetik yang dialami oleh anak tersebut?

_____

[1 mark]
[1 markah]

iii) Give **one** reason for the answer in 8(d)(ii).
*Berikan **satu** sebab bagi jawapan dalam 8(d)(ii).*

_____

_____

[1 mark]
[1 markah]

iv) Explain how this genetic disease can be caused by the radioactive rays.
Jelaskan bagaimana penyakit genetik tersebut boleh disebabkan oleh sinar radioaktif.

_____

_____

[2 marks]
[2 markah]

9 Diagram 9 shows the blood circulatory system and the lymphatic system in the human body.
Rajah 9 menunjukkan sistem peredaran darah dan sistem limfa yang terdapat dalam badan manusia.

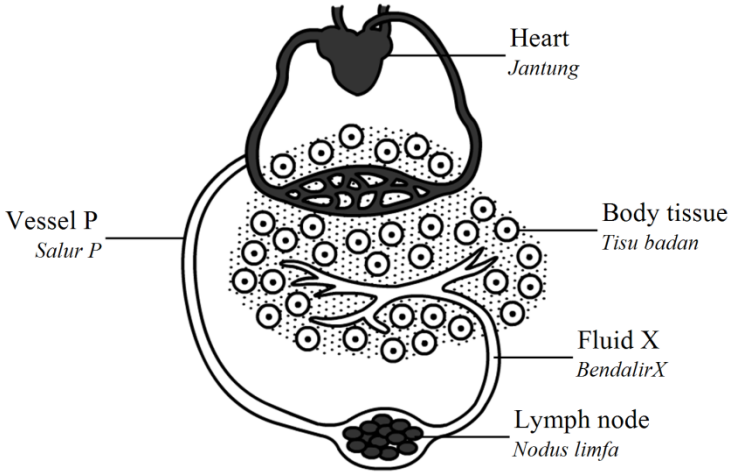


Diagram 9
Rajah 9

a) (i) Name fluid X.
Namakan bendalir X.

_____

[1 mark]
[1 markah]

(ii) What happens to the components of fluid X when it passes through the lymph node?
Apakah yang berlaku komponen dalam bendalir X semasa melalui nodus limfa?

_____

_____

[1 mark]
[1 markah]

b) (i) Describe how fluid X is formed from the blood.
Terangkan bagaimana bendalir X terbentuk daripada darah.

_____

_____

[2 marks]

[2 markah]

(ii) State **one** difference between fluid X and the blood.
*Nyatakan **satu** perbezaan antara bendalir X dengan darah.*

[1 mark]
[1 markah]

c) (i) Explain the effect on the system if a part of vessel P is blocked.
Terangkan kesannya ke atas sistem tersebut jika satu bahagian pada salur P didapati tersumbat.

[2 marks]
[2 markah]

(ii) What happens to the leg if vessel P in the leg is blocked.
Apakah yang berlaku kepada kaki jika salur P di kaki didapati tersumbat.

[1 mark]
[1 markah]

d) Explain how the composition of the tissue fluid is maintained by the blood circulatory system and the lymphatic system by stating the substances transported by both systems.
Jelaskan bagaimana komposisi bendalir tisu dikekalkan oleh sistem peredaran darah dan sistem limfa dengan menyatakan bahan-bahan yang diangkut oleh kedua-dua sistem.

[3 marks]
[3 markah]

10 Diagram 10 shows a longitudinal section of a flower during fertilization.
Rajah 10 menunjukkan keratan membujur bunga semasa persenyawaan.

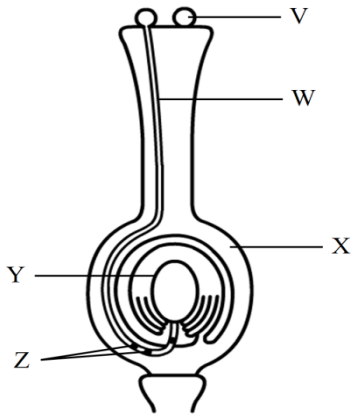


Diagram 10
Rajah 10

a) Name the structures W, X, Y and Z.
Namakan struktur W, X, Y dan Z.

V : _____

W : _____

X : _____

Y : _____

Z : _____

[4 marks]
[4 markah]

b) (i) Draw a section through the ovule, showing all the cells in Y. Label the cells involved in fertilization.
Lukis keratan melalui ovul yang menunjukkan semua sel dalam Y. Label sel-sel yang terlibat dalam persenyawaan.

[3 marks]
[3 markah]

(ii) What is the significance of having two Z structures in the fertilization?
Apakah signifikan mempunyai dua struktur Z dalam persenyawaan?

_____

_____

[2 marks]
[2 markah]

c) Structure V has to be kept dormant for future research purposes.
Struktur V hendak disimpan dorman untuk kegunaan penyiasatan di masa depan.

(i) Explain how V can be prevented from germinating.
Jelaskan bagaimana V boleh dielakkan daripada bercambah.

_____

_____

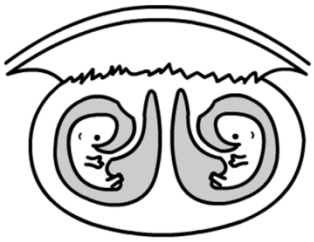
[2 marks]
[2 markah]

(ii) Suggest **one** method to stimulate the germination of V if it is to be germinated.
*Cadangkan **satu** kaedah untuk merangsang percambahan V jika ia ingin dicambahkan.*

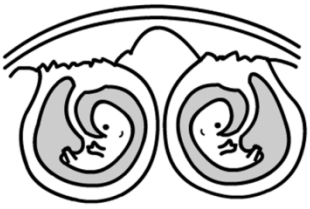
_____

[1 mark]
[1 markah]

11 Diagram 11 shows two types of twins.
Rajah 11 menunjukkan dua jenis anak kembar.



X



Y

Diagram 11

Rajah 11

a) (i) Name the types of twins X and twins Y.
Namakan jenis kembar X dan kembar Y.

X: _____

Y: _____

[2 marks]
[2 markah]

(ii) Explain how twins Y are formed.
Jelaskan bagaimana kembar Y terbentuk.

_____

_____

[2 marks]
[2 markah]

b) State **two** functions of placenta.
*Nyatakan **dua** fungsi plasenta.*

_____

_____

_____

[2 marks]
[2 markah]

c) State **two** differences between twins X and twins Y.
*Nyatakan **dua** perbezaan antara kembar X dan kembar Y.*

_____

_____

_____

[2 marks]
[2 markah]

d) Explain why twins X that are brought up by two different adopted families do not have the same body size when they are adult.
Jelaskan mengapa kembar X yang dibesarkan oleh dua keluarga angkat yang berbeza tidak serupa badan size apabila dewasa.

_____

_____

_____

[2 marks]
[2 markah]

e) Give **two** reasons why a woman who is pregnant should not smoke.
*Berikan **dua** sebab mengapa seorang perempuan yang disahkan hamil tidak patut merokok.*

_____

_____

_____

[2 marks]
[2 markah]

12 Diagram 12 shows the genetic diagram of the cross between a purple flower pea plant with smooth seed and white flower pea plant with wrinkled seed. P is the dominant allele for purple flower and p is the recessive allele for white flower. S is the dominant allele for smooth seed while s is the recessive allele for wrinkled seed.
Rajah 13 menunjukkan rajah genetik bagi kacukan antara tumbuhan kacang pea bunga ungu dengan biji benih licin dan tumbuhan kacang pea bunga putih dengan biji benih berkedut. P ialah alel dominan bagi bunga ungu dan p ialah alel resesif bagi bunga putih. S ialah alel dominan bagi biji benih licin dan s ialah alel resesif bagi biji benih berkedut.

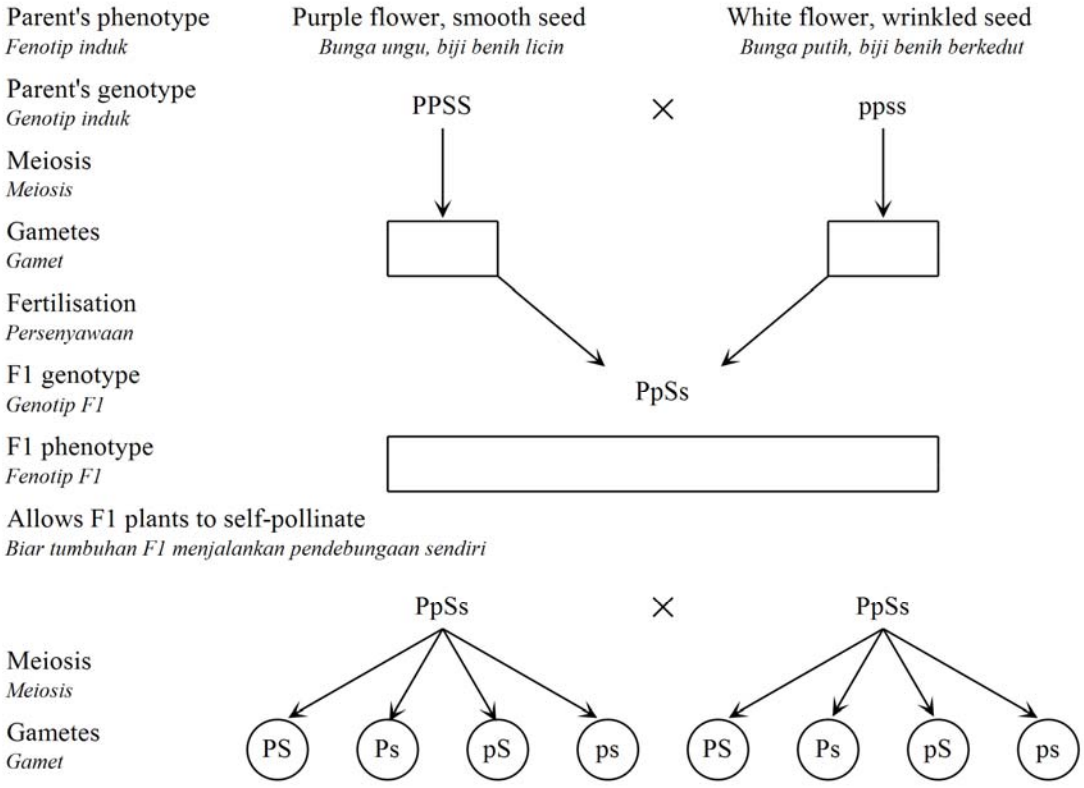


Diagram 12
Rajah 12

a) (i) Write the genotype of gametes in the boxed provided in the Diagram 12.
Tuliskan genotip gamet dalam petak yang disediakan dalam Rajah 12.

[2 marks]
[2 markah]

(ii) State the phenotype of F1 generation in the box provided in Diagram 12.
Nyatakan fenotip bagi generasi F1 dalam petak yang disediakan dalam Rajah 12.

[1 mark]
[1 markah]

b) Table 5 shows the Punnett's square of the self cross between offsprings in F1 generation to form the F2 generation.
Jadual 5 menunjukkan segiempat sama Punnett bagi kacukan sesama sendiri anak generasi F1 untuk menghasilkan generasi F2.

Male gamete *Gamet jantan* / Female gamete *Gamet betina*	PS	Ps	pS	ps
PS	PPSS		PpSS	
Ps	PPSs		PpSs	
pS	PpSS		ppSS	
ps	PpSs		ppSs	

Table 5
Jadual 5

(i) Complete the Punnett's square by filling the genotype in Table 5.
Lengkapkan segiempat sama Punnett dengan mengisi genotip ke dalam Jadual 5.

[2 marks]
[2 markah]

(ii) Determine the probability of having a purple flower pea plant with wrinkled seed in F2 generation.
Tentukan kebarangkalian memperoleh tumbuhan kacang pea bunga ungu dengan biji benih berkedut dalam generasi F2.

_____

[1 mark]
[1 markah]

c) (i) Explain the ratio of the offsprings produced in F2 generation based on Mendel's Law.
Jelaskan nisbah anak-anak generasi F2 yang terhasil berdasarkan kepada Hukum Mendel.

_____

_____

_____

[3 marks]
[3 markah]

(ii) Based on the Punnett's square, explain why the offsprings of pea plants in F2 generation has varieties of traits.
Berdasarkan segiempat sama Punnett, jelaskan mengapa anak tumbuhan kacang pea dalam generasi F2 mempunyai trait yang pelbagai.

[3 marks]
[3 markah]

13 Diagram 13 shows a sequence of stages in the synthesis of an extracellular enzyme in a human pancreatic cell. The stages are labelled as Stage I, Stage II and Stage III.
Rajah 13 menunjukkan turutan peringkat dalam sintesis suatu enzim luar sel dalam sel pankreas manusia. Peringkat-peringkat tersebut dilabelkan sebagai Peringkat I, Peringkat II dan Peringkat III.

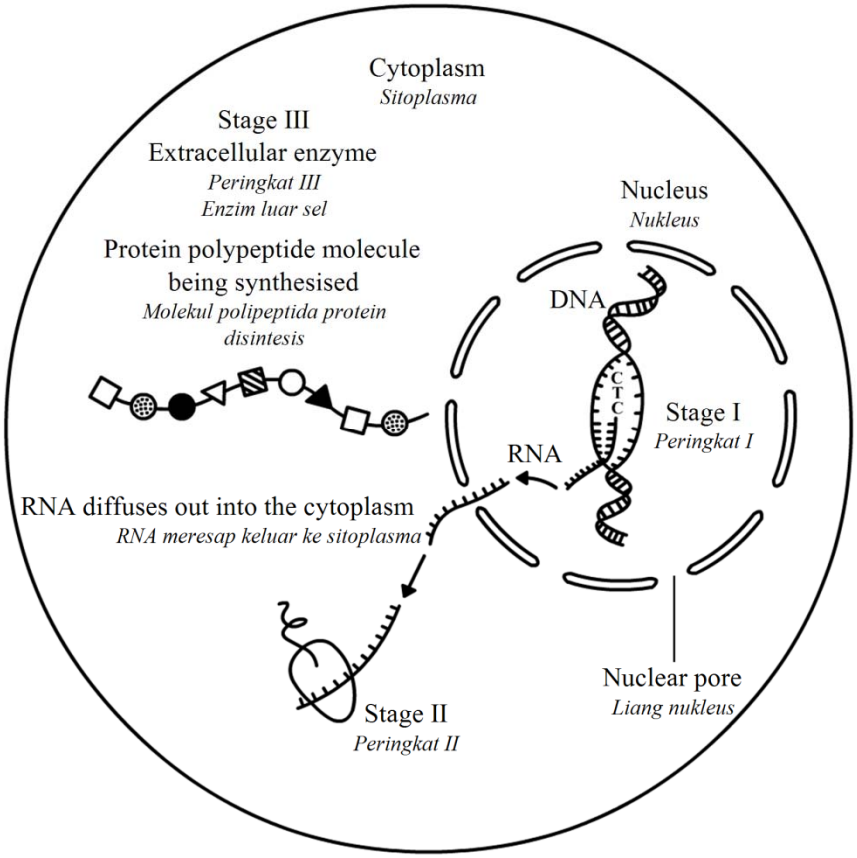


Diagram 13
Rajah 13

a) Explain the changes that occurred in the double helix of the DNA strand duting Stage I.
Jelaskan perubahan yang berlaku dalam rantai heliks ganda dua DNA semasa Peringkat I.

[2 marks]
[2 markah]

b) (i) State **two** differences between the structure of the protein polypeptide molecule and the DNA molecule.
*Nyatakan **dua** perbezaan antara struktur molekul polipeptida protein dengan molekul DNA.*

[2 marks]
[2 markah]

(ii) Differentiate between the structures of DNA and RNA.
Bezakan antara struktur DNA dengan RNA.

[1 mark]
[1 markah]

c) Explain how the protein formed at the ribosome is transformed into the extracellular enzyme so that it can be secreted from the cell.
Jelaskan bagaimana protein yang terbentuk di ribosom diubah bentuk menjadi enzim luar sel supaya boleh dirembes keluar daripada sel.

[3 marks]
[3 markah]

d) Diagram 13.2 shows a gene mutation that occurs in the DNA strand containing the base sequence CTC.
Rajah 13.2 menunjukkan mutasi gen yang berlaku pada rantai DNA yang mengandungi urutan bes CTC.

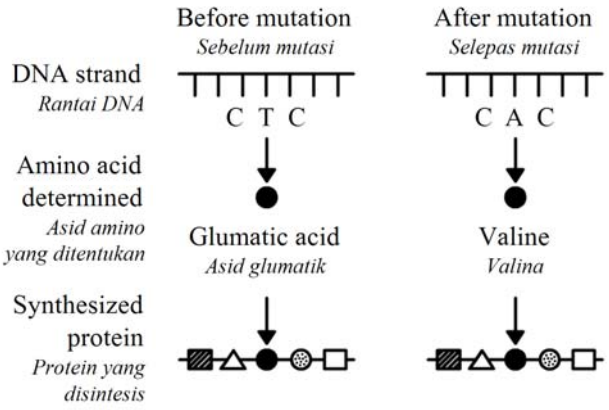


Diagram 13.2
Rajah 13.2

Explain how the mutation affects the specific characteristic or trait controlled.
Jelaskan bagaimana mutasi tersebut mempengaruhi ciri atau trait tertentu yang terkawal.

_____

_____

_____

[3 marks]
[3 markah]

ANSWER SCHEME

SECTION A

1	C	26	D
2	D	27	D
3	D	28	A
4	B	29	A
5	D	30	C
6	A	31	B
7	D	32	B
8	D	33	C
9	C	34	D
10	C	35	B
11	B	36	C
12	A	37	A
13	A	38	D
14	A	39	C
15	C	40	A
16	D	41	C
17	C	42	A
18	B	43	C
19	A	44	A
20	C	45	A
21	B	46	B
22	B	47	C
23	A	48	A
24	A	49	A
25	B	50	B

SECTION B

1 (a) P: Plasma membrane
Membran plasma
Q: Cytoplasm
Sitoplasma
R: Nucleus
Nukleus
S: Cell wall
Dinding sel

(b)

Animal cell ***Sel haiwan***	**Plant cell** ***Sel tumbuhan***
Has no fixed shape *Tidak mempunyai bentuk tetap*	Has a fixed shape *Mempunyai bentuk tetap*
Has no cell wall *Tidak mempunyai dinding sel*	Has a cell wall *Mempunyai dinding sel*
Food stored in the form of glycogen *Makanan disimpan dalam bentuk glikogen*	Food stored in the form of starch *Makanan disimpan dalam bentuk kanji*

(c) Cytoplasm and nucleus
Sitoplasma dan nukleus

(d) Controls the exchange of substances between the cell and its environment.
Mengawal pertukaran bahan-bahan di antara sel dan persekitarannya.

(e) (i) Tonoplast
Tonoplas
(ii) Absorbs light energy for the photosynthesis process.
Menyerap tenaga cahaya bagi proses fotosintesis.

2

(a) (i) Skin
Kulit
(ii) - Regulating body temperature
Mengawal suhu badan
- Eliminating urea
Menyingkirkan urea
- As a protective layer
Sebagai lapisan pelindung

(b) - P contains groups of different tissues.
P mengandungi kumpulan tisu-tisu yang berlainan.
- Erector muscle contains a group of cells which perform a specific function.
Otot regang mengandungi sekumpulan sel yang menjalankan fungsi yang khusus.

(c) - Integumentary system
Sistem integumen
- Excretory system
Sistem perkumuhan

(d) - The hair lies when the erector muscle relaxes.
Bulu roma rebah apabila otot regang mengendur.
- The hair follicles trap a thin layer of air so that more heat is lost to the surroundings.
Bulu roma memerangkap satu lapisan nipis udara supaya lebih banyak haba hilang ke persekitaran.
- Sweat gland secretes sweat which evaporates and causes an amount of heat to be lost to the surroundings.
Kelenjar peluh merembeskan peluh yang menyejat dan menyebabkan sejumlah haba hilang ke persekitaran.

3

(a) (i) Mitochondrion
Mitokondrion
(ii) To increase total surface area for the efficiency of cellular respiration.
Untuk menambahkan jumlah luas permukaan untuk kecekapan respirasi sel.

(b) (i) X: Glucose
Glukosa
Y: Water
Air
(ii) - Less energy is produced if the blood sugar is lower than the normal range.
Kurang tenaga akan terhasil jika gula darah rendah daripada had normal.
- Pancreas secrete glucagon to convert glycogen to glucose.
Pankreas merembeskan glukagon untuk menukarkan glukogen kepada glukosa.
- Cellular respiration occurs.
Respirasi sel berlaku.

(c)

Muscle cell ***Sel otot***	**Yeast cell** ***Sel yis***
Product is lactic acid *Produk adalah asid laktik*	Product is ethanol *Produk adalah etanol*
Carbon dioxide is not released *Karbon dioksida tidak dibebaskan*	Carbon dioxide is released *Karbon dioksida dibebaskan*

4

(a) X: Hypertonic solution
Larutan hipertonik
Y: Hypotonic solution
Larutan hipotonik

(b) X: 30% sucrose solution
Larutan sukrosa 30%
Y: Distilled water
Air suling

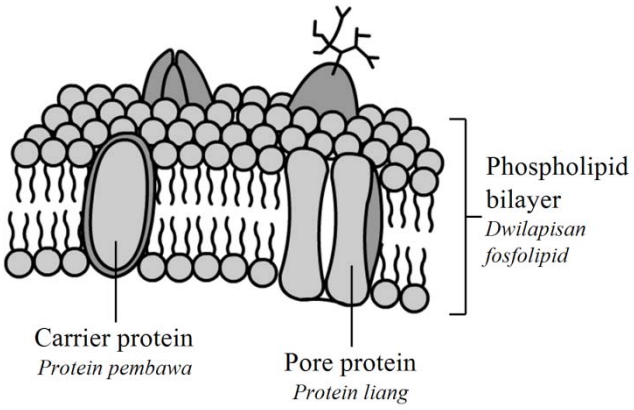
(c) X: The strip becomes shorter, thinner and softer. The strip curves inwards.
Jalur menjadi lebih pendek, nipis dan lembut. Jalur melengkung ke dalam.
Y: The strip becomes longer, thicker, turgid and firm. The strip curves outwards.
Jalur menjadi lebih panjang, tebal, segah dan keras. Jalur melengkung ke luar.

(d) - Excess fertilizer will cause the soil water to be hypertonic towards the root hair cells.
Baja berlebihan menyebabkan air tanah menjadi hipertonik terhadap sel akar rambut.
- Water from the root hair cells diffuses out to the soil by osmosis.
Air daripada sel akar rambut meresap keluar ke dalam tanah secara osmosis.
- The cells become plasmolysed and leads to wilting.
Sel mengalami plasmolisis dan akhirnya layu.

(e) Advantage:
Kebaikan:
- It keeps longer.
Ia tahan lebih lama.

Disadvantages:
Keburukan:
- The sugar content of the food is too high.
Kandungan gula dalam makanan terlalu tinggi.
- Some of the nutrients such as vitamin C are lost.
Sebahagian nutrien seperti vitamin C hilang.

5 (a)



(b) - Consists of hydrophilic heads and hydrophobic tails.
Mengandungi kepala hidrofilik dan ekor hidrofobik.
- The hydrophilic heads are facing the exterior and the interior of the cell.
Kepala hidrofilik mengadap ke arah luar dan arah dalam sel.

(c) (i) - Glucose consists of uncharged large-sized molecules which cannot pass through the phospholipid bilayer.
Glukosa terdiri daripada molekul bersaiz besar yang tidak bercas yang tidak dapat melalui dwilapisan fosfolipid.
- It needs a specific carrier protein to transport it across the phospholipid bilayer.
Ia memerlukan protein pembawa khusus untuk mengangkutnya melalui dwilapisan fosfolipid.

(ii) - By active transport.
Secara pengangkutan aktif.
- It needs energy which is produced by cellular respiration.
Ia memerlukan tenaga yang dihasilkan oleh respirasi sel.
- Carrier proteins bind with the calcium ions and change their shape, thus carrying the ions across the plasma membrane.
Protein pembawa terikat dengan ion kalsium dan berubah bentuk, dengan itu membawa ion kalsium merentasi membran plasma.

(d) - Selective barrier of the phospholipid bilayer.
Rintangan memilih bagi dwilapisan fosfolipid.
- Specific transport proteins build into the membrane.
Protein pengangkut khusus terbina di dalam membran.

6

(a) P: Chiasma
Kiasma
Q: Bivalent
Bivalen

(b) Synapsis
Sinapsis

(c) Crossing over
Pindah silang

(d) 1. Non-sister chromatids exchange segments of DNA.
Kromatid bukan beradik bertukar segmen DNA.
2. New combination of genes on a chromosome.
Kombinasi gen yang baru pada kromosom.

(e) (i) 1. Ultraviolet light
Sinar ultraungu
2. X-ray
Sinar-X

(ii) Factor Y causes mutation which results in uncontrolled cell division.
Faktor Y menyebabkan mutasi yang menyebabkan pembahagian sel yang tidak terkawal.

(iii) 1. Radiotherapy
Radioterapi
2. Chemotherapy
Kemoterapi

7

(a)

Aspect ***Aspek***	Cell X *Sel X*	Cell Y *Sel Y*
Types of cell division ***Jenis pembahagian sel***	Meiosis *Meiosis*	Mitosis *Mitosis*
Stage of cell division ***Peringkat pembahagian sel***	Telophase I *Telofasa I*	Anaphase *Anafasa*
Chromosomal behaviour ***Perlakuan kromosom***	Cytokinesis occurs to produce two haploid daughter cells *Sitokinesis berlaku untuk menghasilkan dua anak sel haploid*	The sister chromatids separate and move to opposite poles of the cell *Kromatid beradik berpisah dan bergerak ke kutub bertentangan sel*

(b) (i) 47

(ii) Down's syndrome
Sindrom Down

(iii) Slanted eyes
Mata sepet

(c) (i) Chromosomal mutation

Mutasi kromosom

(ii) - The failure of the sex chromosomes to separate during anaphase I
Kegagalan kromosom seks untuk terpisah semasa anafasa I
- A sperm which has 23 autosomes and X, X chromosomes fertilises an ovum with the normal number of chromosomes and the resultant zygote has the normal number of sex chromosomes but an abnormal number of autosomes, 45 + XX
Sperma yang mempunyai 23 kromosom autosom dan kromosom X, X bersenyawa dengan ovum yang mempunyai bilangan kromosom yang normal dan menghasilkan zigot yang mempunyai bilangan kromosom seks yang normal tetapi bilangan kromosom autosom yang abnormal, 45 + XX

8

(a) (i) Meiosis I
(ii) P → S → R → Q

(b) (i) - The chromosomes condense, thicken and become clear
Kromosom padar, menebal dan menjadi jelas
- Homologous chromosome exchange the genetic material by crossing over
Kromosom homolog bertukar bahan genetik melalui pindah silang

(ii) Increases genetic diversity
Meningkatkan kepelbagaian genetik

(c) A zygote is formed when the nucleus of a sperm fuses with the nucleus of an ovum during fertilisation.
Satu zigot terbentuk apabila nukleus sperma bercantum dengan nukleus ovum melalui persenyawaan.

(d) (i) 47
(ii) Klinefelter's syndrome
Sindrom Klinefelter
(iii) Has an extra sex chromosome
Mempunyai satu kromosom seks yang lebih
(iv) Radioactive rays can cause mutation of the chromosomes, as a result of which an extra sex chromosome is present.
Sinar radioaktif boleh menyebabakan mutasi kromosom, hasilnya satu kromosom seks yang lebih hadir.

9

(a) (i) Lymph
Limfa
(ii) Pathogens and toxic substances are neutralised.
Patogen dan bahan toksik dineutralkan.

(b) (i) - Blood plasma diffuses from the capillaries.
Plasma darah meresap dari kapilari.
- The tissue fluid formed diffuses into the lymphatic vessels.
Bendalir tisu yang terbentuk meresap masuk ke dalam salur limfa.

(ii) Fluid X do not have erythrocytes whereas blood has erythrocytes.
Bendalir X tidak mengandungi eritrosit manakala darah mengandungi eritrosit.

(c) (i) - Interstitial fluid fails to return to the blood circulatory system.
Bendalir intersit gagal dikembalikan ke sistem peredaran darah.
- Tissue fluid accumulates in the spaces between the cells.
Bendalir tisu terkumpul di dalam ruang di antara sel.

(ii) The leg will be swollen.
Kaki menjadi bengkak.

(d) - Glucose and amino acids are transported in the blood circulatory system entering the body tissues forming tissue fluid.
Glukosa dan asid amino diangkut di dalam sistem peredaran darah memasuki tisu badan membentuk bendalir tisu.

- Fatty acids and glycerol are transported by the lymphatic system into the blood circulatory system.
Asid lemak dan gliserol diangkut oleh sistem limfa ke dalam sistem peredaran darah.

- Some of the contents of the tissue fluid enter the lymphatic system and some enter the blood circulatory system at the ends of the venules.
Sebahagian daripada kandungan bendalir tisu memasuki sistem limfa dan sebahagian lagi memasuki sistem peredaran darah di hujung venul.

10

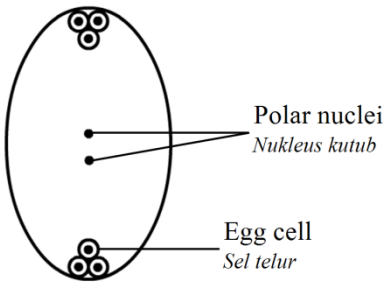
(a) W: Pollen tube V:pollen
Tiub debunga

X: Ovary
Ovari

Y: Embryo sac
Pundi embrio

Z: Male gamete
Gamet jantan

(b) (i)



(ii) - One Z structure fertilizes an egg cell to form a diploid zygote.
Satu struktur Z mensenyawakan satu sel telur untuk membentuk zigot diploid.

- One more Z structure fuses with two polar nuclei to form a triploid zygote.
Satu lagi struktur Z bergabung dengan dua nukleus kutub membentuk zigot triploid.

(c) (i) - Keep V in a dry place.
Simpan V di tempat kering.

- Moisture initiates germination.
Kelembapan mencetuskan percambahan.

(ii) Spraying a surgary solution onto V.
Menyembur larutan gula ke atas V.

11

(a) (i) X: Identical twins
Kembar seiras

Y: Fraternal twins
Kembar tak seiras

(ii) When two ova are released from an ovary at the same time, the ova are fertilised by two different sperms at the same time and two different zygotes are formed.
Apabila dua ovum dibebaskan dari ovari pada masa yang sama, setiap ovum disenyawakan oleh dua sperma berlainan pada masa yang sama dan dua zigot berlainan terbentuk.

(b) - Provides nutrients for the growth of the foetus.
Membekalkan nutrien untuk perkembangan fetus.

- Secretes oestrogen and progesterone.
Merembeskan estrogen dan progesteron.

(c) - Twins X share the same placenta whereas twins Y have separate placentae.
Kembar X berkongsi satu plasenta yang sama manakala kembar Y mempunyai plasenta yang berbeza.

- Twins X are similar in physial appearance but twins Y are not.
Kembar X sama dari segi rupa fizikal manakala kembar Y tidak.

(d) They have different eating habits and different daily activities.
Mereka mempunyai tabiat makan yang berbeza dan aktiviti harian yang berbeza.

(e) - Nicotine can diffuse through the placenta to the foetus and may cause brain damage.
Nikotin boleh meresap melalui plasenta kepada fetus dan boleh menyebabkan kerosakan otak.

- Carbon monoxide can diffuse through the placenta to the foetus and will deprive the foetal tissues from obtaining oxygen.
Karbon monoksida boleh meresap melalui plasenta ke fetus dan akan menghalang tisu fetus daripada mendapat oksigen.

12

(a) (i) PS, ps

(ii) Purple flower, smooth seed
Bunga ungu, biji benih licin

(b) (i)

Male gamete *Gamet jantan* / Female gamete *Gamet betina*	PS	Ps	pS	ps
PS	PPSS	PPSs	PpSS	PpSs
Ps	PPSs	PPss	PpSs	Ppss
pS	PpSS	PpSs	ppSS	ppSs
ps	PpSs	Ppss	ppSs	ppss

(ii) $\frac{3}{16}$

(c) (i) - There are four possible combinations of the alleles in both the male and female gametes: PS, Ps, pS and ps
Terdapat empat kemungkinan kombinasi alel dalam kedua-dua gamet jantan dan gamet betina iaitu PS, Ps, pS dan ps

- Four different phenotypes are produced by the nine different combinations of the phenotypes

Empat fenotip berbeza dihasilkan melalui kombinasi sembilan fenotip yang berbeza

- The phenotypes and the ratio of the plants obtained in the F2 generation are 9 (purple, smooth) : 3 (purple, wrinkled) : 3 (white, smooth) : 1 (white, wrinkled)
  Fenotip dan nisbah tumbuhan yang dihasilkan dalam generasi F2 ialah 9 (ungu, licin) : 3 (ungu, berkedut) : 3 (putih, licin) : 1 (putih, berkedut)

(ii) - During prophase I, crossing over occurs
Semasa profasa I, pindah silang berlaku

- This causes a random combination of allele to take place in gamete formation and producing variation in gametes
  Hal ini menyebabkan gabungan alel berlaku secara rawak dalam pembentukan gamet dan menghasilkan variasi dalam gamet
- Random fertilization takes places so any male gamete can fuse with any female gamete
  Persenyawaan berlaku secara rawak oleh itu mana-mana gamet jantan boleh bercantum dengan mana-mana gamet betina

13

(a) - The double helix of DNA opens.
Rantai heliks ganda dua DNA terbuka.

- An RNA strand is produced.
  Satu rantai RNA dihasilkan.

(b) (i) - The polypeptides consist of amino acids while DNA consists of nucleotide units.
Polipeptida terdiri daripada asid-asid amino manakala DNA terdiri daripada unit nukleotida.

- The polypeptide is in the form of a single linear chain while DNA is a double helix strand.
  Polipeptida adalah dalam bentuk satu rantai tunggal yang lurus manakala DNA terdiri daripada rantai heliks ganda dua.

(ii) - DNA consists of two nucleotide chains while RNA consists of a single nucleotide chain.
DNA terdiri daripada dua rantai nukleotida manakala RNA terdiri daripada satu rantai nukleotida.

- DNA chain is long, RNA chain is short.
  Rantai DNA panjang, rantai RNA pendek.

(c) - Protein enters the rough endoplasmic reticulum.
Protein memasuki jalinan endoplasma kasar.

- Modified in the rough endoplasmic reticulum into an extracellular enzyme.
  Diubahsuai di dalam jalinan endoplasma kasar menjadi enzim luar sel.
- Carried to the Golgi apparatus by a transport vesicle.
  Dibawa ke jasad Golgi oleh vesikel pengangkut.
- Packed in the Golgi apparatus for excretion.
  Dibungkus dalam jasad Golgi untuk dirembes ke luar sel.

(d) - Mutation changes the nitrogenous base, causing glutamic acid to be replaced by valine.
Mutasi mengubah bes bernitrogen menyebabkan asid glutamik digantikan dengan valina.

- This produces a different protein and the trait shows a defect.
  Hal ini menghasilkan protein berbeza dan trait menunjukkan kecacatan.