

SULIT
SP025/2
Physics 2
Paper 2
Semester II
Session 2019/2020
2½ hours

SP025/2
Fizik 2
Kertas 2
Semester II
Sesi 2019/2020
2½ jam



**KEMENTERIAN
PENDIDIKAN
MALAYSIA**

BAHAGIAN MATRIKULASI
MATRICULATION DIVISION

PEPERIKSAAN SEMESTER PROGRAM MATRIKULASI
MATRICULATION PROGRAMME EXAMINATION

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIBERITAHU.
DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Kertas soalan ini mengandungi **18** halaman bercetak.

*This question paper consists of **18** printed pages.*

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SULIT

Answer all questions.
Jawab semua soalan.

1 (a)

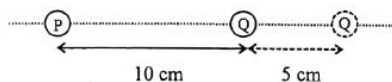


FIGURE 1
RAJAH 1

- (i) The electric field at a point 10 cm away from a charge P as in FIGURE 1 is $2.7 \times 10^6 \text{ N C}^{-1}$. Determine the charge of P.
Medan elektrik pada satu titik 10 cm dari satu cas P seperti RAJAH 1 ialah $2.7 \times 10^6 \text{ N C}^{-1}$. Tentukan cas P.
- (ii) With reference to FIGURE 1, a charge Q is placed 10 cm away from charge P. When charge Q is moved horizontally to the right to a position 5 cm from its initial position, there is a 0.54 J change in its electric potential energy of the system. What is the charge of Q?
Merujuk kepada RAJAH 1, satu cas Q diletakkan 10 cm dari cas P. Apabila cas Q digerakkan ke kanan secara mengufuk 5 cm dari posisi asalnya, terdapat perubahan 0.54 J pada tenaga keupayaan elektrik pada sistem. Apakah cas Q?
- (iii) Sketch the electric force vectors on charge P and Q.
Lakarkan vektor daya elektrik yang bertindak ke atas P dan Q.
- (iv) If charge Q is again moved horizontally to the right to a new position, and the electric force on it is -4.05 N ; how far apart is charge Q from charge P?
Jika cas Q digerakkan lagi ke kanan secara mengufuk ke satu posisi baharu dan daya kekuatan elektrik ke atasnya ialah -4.05 N ; berapakah jarak terpisah antara cas P dan Q?

[10 marks]
[10 markah]

- (b) Two oppositely charged parallel plates are held 2 mm apart. A $4 \times 10^{-5} \text{ J}$ of work is needed to move a $2 \mu\text{C}$ point charge from one plate to the other. Calculate the electric field between the plates.
Dua plat selari berlawanan cas terpisah sejauh 2 mm. Satu kerja $4 \times 10^{-5} \text{ J}$ perlu dilakukan untuk menggerakkan satu cas titik $2 \mu\text{C}$ dari satu plat ke plat yang lain. Hitung medan elektrik antara plat.

[3 marks]
[3 markah]

SULIT

2

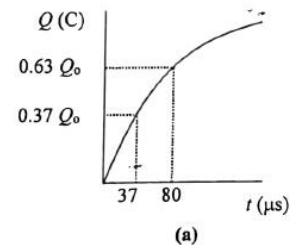
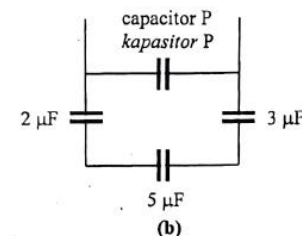


FIGURE 2
RAJAH 2

- (a) The graph in FIGURE 2(a) shows how the charge, Q on a capacitor P changes with time, t when it is charged through a 20Ω resistor. Determine the capacitance of capacitor P.
Graf dalam RAJAH 2(a) menunjukkan bagaimana cas, Q pada satu kapasitor P berubah dengan masa, t apabila ia dicas melalui satu perintang 20Ω . Tentukan kapasitans bagi kapasitor P.
- (b) Capacitor P is then arranged as shown in FIGURE 2(b). Determine the effective capacitance.
Kapasitor P kemudian disusun seperti RAJAH 2(b). Tentukan kapasitans berkesan.

[4 marks]
[4 markah]



(a)

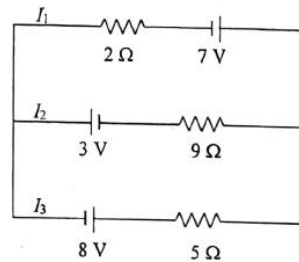


FIGURE 3.1
RAJAH 3.1

For the circuit in FIGURE 3.1, determine the
Untuk litar dalam RAJAH 3.1, tentukan

- current I_1 , I_2 and I_3 .
arus I_1 , I_2 dan I_3 .
- number of electrons passing through the $9\ \Omega$ resistor in 2 s.
bilangan elektron melalui perintang $9\ \Omega$ dalam 2 s.
- power dissipated by the $5\ \Omega$ resistor.
kuasa terlesap oleh perintang $5\ \Omega$.
- change in the resistance of the $2\ \Omega$ resistor when there is a $30\ ^\circ\text{C}$ rise in its temperature. The temperature coefficient of resistivity of the resistor is $6.8 \times 10^{-3}\ ^\circ\text{C}^{-1}$.
perubahan rintangan pada perintang $2\ \Omega$ apabila suhunya meningkat sebanyak $30\ ^\circ\text{C}$. Pekali kerintangan suhu perintang ialah $6.8 \times 10^{-3}\ ^\circ\text{C}^{-1}$.

[10 marks]
[10 markah]

(b)

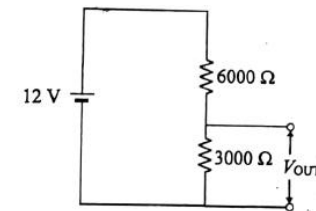


FIGURE 3.2
RAJAH 3.2

FIGURE 3.2 shows a potential divider circuit.

RAJAH 3.2 menunjukkan satu litar pembahagi keupayaan.

- Calculate the output voltage.
Hitung voltan output.
- If a voltmeter of resistance $3000\ \Omega$ is connected across the output, determine the reading of the voltmeter.

Jika satu voltmeter dengan rintangan $3000\ \Omega$ disambungkan merentasi output, tentukan bacaan voltmeter.

[5 marks]
[5 markah]

(a)

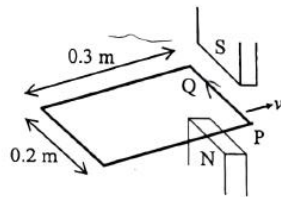


FIGURE 4.1
RAJAH 4.1

FIGURE 4.1 shows a rectangular wire loop $0.3 \text{ m} \times 0.2 \text{ m}$ moving horizontally to the right at 12 m s^{-1} in a uniform magnetic field of 0.8 T . The induced current in the wire is 3 A .

RAJAH 4.1 menunjukkan satu gelung dawai segi empat tepat $0.3 \text{ m} \times 0.2 \text{ m}$ bergerak mengufuk pada 12 m s^{-1} ke kanan dalam medan magnet seragam 0.8 T . Arus teraruh dalam dawai ialah 3 A .

- Determine the resistance of the wire loop.
Tentukan rintangan gelung dawai.
- Determine the direction of the induced current. Explain how you determine the direction of the induced current.
Tentukan arah arus teraruh. Jelaskan bagaimana anda menentukan arah arus teraruh.

[4 marks]
[4 markah]

(b)

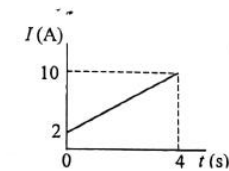


FIGURE 4.2
RAJAH 4.2

A 6 cm long solenoid with 400 turns and cross-sectional area $7 \times 10^{-4} \text{ m}^2$ experiences a changing current as shown in graph in FIGURE 4.2. Determine the

Satu solenoid 6 cm panjang mempunyai 400 lilitan dan luas keratan rentas $7 \times 10^{-4} \text{ m}^2$ mengalami perubahan arus seperti graf dalam RAJAH 4.2. Tentukan

- induced emf.
dge teraruh.
- magnetic flux through each turn and the stored energy at the instant when the current is 3 A .
fluks magnet untuk setiap lilitan dan tenaga tersimpan apabila arusnya ialah 3 A .

[9 marks]
[9 markah]

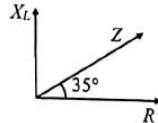


FIGURE 5
RAJAH 5

FIGURE 5 shows a phasor diagram of an RL series circuit connected to an AC source with rms voltage across the inductor of 62.8 V at 50 Hz, 0.8 H inductor and an unknown resistor.

RAJAH 5 menunjukkan satu gambar rajah fasor satu litar siri RL yang disambungkan kepada satu sumber AU dengan voltan pmkd merentasi induktor 62.8 V dan frekuensi 50 Hz, induktor 0.8 H dan satu perintang yang tidak diketahui.

- (a) Determine the
Tentukan

- resistance of the resistor.
rintangan pada perintang.
- peak voltage of the AC source.
voltan puncak bagi sumber AU.
- average power.
kuasa purata.

[9 marks]

[9 markah]

- (b) If the resistor is removed from the circuit, draw the variation of current, I and voltage, V against time, t on the same labelled graph.

Jika perintang tersebut dikeluarkan daripada litar, lukiskan perubahan arus, I dan voltan, V melawan masa, t pada satu graf berlabel yang sama.

[4 marks]

[4 markah]

- 6 (a) An object is placed 15 cm in front of a mirror. The image formed by the mirror is upright and magnified 2 times.

Satu objek diletakkan 15 cm di hadapan satu cermin. Imej yang terbentuk ialah tegak dengan pembesaran 2 kali ganda.

- Is the mirror convex or concave? Explain your answer.
Adakah cermin itu cembung atau cekung? Jelaskan jawapan anda.
- What is another characteristic of the image? Explain your answer.
Apakah satu lagi ciri imej? Jelaskan jawapan anda.
- Determine the radius of curvature of the mirror.
Tentukan jejari kelengkungan cermin.

[7 marks]

[7 markah]



FIGURE 6.1
RAJAH 6.1

- (b) FIGURE 6.1 shows a lens with radii of curvature of 15 cm and 50 cm, made of glass with refractive index 1.55. Determine the focal length and type of lens.

RAJAH 6.1 menunjukkan satu kanta dengan jejari-jejari kelengkungan 15 cm dan 50 cm, yang diperbuat daripada kaca dengan indeks biasan 1.55. Tentukan jarak fokus dan jenis kanta.

[2 marks]

[2 markah]

(c)

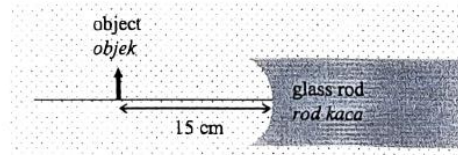


FIGURE 6.2
RAJAH 6.2

FIGURE 6.2 shows an object and a glass rod immersed in a liquid. The rod has a refractive index of 1.7 and radius of curvature 8.0 cm. If the object distance is 15 cm and the virtual image distance is 13 cm, determine the refractive index of the liquid.

RAJAH 6.2 menunjukkan satu objek dan satu rod kaca drendam dalam satu cecair. Rod mempunyai indeks biasan 1.7 dan jejari kelengkungan 8.0 cm. Jika jarak objek ialah 15 cm dan jarak imej maya ialah 13 cm, tentukan indeks biasan cecair.

[3 marks]
[3 markah]

- 7 (a) In a double slit experiment, the incident wavelength is 660 nm, the slit separation is 0.25 mm, and the screen is placed 90 cm away from the slits.
Dalam satu eksperimen dwi-celah, panjang gelombang tuju ialah 660 nm, jarak pisah celah ialah 0.25 mm, dan layar terletak 90 cm dari celah.
- (i) Calculate the distance from the second to the third destructive interference fringe.
Hitung jarak antara pinggir interferens memusnah kedua dan ketiga.
- (ii) The double-slits is now replaced with a diffraction grating. If the maximum number of bright fringes is 15, calculate the slit separation of the grating.
Dwi-celah sekarang digantikan dengan satu parutan belauan. Jika bilangan pinggir cerah maksimum ialah 15, hitung jarak pisah celah belauan.
- [9 marks]
[9 markah]
- (b) A soap film with refractive index 1.3 and minimum thickness 0.177 μm appears reddish under white light. Calculate the wavelength of light that is missing from the reflection.
Satu filem sabun dengan indeks biasan 1.3 dan ketebalan minimum 0.177 μm kelihatan kemerah-merahan dalam pancaran cahaya putih. Hitung panjang gelombang cahaya yang hilang daripada pantulan.
- [3 marks]
[3 markah]

8

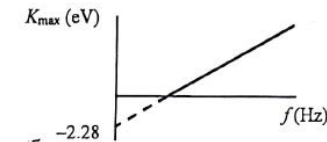


FIGURE 8
RAJAH 8

FIGURE 8 shows a graph of photoelectron maximum kinetic energy, K_{max} against frequency of light, f from a photoelectric effect experiment. Calculate the

RAJAH 8 menunjukkan satu graf tenaga kinetik maksimum fotoelektron, K_{max} melawan frekuensi cahaya, f hasil daripada satu eksperimen kesan fotoelektrik. Hitung

- (a) maximum speed of the photoelectron.
laju maksimum fotoelektron.
- (b) stopping potential.
keupayaan penghenti.
- (c) threshold frequency.
frekuensi ambang.

[6 marks]
[6 markah]

- 9 A beam of electrons is accelerated through a potential difference of 4500 V in a Davisson and Germer experiment.

Satu alur elektron dipecut melalui satu beza upaya 4500 V dalam eksperimen Davisson dan Germer.

- (a) Calculate the de Broglie wavelength of the electrons.
Hitung panjang gelombang de Broglie bagi elektron.

[2 marks]
[2 markah]

- (b) Will the diffraction pattern become larger, remain unchanged or narrower when proton is used instead of electrons? Justify your answer.

Adakah corak parutan membesar, tidak berubah, atau mengecil apabila proton menggantikan elektron? Jelaskan jawapan anda.

[2 marks]
[2 markah]

10

- (a) Calculate the binding energy per nucleon of a sodium nucleus ($^{23}_{11}\text{Na}$) in MeV nucleon^{-1} . The atomic mass of sodium is 22.989769 u .

Hitung tenaga ikatan per nukleon bagi satu nukleus natrium ($^{23}_{11}\text{Na}$) dalam MeV nukleon^{-1} . Jisim atom natrium ialah 22.989769 u .

[4 marks]
[4 markah]

- (b) Calculate the activity of a $5 \mu\text{g } ^{24}\text{Na}$ which has a half-life of 14.9 hours .

Hitung aktiviti $5 \mu\text{g } ^{24}\text{Na}$ yang mempunyai separuh hayat 14.9 jam .

[4 marks]
[4 markah]

END OF QUESTION PAPER
KERTAS SOALAN TAMAT