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.*

Answer **all** questions.
*Jawab **semua** soalan.*

1 (a)

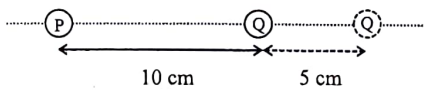


FIGURE 1
RAJAH 1

(i) The electric field at a point 10 cm away from a charge P as in **FIGURE 1** is 2.7×10^6 N C^{-1}. Determine the charge of P.

Medan elektrik pada satu titik 10 cm *dari satu cas* P *seperti **RAJAH 1** ialah* 2.7×10^6 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?

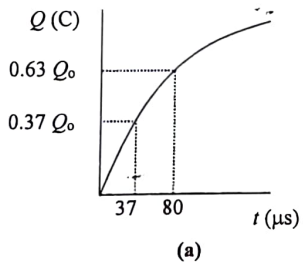
[10 *marks*]
[10 *markah*]

(b) Two oppositely charged parallel plates are held 2 mm apart. A 4×10^{-5} J of work is needed to move a 2 μC point charge from one plate to the other. Calculate the electric field between the plates.

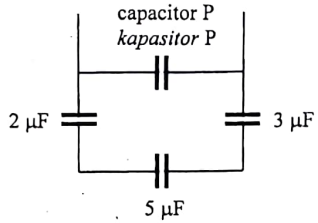
Dua plat selari berlawanan cas terpisah sejauh 2 mm. *Satu kerja* 4×10^{-5} J *perlu dilakukan untuk menggerakkan satu cas titik* 2 μC *dari satu plat ke plat yang lain. Hitung medan elektrik antara plat.*

[3 *marks*]
[3 *markah*]

2



(a)



(b)

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 20 Ω 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* 20 Ω. *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*]

3 (a)

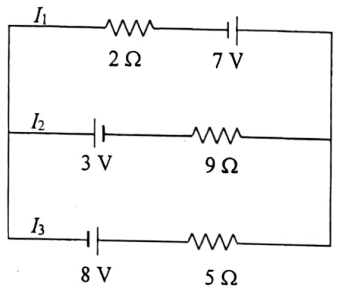


FIGURE 3.1
***RAJAH* 3.1**

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

(i) current I_1, I_2 and I_3.
arus I_1, I_2 *dan* I_3.

(ii) number of electrons passing through the 9 Ω resistor in 2 s.
bilangan elektron melalui perintang 9 Ω *dalam* 2 s.

(iii) power dissipated by the 5 Ω resistor.
kuasa terlesap oleh perintang 5 Ω.

(iv) change in the resistance of the 2 Ω resistor when there is a 30 °C rise in its temperature. The temperature coefficient of resistivity of the resistor is 6.8×10^{-3} °C^{-1}.
perubahan rintangan pada perintang 2 Ω *apabila suhunya meningkat sebanyak* 30 °C. *Pekali kerintangan suhu perintang ialah* 6.8×10^{-3} °C^{-1}.

[10 *marks*]
[10 *markah*]

(b)

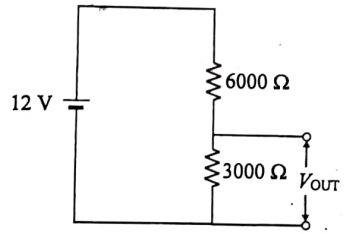


FIGURE 3.2
***RAJAH* 3.2**

FIGURE 3.2 shows a potential divider circuit.
***RAJAH* 3.2** *menunjukkan satu litar pembahagi keupayaan.*

(i) Calculate the output voltage.
Hitung voltan output.

(ii) If a voltmeter of resistance 3000 Ω is connected across the output, determine the reading of the voltmeter.
Jika satu voltmeter dengan rintangan 3000 Ω *disambungkan merentasi output, tentukan bacaan voltmeter.*

[5 *marks*]
[5 *markah*]

4 (a)

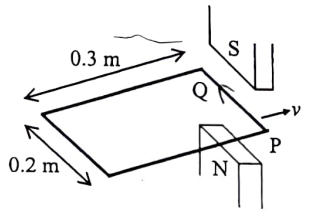


FIGURE 4.1
***RAJAH* 4.1**

FIGURE 4.1 shows a rectangular wire loop 0.3 m × 0.2 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 m × 0.2 m *bergerak mengufuk pada* 12 m s^{-1} *ke kanan dalam medan magnet seragam* 0.8 T. *Arus teraruh dalam dawai ialah* 3 A.

(i) Determine the resistance of the wire loop.

Tentukan rintangan gelung dawai.

(ii) 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)

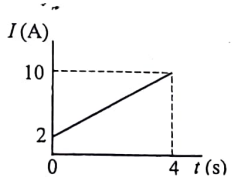


FIGURE 4.2
***RAJAH* 4.2**

A 6 cm long solenoid with 400 turns and cross-sectional area 7×10^{-4} 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* 7×10^{-4} m^2 *mengalami perubahan arus seperti graf dalam* ***RAJAH* 4.2**. *Tentukan*

(i) induced emf.

dge *teraruh.*

(ii) 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*]

5

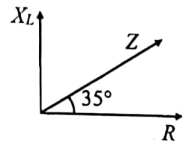


FIGURE 5
***RAJAH* 5**

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

(i) resistance of the resistor.

rintangan pada perintang.

(ii) peak voltage of the AC source.

voltan puncak bagi sumber AU.

(iii) 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.*

(i) Is the mirror convex or concave? Explain your answer.

Adakah cermin itu cembung atau cekung? Jelaskan jawapan anda.

(ii) What is another characteristic of the image? Explain your answer.

Apakah satu lagi ciri imej? Jelaskan jawapan anda.

(iii) 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)

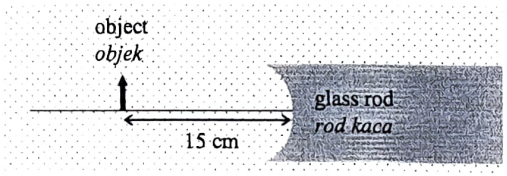


FIGURE 6.2
***RAJAH* 6.2**

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 direndam 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

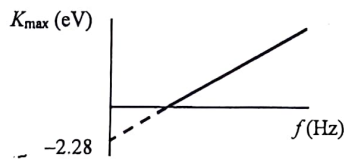


FIGURE 8
***RAJAH* 8**

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 ($^{23}_{11}Na$) in MeV nucleon^{-1}. The atomic mass of sodium is 22.989769 u.

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

[4 *marks*]
[4 *markah*]

(b) Calculate the activity of a 5 μg ^{24}Na which has a half-life of 14.9 hours.

Hitung aktiviti 5 μg ^{24}Na *yang mempunyai separuh hayat* 14.9 *jam*.

[4 *marks*]
[4 *markah*]

END OF QUESTION PAPER
KERTAS SOALAN TAMAT