



امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

الفصل الدراسي الثاني - الدور الأول - للعام الدراسي ١٤٤٧/١٤٤٦ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٥) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (⬭) وفق النموذج الآتي:

س – عاصمة سلطنة عمان هي:

⬭ القاهرة ⬭ الدوحة

⬬ مسقط ⬭ أبوظبي

ملاحظة: يتم تظليل الشكل (⬬) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ⬬ **غير صحيح** ⬭ ◉ ◒ ⊗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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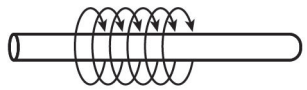
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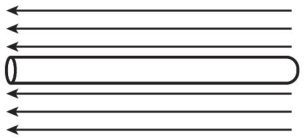
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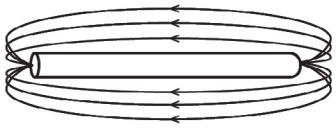
Question 1: Multiple Choice Questions (14 marks)

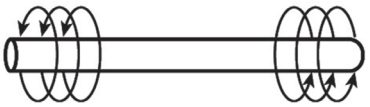
There are 14 multiple-choice items worth one mark each.
Shade in the bubble (⬭) next to the correct answer for each item.

1) Which one of the following shows the magnetic flux lines produced by a current in a straight wire?

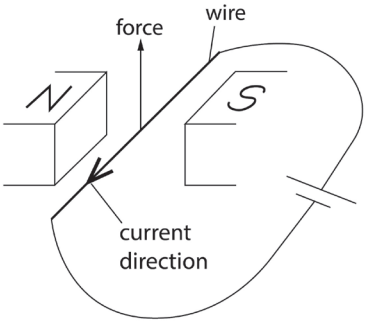
⬭ 

⬭ 

⬭ 

⬭ 

2) An experiment was conducted to see the magnetic effect of an electric current on a wire. It was found that the wire moves upwards as shown in the figure below. What can be done to make the wire move downwards?



⬭ Use stronger magnets.

⬭ Decrease the current intensity.

⬭ Move the magnets closer to each other.

⬭ Change the direction of the current.

3) A conductive strip carries an electric current of ($I = 5\,A$), which has (6.0×10^{28}) free electrons per m^3 in the presence of ($B = 0.2\,T$) magnetic field perpendicular to it. If the strip's thickness is ($t = 0.1\,mm$), what is the Hall voltage across the strip?

⬭ 1.04×10^{-6} V

⬭ 2.08×10^{-6} V

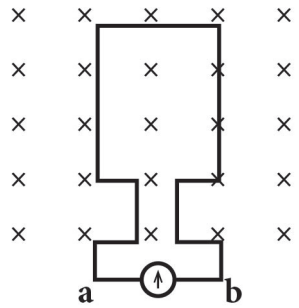
⬭ 4.17×10^{-6} V

⬭ 8.33×10^{-6} V

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Question 1 continued

4) A rectangular coil moves at a constant speed to the left through a uniform magnetic field (B) as shown in the opposite figure. Determine the direction of the induced current in the coil as it exits the magnetic field.

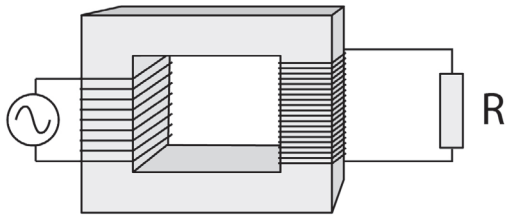


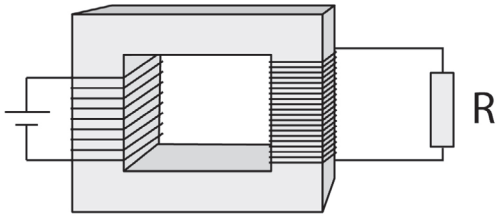
- ⬭ Clockwise.
- ⬭ Counterclockwise.
- ⬭ From **a** to **b**.
- ⬭ No induced current.

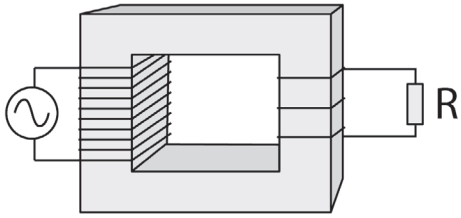
5) Which one of the following situations will **not cause** the generation of an induced (e.m.f)?

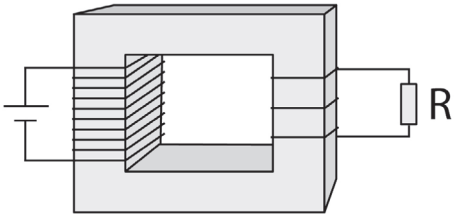
- ⬭ Moving a magnetic field around a conducting loop.
- ⬭ Moving a conductor inside a changing magnetic field.
- ⬭ Changing the surrounding magnetic field of a conducting loop.
- ⬭ Passing a steady current through a conductor in a constant magnetic field.

6) Which figure below represents a working step-down transformer?

⬭ 

⬭ 

⬭ 

⬭ 

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Question 1 continued

7) An alternating current (I) varies with time (t) according to the equation:

$$I = 3 \sin(50t)$$

What is the mean power dissipated in a resistance of (10 Ω)?

- ○ 21 W
- ○ 30 W
- ○ 45 W
- ○ 810 W

8) A light of wavelength (450 nm) incident on a metal surface, emits photo electrons. If the light is replaced with another light of double intensity and a wavelength of (400 nm), how will the number of the emitted photoelectrons and their kinetic energy be affected?

	Number of ejected photoelectrons	Kinetic energy of the ejected photoelectrons
○	Decrease	Decrease
○	Increase	Increase
○	Decrease	Increase
○	Increase	Decrease

9) A metal of work function (2.9 eV) is used in a photoelectric cell. Which one of the following wavelengths will emit photoelectrons from the metal with maximum kinetic energy?

- ○ 3.50×10^{-7} m
- ○ 4.28×10^{-7} m
- ○ 5.20×10^{-7} m
- ○ 7.01×10^{-7} m

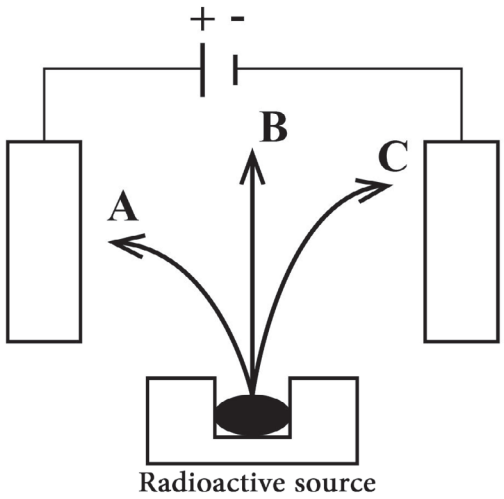
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Question 1 continued

10) Which one of the following is correct about the observation and the conclusion in an alpha particle scattering experiment?

	Observation	Conclusion
○	Most alpha particles come straight back	The nucleus is negatively charged
○	Most alpha particles come straight back	The mass of the atom is concentrated in its center
○	Most alpha particles go straight through	The mass of the atom is concentrated in its center
○	Most alpha particles go straight through	The nucleus is negatively charged

11) The figure below shows a radioactive element that radiates three different radiations (A), (B), and (C). Which row correctly identifies the three radiations?



	A	B	C
○	Alpha	Beta	Gamma
○	Alpha	Gamma	Beta
○	Gamma	Beta	Alpha
○	Beta	Gamma	Alpha

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Question 1 continued

12) How many neutrons does an element with the symbol ($^{90}_{38}\mathrm{X}$) contain?

- 38
- 52
- 90
- 128

13) The mass difference between the nucleus ($^{7}_{3}\mathrm{Li}$) and its components is (0.042 u). What is the nuclear binding energy per nucleon in **MeV**?

- 3.923
- 5.604
- 13.076
- 39.228

14) If the decay constant of element (A) is twice the decay constant of element (B), and the half-life of element (B) is (10 years), what is the half-life of element (A)?

- 2 years
- 5 years
- 10 years
- 20 years

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Question 2: Extended Questions (56 marks)

Write your answer for each of the following questions in the space provided.

Be sure to show all your work, including the correct units where applicable.

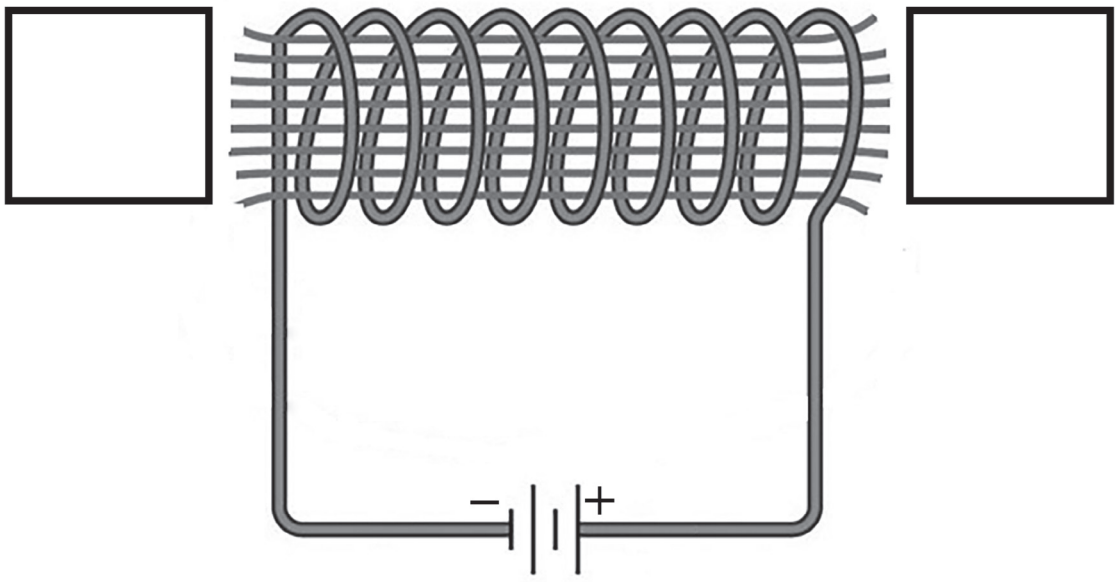
15) a. Complete the table below. (2 marks)

Term	Definition
_____	A region of space where a force is experienced either by moving charges or by permanent magnets.
_____	An uniform magnetic flux density which, acting normally on a long straight wire carrying a current of 1 ampere, causes a force per unit length of ($1N\ m^{-1}$) on the conductor.

b. On the figure below: (2 marks)

(i) Draw the direction of (I).

(ii) Write the name of the magnetic poles in the two boxes.



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16) Force of (0.01 N) acting on a wire of length (0.2 m) carries a current of (5 A). If the wire is placed perpendicularly to the magnetic field,
what is the magnetic flux density (B)? (2 marks)

17) Beam of charged ions passes through a velocity selector that contains an electric field (4.2×10^{4} V/m) and a magnetic field (8.4×10^{-3} T), which are perpendicular to each other.

a. If the ions do not deflect as they pass through the device, find the velocity (v) of the ions. (2 marks)

b. If the electric field is reversed and the charge of the ions is (3.2×10^{-19} C), calculate the net force acting on the beam as it enters the device. (3 marks)

c. Write two components of an electron beam tube. (2 marks)

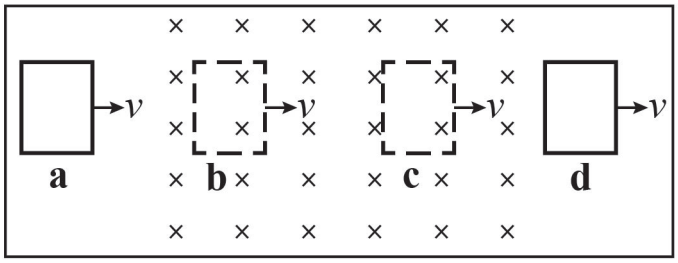
1. _____

2. _____

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Question 2 continued

18) The figure below shows a square loop passing perpendicularly with a constant velocity through a uniform magnetic field with a magnetic flux density of (4 T).



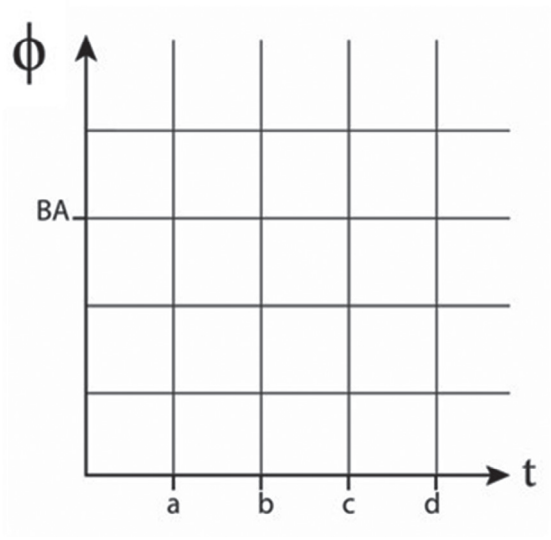
a. Define each of the following:

- Magnetic flux. (1 mark)

- Weber. (1 mark)

b. In the diagram opposite sketch a graph showing the variation of the magnetic flux (ϕ) through the loop with time (t) between points **a** and **d**.

(2 marks)



c. If the magnetic flux through the square loop is (5×10^{-2} Wb), calculate the length of one side of the loop. (3 marks)

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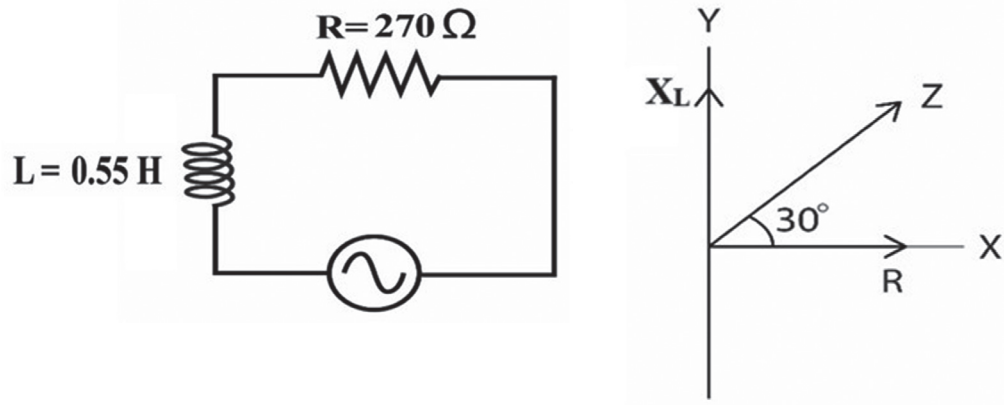
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Question 2 continued

19) a. Complete the table below. (3 marks)

AC Circuit component	Impedance	Phase angle between the current and the voltage (use the terms **leads, lags** and **in phase**)
Only L	X_L	_____
_____	X_c	Current leads the e.m.f by an angle of $\frac{\pi}{2}$
LCR (in resonance)	_____	The current and the **e.m.f** are in phase

b. The figure below shows a LR circuit and its phasor diagram.

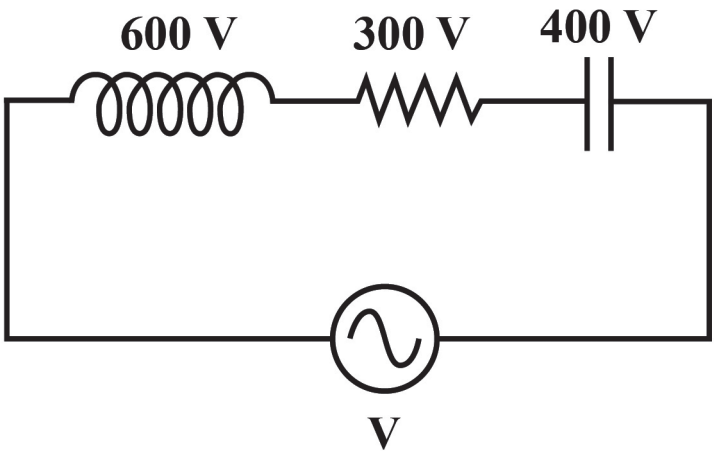


If a capacitor was added to the above circuit with a capacitive reactant of (X_C = 67 Ω), calculate the new phase angle (θ). (4 marks)

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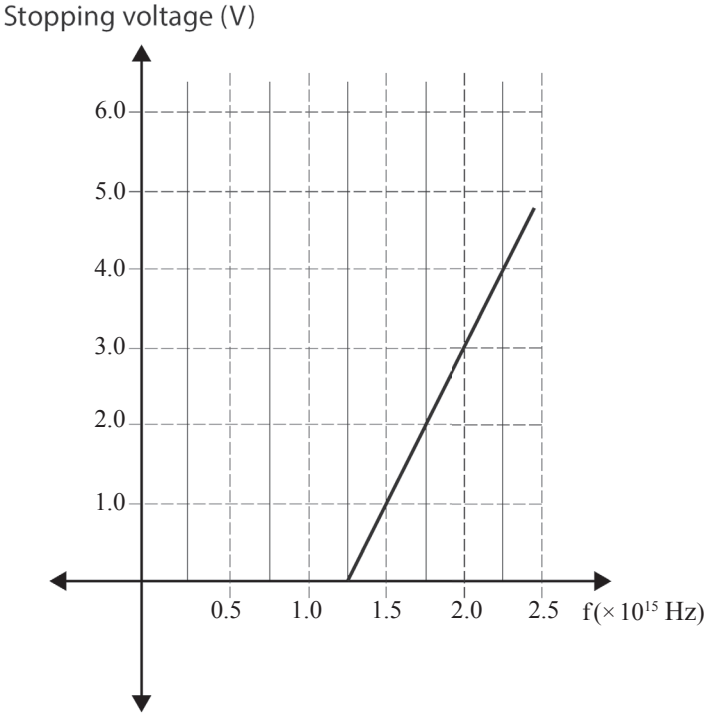
Question 2 continued

20) The figure below shows a LCR circuit.



Calculate the value of the alternating voltage (V). (2 marks)

21) The figure below shows the variation of the stopping voltage (V_o) against the frequency (f) of the incident light on the surface of a photoelectric cell.



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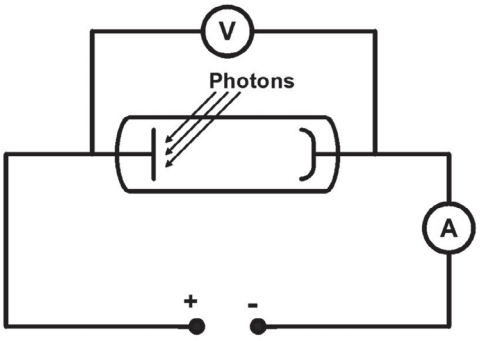
Question 2 continued

a. Define stopping voltage. (1 mark)

b. What is the value of the threshold frequency? (1 mark)

c. If the frequency of the incident light is (1.75×10^{15} Hz), calculate the maximum velocity of the emitted electrons. (4 marks)

22) The figure below shows an experiment that investigated photoelectric effects. The incident photons have a frequency of (1.4×10^{15} Hz). A potential difference was applied and data was collected as shown in the table below.



Current (μA)	Potential difference (V)
20	0.25
6	0.75
0	1.25

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Question 2 continued

a. Define photon. (1 mark)

b. Find the energy of the incident photon. (1 mark)

c. Calculate the maximum kinetic energy of the emitted electrons. (2 marks)

23) The table below shows a summary of the composition of radioactive emissions (Alpha, Beta, and Gamma).

Fill in the blanks. (4 marks)

Property	(α) particle	(β-) particle	(β+) particle	(γ) gamma radiation
Mass	_____	About u/2000	About u/2000	_____
Nature	Helium	Electron	_____	Electromagnetic waves
Speed	Up to 0.05 c	Up to 0.99 c	Up to 0.99 c	_____

24) A nucleus of Radium ($^{226}_{88}Ra$) radiates and turns into Radon ($^{222}_{86}Rn$).

a. Complete the nuclear equation. (1 mark)

$$^{226}_{88}Ra \longrightarrow {}^{222}_{86}Rn + _____$$

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Question 2 continued

b. Data for the masses of some particles is given in the table below.

Particle	Mass/u
Proton	1.00728
Neutron	1.00867
Radon ($^{222}_{86}\mathrm{Rn}$)	222.00

Calculate the following:

(i) The mass defect of ($^{222}_{86}\mathrm{Rn}$). (2 marks)

(ii) The binding energy of ($^{222}_{86}\mathrm{Rn}$) in **MeV**. (2 marks)

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Question 2 continued

25) A sample of Astatine ($^{215}_{85}\mathrm{At}$) initially contains (1.68×10^{19} nuclei) and its half-life is (100×10^{-6} s).

a. Define half-life. (1mark)

b. Calculate its initial radioactivity (A_o). (2 marks)

c. Radioactivity after a time of (2.0×10^{-4} s). (2 marks)

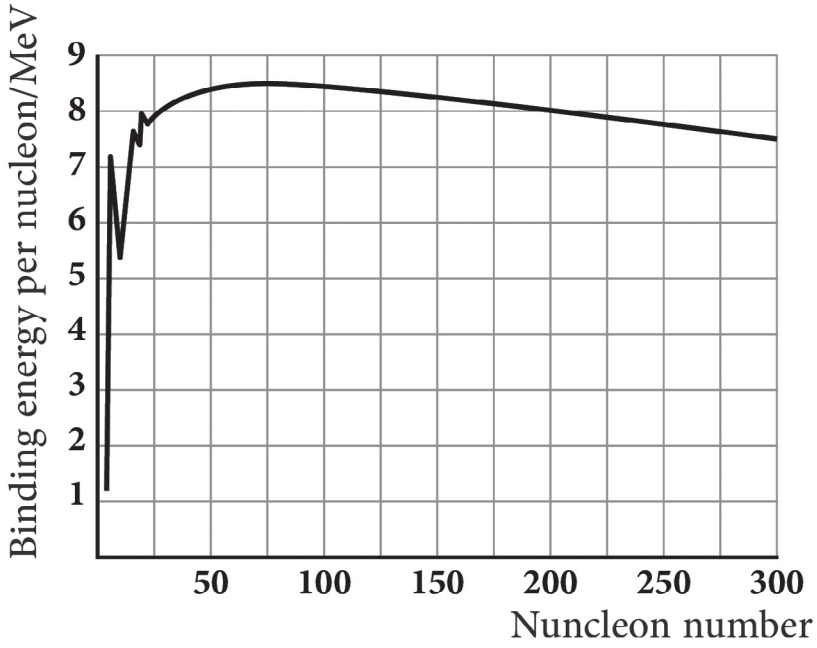
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Question 2 continued

26) The graph below shows the relationship between the binding energy per nucleon and the number of nucleons.



Calculate the energy released in units (MeV) when a nucleus with (200) nucleons splits into two nuclei, each containing (100) nucleons. (3 marks)

[End of Examination]

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Formulas and constants

Magnetic fields and electromagnetism	$F_m = BIl\sin\theta$	$F_m = qvB\sin\theta$	$\frac{e}{m_e} = \frac{2V}{B^2r^2}$
	$V_H = \frac{BI}{ntq}$	$\nu = \frac{E}{B}$	
Electromagnetic induction	$E = \frac{-\Delta(N\Phi)}{\Delta t}$	$\Phi = BA\sin\theta$	$A = \pi r^2$; $r = \frac{mv}{Bq}$
Alternating currents	$x = x_o\sin(\omega t)$	$\omega = 2\pi f$	$P = I^2R$
	$I_{r.m.s} = \frac{I_o}{\sqrt{2}}$	$V_{r.m.s} = \frac{V_o}{\sqrt{2}}$	$P = IV$
	$X_L = 2\pi fL$	$X_C = \frac{1}{2\pi fC}$	$\Delta V_{r.m.s} = I_{r.m.s}R$
	$\Delta V_{r.m.s} = I_{r.m.s}Z$	$\Delta V_{r.m.s} = I_{r.m.s}X_L$	$\Delta V_{r.m.s} = I_{r.m.s}X_C$
	$Z = \sqrt{R^2 + (X_L - X_C)^2}$	$\tan\varphi = \frac{X_L - X_C}{R}$	
	$\Delta V_{max} = \sqrt{\Delta V_R^2 + (\Delta V_L - \Delta V_C)^2}$		$\tan\varphi = \frac{\Delta V_L - \Delta V_C}{\Delta V_R}$
	$\frac{V_S}{V_P} = \frac{N_S}{N_P} = \frac{I_P}{I_S}$	$f_r = \frac{1}{2\pi\sqrt{LC}}$	
Quantum Physics	$E = hf = \frac{hc}{\lambda}$	$\frac{1}{2}m_e v_{max}^2 = e\,V_o$	$\phi = hf_o$
	$hf = hf_o + \frac{1}{2}m_e v_{max}^2$		$KE_{max} = hf - \phi$
Particle and Nuclear physics	$E = \Delta mc^2 = \frac{934\,MeV}{u}$	$A = \frac{-\Delta N}{\Delta t} = N\lambda$	
	$\lambda = \frac{0.693}{t_{\frac{1}{2}}}$	$X = X_0e^{-\lambda t}$	
Constants	$c = 3\times10^8 m\,s^{-1}$ $m_e = 9.11\times10^{-31}Kg$ $q_e = 1.60\times10^{-19}C$	$h = 6.63\times10^{-34}J.s$ $m_p = 1.67\times10^{-27}Kg$ $u = 1.66\times10^{-27}Kg$	

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مركز القياس والتقويم التربوي
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سلطنة عمان
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GENERAL EDUCATION DIPLOMA EXAMINATION

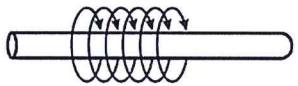
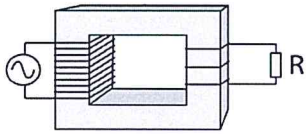
Royal Guard of Oman Technical College,

Physics 2nd Semester, 1st Session 2024-2025

Marking Guide

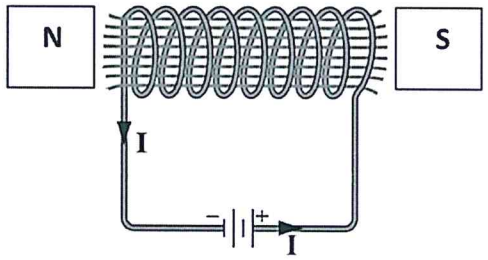
Note: the marking guide in (14) pages **Full marks: (70)**

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Mark	C.L	Ob	page
1		1	K	1.1B	8
2	Change the direction of the current	1	A	1.2A	12
3	1.04×10^{-6} V	1	A	1.3C	24
4	Clockwise	1	R	2.1 E	31
5	Passing a steady current through a conductor in a constant magnetic field.	1	A	2.1G	29
6		1	K	3.3A	49
7	45 W	1	A	3.1-B	36

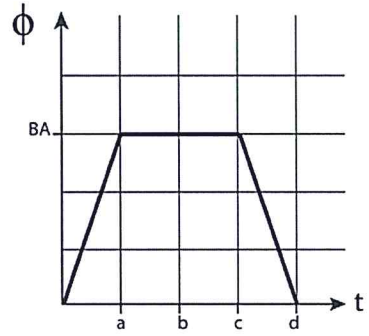
Item	Answer	Mark	C.L	Ob	page
8	Number of ejected photoelectrons: Increase; Kinetic energy of the ejected photoelectrons: Increase	1	A	4.2-E	59
9	$3.5 \times 10^{-7}\ m$	1	R	4.2-I	63-64
10	Observation: Most alpha particles go straight through; Conclusion: The mass of the atom is concentrated in its center	1	k	5.1-A	76
11	A: Beta; B: Gamma; C: Alpha	1	k	5.1-G	75
12	52	1	A	5.1-C	68
13	5.604	1	A	5.2-D	84
14	5 years	1	R	5.3-C	92&94

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

<table>
<tr><th>Item</th><th>Part</th><th>Answer</th><th>Mark</th><th>C.L</th><th>O.B</th><th>Page</th><th>ADDITIONAL INFORMATION</th></tr>
<tr><td rowspan="2">15</td><td>a</td><td>
<table>
<tr><th>Term</th><th>Definition</th></tr>
<tr><td>Magnetic field</td><td>A region of space where a force is experienced either by moving charges or by permanent magnets.</td></tr>
<tr><td>Tesla</td><td>An uniform magnetic flux density which, acting normally on a long straight wire carrying a current of 1 ampere, causes a force per unit length of (1N m^{-1}) on the conductor.</td></tr>
</table>
</td><td>1
1</td><td>K</td><td>1.1A
1.2C</td><td>11&
14</td><td></td></tr>
<tr><td>b</td><td>
</td><td>1
1</td><td>A</td><td>1.1C</td><td>8</td><td>One mark for both correct magnetic poles
One mark for the current</td></tr>
</table>

Item	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
16	$B = \frac{F}{Il\sin\theta}$ when θ=90°: $B = \frac{0.01}{5 \times 0.2}$ B=0.01 T	1 1	A	1.2B	13	

Item	Part	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
17	a	$v = \frac{E}{B}$ $v = \frac{4.2 \times 10^4}{8.4 \times 10^{-3}}$ $v = 5 \times 10^6$ m/s	1 1	A	1.3H	22	
	b	$F_m = qvB$ $F_m = 3.2 \times 10^{-19} \times 5.0 \times 10^6 \times 8.4 \times 10^{-3}$ $= 1.344 \times 10^{-14} N$ $F_{net} = 2 \times F_m = 2 \times 1.344 \times 10^{-14}$ $= 2.688 \times 10^{-14} N$	1 1 1	R	1.3-B	21	
	c	* Helmholtz coils provide magnetic field B perpendicular to the beam. * Low-pressure gas. * Luminous path of the electron beam.	2	K	1.3E	20	Any two of the list

Item	Part	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
18	a	- The product of the magnetic flux density and the area normal to the lines of flux. - Equal to one tesla meter-squared.	1 1	K	2.1A	27	
	b		2	A	2.1B	27	One mark for the intervals (a,b or c,d) One mark for the interval (b,c)
	c	$\Phi = BA$ $5 \times 10^{-2} = 4 \times l^2$ $l^2 = \frac{5 \times 10^{-2}}{4}$ $l^2 = 125 \times 10^{-4}$ $\sqrt{l^2} = \sqrt{125 \times 10^{-4}}$ $l = 0.118\ m$	1 1 1	R A A	2.1B	27	

<table>
<tr><th>Item</th><th>Part</th><th>Answer</th><th>Mark</th><th>C.L</th><th>O.B</th><th>Page</th><th>ADDITIONAL INFORMATION</th></tr>
<tr><td>19</td><td>a</td><td>
<table>
<tr><th>AC Circuit component</th><th>Impedance</th><th>Phase angle between the current and the voltage
(use the terms leads, lags and in phase)</th></tr>
<tr><td>Only L</td><td>X_L</td><td>Current lags behind the e.m.f by an angle of $\frac{\pi}{2}$
Or
Voltage across the conductor leads the current by an angle of $\frac{\pi}{2}$</td></tr>
<tr><td>Only C</td><td>X_C</td><td>Current leads the e.m.f by an angle of $\frac{\pi}{2}$</td></tr>
<tr><td>LCR
(in resonance)</td><td>R</td><td>The current and the e.m.f are in phase</td></tr>
</table>
</td><td>1
1
1</td><td>K</td><td>3.2-A</td><td>41-46</td><td></td></tr>
<tr><td></td><td>b</td><td>$X_L = \tan(30) \times R$
$X_L = \tan(30) \times 270$
$X_L = 155.88\ \Omega$
$\tan(\theta) = \frac{X_L - X_C}{R}$
$\tan(\theta) = \frac{155.88 - 67}{270}$
$\theta = \tan^{-1}(0.329)$
$\theta = 18.2^o$</td><td>1
1
1
1</td><td>R
R
A
A</td><td>3.2-C</td><td>41-45</td><td></td></tr>
</table>

Item	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
20	$V = \sqrt{(\Delta V_R)^2 + (\Delta V_L - \Delta V_C)^2}$ $V = \sqrt{(300)^2 + (600 - 400)^2}$ $V = 360.56\ \text{V}$	1 1	A	3.2-D	45	

Item	Part	Answer	Mark	C.L	B.O	Page	ADDITIONAL INFORMATION
21	a	The applied voltage against the motion of the photoelectrons to stop their movement.	1	K	4.2-H	59	**Any words that give the same meaning**
	b	$1.25 \times 10^{15} Hz$	1	K	4.2-C	64	Do not accept without the power of 15

	c	$KE_{max} = hf - hf_o$ $KE_{max} = (6.63 \times 10^{-34} \times 1.75 \times 10^{15}) - (6.63 \times 10^{-34} \times 1.25 \times 10^{15})$ $KE_{max} = 3.315 \times 10^{-19} J$ $\frac{1}{2} m_e v_{max}^2 = 3.315 \times 10^{-19}$ $v_{max}^2 = \frac{3.315 \times 10^{-19} \times 2}{9.1 \times 10^{-31}}$ $v_{max} = \sqrt{\frac{3.315 \times 10^{-19} \times 2}{9.1 \times 10^{-31}}}$ $v_{max} = 8.5 \times 10^5 \, m/s$	1 1 1 1	A	4.2-F	61	Accept $KE_{max} = eV_o$ $KE_{max} = 1.6 \times 10^{-19} \times 2$ (one mark) $KE_{max} = 3.2 \times 10^{-19} J$ (one mark)

22	a	A quantum of energy in the form of electromagnetic radiation.	1	K	4.1-B	55	Accept any words with the same meaning and must include the word quantum energy

	b	$E = hf$ $E = 6.63 \times 10^{-34} \times 1.4 \times 10^{15}$ $E = 9.25 \times 10^{-19} J$	1	A	4.1-C	55	
	c	$KE_{max} = eV_o$ $KE_{max} = 1.6 \times 10^{-19} \times 1.25$ $KE_{max} = 2.0 \times 10^{-19} J$	1 1 1	R	4.2-G	59	

Item	Answer	Mark	C.L	B.O	Page	ADDITIONAL INFORMATION
23		4	K	5.1-G	75	Each blank is worth one mark

Property	α- particle	β- minus particle	β- plus particle	γ- gamma radiation
Mass	4u			0 or zero
Nature			Positron	
Speed				C

Item	Part	Answer	Mark	C.L	B.O	Page	ADDITIONAL INFORMATION
24	a	$^{226}_{88}Ra \rightarrow {}^{222}_{86}Rn + {}^{4}_{2}He$	1	A	5.2-C	71-75	
	b(i)	$mass\ defect = \{(86 \times 1.00728 + 136 \times 1.00867) - 222\}$ $mass\ defect = 1.8052\ u$	1 1	A	5.2-A	82-83	
	b(ii)	$The\ binding\ energy = \Delta mC^2$ $= 1.8052u \times 934\ {}^{Mev}/_{u}$ $= 1686.1\ Mev$	1 1	A			

Item	Part	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
25	a	The half – life of a radioactive nuclide is the time taken for the number of undecayed nuclei to be reduced to half its original number.	1	K	5.3-E	89	
	b	$\lambda = \frac{0.693}{t_{\frac{1}{2}}}$ $\lambda = \frac{0.693}{100 \times 10^{-6}} = 6930\ s^{-1}$ $A_\circ = N_\circ \lambda$ $A_\circ = 1.68 \times 10^{19} \times 6930$ $A_\circ = 1.16 \times 10^{23}\ Bq$	1 1	A	5.3-F & 5.3-C	94 & 92	

	c	$A = A_{\circ}\, e^{-\lambda t}$ $A = 1.16 \times 10^{23} \times e^{-(6930 \times 2 \times 10^{-4})}$ $A = 2.9 \times 10^{22}\ Bq$	1 1	A	5.3-D	93	

Item	Part	Answer	Mark	C.L	O.B	Page	ADDITIONAL INFORMATION
26		$Energy\ with 200 = 8 \times 200 = 1600\ MeV$ $Energy\ with\ 100 = (8.3 \times 100) \times 2 = 1660\ MeV$ $\Delta E = 1660 - 1600$ $\Delta E = 60\ MeV$	1 1 1	R	5.2-F&G	83	Accept (8.4, 8.5) MeV for binding energy per nucleon

End of Marking Guide





امتحان دبلوم التعليم العام

لكلية الحرس السلطاني العماني التقنية (ثنائية اللغة)

الفصل الدراسي الثاني - الدور الثاني - للعام الدراسي ١٤٤٦ / ١٤٤٧ هـ - ٢٠٢٤ / ٢٠٢٥ م

تنبيه:
- المادة: الفيزياء.
- الأسئلة في (١٤) صفحة.
- زمن الإجابة: ثلاث ساعات.
- الإجابة في الورقة نفسها.

تعليمات مهمة:

- يجب الحضور إلى قاعة الامتحان قبل عشر دقائق على الأقل من بدء زمن الامتحان.
- يجب إحضار أصل ما يثبت الهوية وإبرازها للعاملين بالامتحانات.
- يجب الالتزام بالزي (الدشداشة البيضاء والمصر أو الكمة للذكور) والزي المدرسي للطالبات ، ويستثنى من ذلك الدارسون من غير العمانيين بشرط الالتزام بالذوق العام، ويمنع على جميع المتقدمات ارتداء النقاب داخل المركز وقاعات الامتحان.
- يحظر على الممتحنين اصطحاب الهواتف النقالة وأجهزة النداء الآلي وآلات التصوير والحواسيب الشخصية والساعات الرقمية الذكية والآلات الحاسبة ذات الصفة التخزينية والمجلات والصحف والكتب الدراسية والدفاتر والمذكرات والحقائب اليدوية والآلات الحادة أو الأسلحة أياً كان نوعها وأي شيء له علاقة بالامتحان.
- يجب على الممتحن الامتثال لإجراءات التفتيش داخل المركز طوال أيام الامتحان.
- يجب على الممتحن التأكد من استلام دفتر امتحانه، مغلفاً بغلاف بلاستيكي شفاف وغير ممزق ، وهو مسؤول عنه حتى يسلمه لمراقبي اللجنة بعد الانتهاء من الإجابة.
- يجب الالتزام بضوابط إدارة امتحانات دبلوم التعليم العام وما في مستواه وأية مخالفة لهذه الضوابط تعرضك للتدابير والإجراءات والعقوبات المنصوص عليها بالقرار الوزاري رقم ٥٨٨ / ٢٠١٥.
- يقوم المتقدم بالإجابة عن أسئلة الامتحان المقالية بقلم الحبر (الأزرق أو الأسود).
- يقوم المتقدم بالإجابة عن أسئلة الاختيار من متعدد بتظليل الشكل (○) وفق النموذج الآتي:

س – عاصمة سلطنة عمان هي:

○ القاهرة ○ الدوحة

● مسقط ○ أبوظبي

ملاحظة: يتم تظليل الشكل (●) باستخدام القلم الرصاص وعند الخطأ، امسح بعناية لإجراء التغيير.

صحيح ● **غير صحيح** ▭ ◉ ◒ ✗ ✓

مُسَوَّدَة، لا يتم تصحيحها

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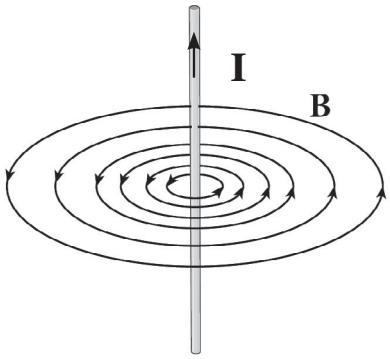
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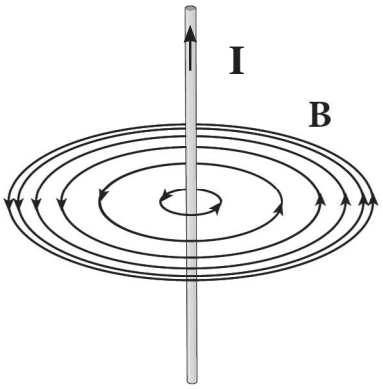
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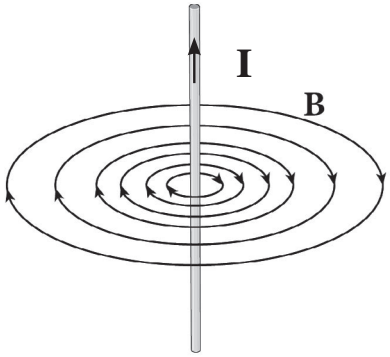
Question 1: Multiple Choice Questions (14 marks)

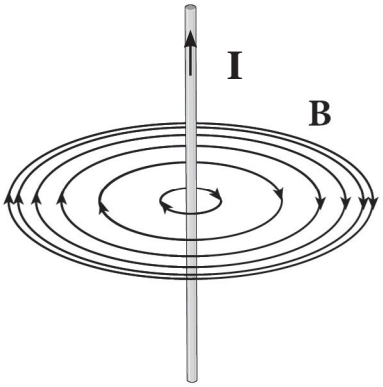
There are 14 multiple-choice items worth one mark each.
Shade in the bubble (⬭) next to the **best** answer for each item.

1) What is the correct pattern of the magnetic field around the wire?

⬭ 

⬭ 

⬭ 

⬭ 

2) A current carrying wire of (5.0 A) is placed at (60°) to a uniform magnetic field of (0.02 T). If the wire is (0.5 m) long, what is the force acting on the wire?

⬭ 0.025 N
⬭ 0.043 N
⬭ 0.050 N
⬭ 0.087 N

3) An electron moves at (2.0×10^6 m s^{-1}) perpendicular to a magnetic field of (0.1 T). What is the radius of its circular path?

⬭ 1.82×10^{-4} m
⬭ 1.136×10^{-4} m
⬭ 5.70×10^{-5} m
⬭ 1.25×10^{-5} m

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Question 1 continued

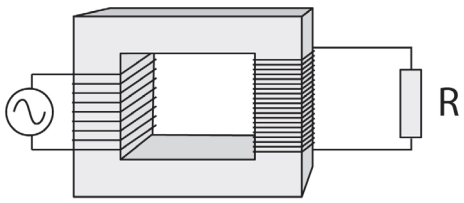
4) A coil of (100 turns) and an area (0.02 m^2) is placed perpendicular to a magnetic field of (0.5 T). If the magnetic field strength drops to zero in (0.1 s), what is the value of the induced **e.m.f.**?

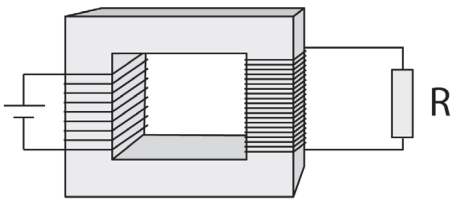
- ☐ 5 V
- ☐ 10 V
- ☐ 15 V
- ☐ 20 V

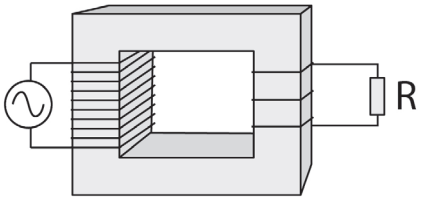
5) If the number of turns of a coil is doubled, while the rate of change of magnetic flux remains constant, what will happen to the induced **e.m.f.**?

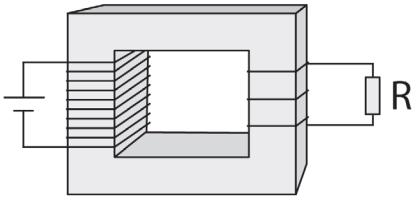
- ☐ be halved.
- ☐ remains the same.
- ☐ be doubled.
- ☐ be zero.

6) Which figure below represents a working step-up transformer.

☐ 

☐ 

☐ 

☐ 

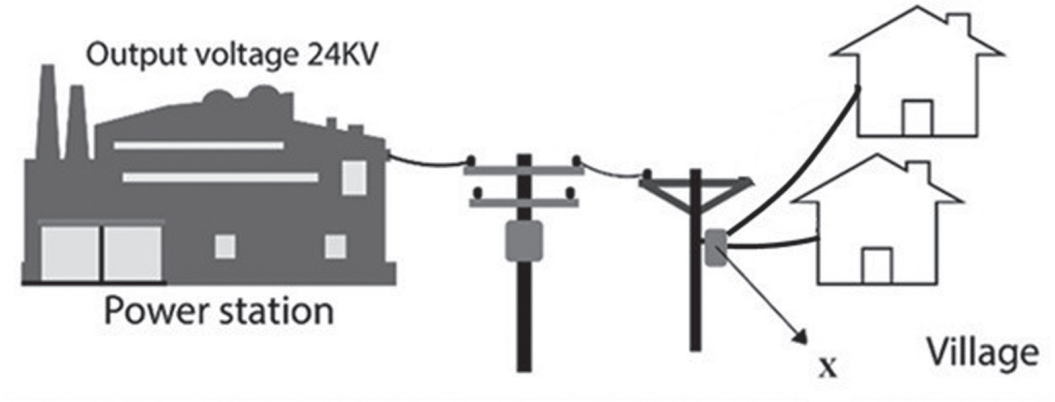
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Question 1 continued

7) The figure below shows a village supplied by a power station.



Which transformer is used in position (**X**) to transfer electricity to the village?

	N_p	N_s	V_s
☐	10	100	24
☐	1000	10	240
☐	2000	1000	24
☐	100	2000	240

8) What is the threshold wavelength for a metal, given that the work function is (1.8 eV)?

☐ 1.24×10^{-6} m ☐ 6.90×10^{-7} m

☐ 2.30×10^{-7} m ☐ 2.30×10^{-15} m

9) When light is incident on a metal surface, electrons are emitted. If the energy of the light is doubled, the maximum kinetic energy of the emitted electrons (KE_{max}) increases from (0.5 eV) to (3.5 eV).

What will be the work function of the metal in (eV)?

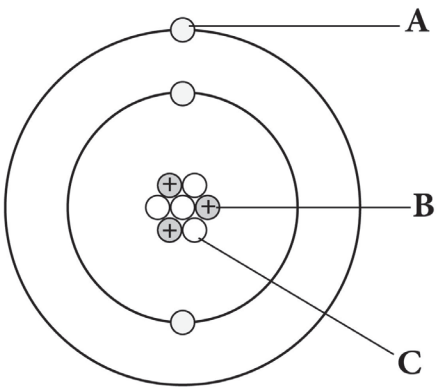
☐ 2.0 ☐ 2.5

☐ 3.5 ☐ 4.0

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Question 1 continued

10) The figure below shows a simple model of an atom.



Which of the following represents the components of an atom denoted by **A**, **B** and **C**?

	A	B	C
☐	Proton	Neutron	Electron
☐	Neutron	Proton	Electron
☐	Electron	Proton	Neutron
☐	Electron	Neutron	Proton

11) Which of the following statements is true about isotopes nuclei?

- ☐ They have the same number of protons, but a different number of neutrons.
- ☐ They have the same numbers of protons, and the same number of neutrons.
- ☐ They have a different number of protons, and a different number of neutrons.
- ☐ They have a different number of protons, and the same number of neutrons.

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Question 1 continued

12) The equation below shows the decay of Iodine.

$$^{131}_{53}\mathrm{I} \longrightarrow {}^{131}_{54}\mathrm{Xe} + _____ + \text{energy}$$

Which of the following is emitted during this decay?

- ☐ $^{4}_{2}\mathrm{He}$
- ☐ $^{0}_{+1}\mathrm{e}$
- ☐ $^{0}_{-1}\mathrm{e}$
- ☐ γ

13) What is the radioactivity of a sample that initially contains (2.66×10^{21}) atoms and its half-life is (5.11×10^{10} s) in (Bq)?

- ☐ 1.14×10^{18}
- ☐ 1.35×10^{11}
- ☐ 3.6×10^{10}
- ☐ 4.2×10^{4}

14) What is the value of the energy released from the reaction ($\mathbf{m}\,^{4}_{2}\mathrm{He} \longrightarrow {}^{12}_{6}\mathrm{C}$), where **m** is the number of Helium atoms knowing that the mass of $^{4}_{2}\mathrm{He}$ = 4.0026 u and $^{12}_{6}\mathrm{C}$ = 12.000 u?

- ☐ 2.7 MeV
- ☐ 3.73 MeV
- ☐ 4.37 MeV
- ☐ 7.28 MeV

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Question 2: Extended Questions (56 marks)

Write your answer for each of the following questions in the space provided.

Be sure to show all your work, including the correct units where applicable.

15) a. State three factors that affect the magnitude of the Hall voltage. (3 marks)

(1) _____

(2) _____

(3) _____

b. An Aluminum strip (0.15×10^{-3} m) thick carries a current of (6.0 A) in a magnetic field of (0.9 T) perpendicular to it. If the free electron density in aluminum is ($6.0 \times 10^{28}\,m^{-3}$), calculate the Hall voltage (V_H). (2 marks)

c. Prove that the velocity of the path of a charged particle remains undeflected when passing through perpendicular electric and magnetic fields is given by:

$$v = \frac{E}{B}$$ (2 marks)

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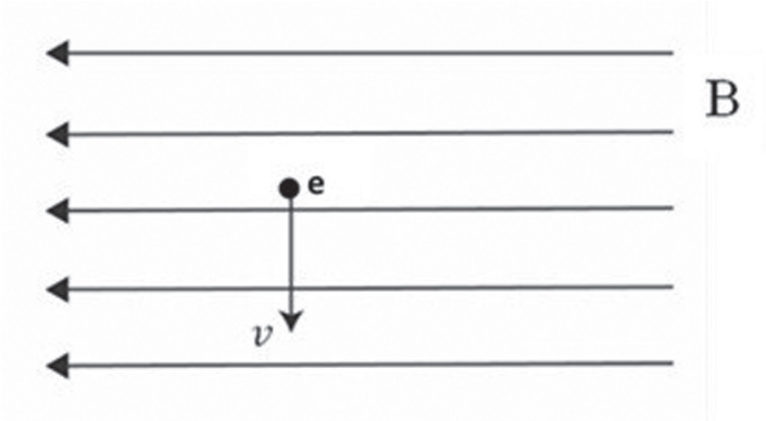
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Question 2 continued

16) a. The effective length of the filament in a light bulb is (0.03 m), and the current in the filament is (0.40 A), for normal brightness.

Calculate the maximum electromagnetic force on the filament when it is in the Earth's magnetic field with a flux density of (4.2×10^{-5} T). (2 marks)

b. An electron moves with a velocity of (2.5×10^{7} m.s^{-1}) in a magnetic field with a flux density of (0.02 T) as shown in the figure below.



(i) Calculate the force acting on the electron. (2 marks)

(ii) Determine the direction of the magnetic force (F_B). (1 mark)

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Question 2 continued

17) a. Complete the table below. (3 marks)

	Faraday's law of electromagnetic induction
Definition	_____ _____
Two factors that affect its magnitude	(1) _____ (2) _____

b. A circular coil with a diameter of (0.1 m) and (120 turns) is placed in a magnetic field perpendicular to its plane. If the field drops from (0.08 T to zero) in (0.02 sec).

(i) Calculate the induced electromotive force. (4 marks)

_____

_____

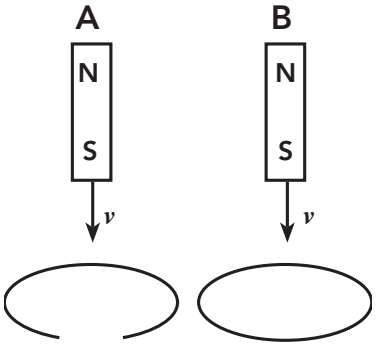
_____

_____

_____

_____

(ii) Two identical magnets (**A** and **B**) are falling from the same height from rest through two Copper rings as shown in the figure opposite. Which one of them will reach the ground first? (1 mark)



▢ **A** ▢ **B** (Shade the correct answer)

Explain your answer.

_____

_____

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Question 2 continued

18) A voltage in an AC circuit is given by: $V = 10 \sin(100\pi t)$

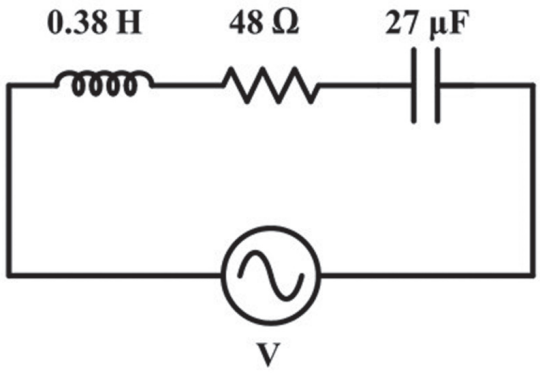
Find each of the following:

a. Voltage peak value (V_o). (1 mark)

b. Angular frequency (ω). (1 mark)

c. The frequency of the AC current. (1 mark)

19) The figure below shows an LCR circuit in resonance.



When the AC power supply produces a maximum voltage of ($\Delta V_{max} = 110\,V$), calculate each the following.

a. The current through the circuit. (2 marks)

b. The frequency of the applied source. (2 marks)

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Question 2 continued

20) Complete the table below for two LCR circuits. (2 marks)

	Inductive Reactance (Ω)	**Capacitive reactance (Ω)**	**Resistance (Ω)**	Phase relationship between current and voltage (use the verbs **lags, leads** or **in phase**)
Circuit (1)	94	57	20	_____
Circuit (2)	48	48	26	_____

21) **a.** Complete the table below. (3 marks)

Term	**Definition**
_____	A quantum of energy in form of electromagnetic radiation.
Work function	_____ _____
_____	The applied voltage against the motion of the photoelectrons to stop their movement.

b. A photon of wavelength (1.40×10^{-7} m) is incident on the surface of a metal with a work function of (1.25 eV).

(i) Calculate the energy of the photon. (2 marks)

_____

_____

_____

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Question 2 continued

(ii) Calculate the maximum kinetic energy of the emitted electron in joules.
(3 marks)

22) The table below shows different metals with their work functions.

Metal	Work function (eV)
Zinc	3.6
Calcium	2.9

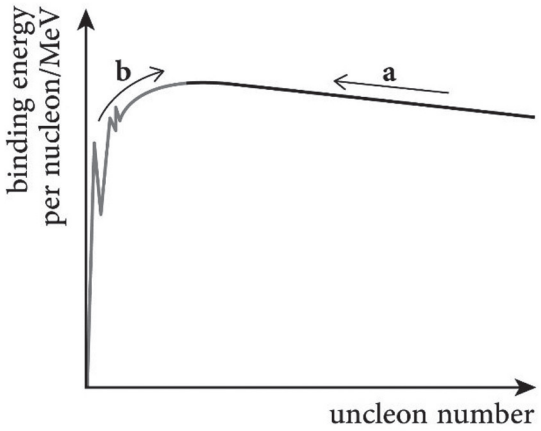
A light with frequency (8.0×10^{14} Hz) was incident in both metals. Explain which metals will emit photoelectrons (mathematically)? (2 marks)

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Question 2 continued

23) The figure below shows the relationship between the binding energy of each nucleon and the number of nucleons



a. Name each process: (2 marks)

Process **a**: _____

Process **b**: _____

b. Why do processes **a** and **b** happen? (1 mark)

_____

_____

24) **a.** Write the definition of each: (2 marks)

- Atomic number:

_____

- Mass number:

_____

b. The following series represents part of the radioactive decay of Uranium ($^{235}_{92}U$).

$$^{235}_{92}U \xrightarrow{a} {}^{231}_{90}Th \xrightarrow{b} {}^{231}_{91}Pa \xrightarrow{c} {}^{227}_{89}Ac$$

What are the particles emitted during:

decay **b:** _____ (1 mark)

decay **c:** _____ (1 mark)

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Question 2 continued

25) The table below shows the mass of some particles.

Nucleus of particle	Mass/ u
Proton	1.00728
Neutron	1.00867
Uranium -235	235.00

Calculate each of the following:

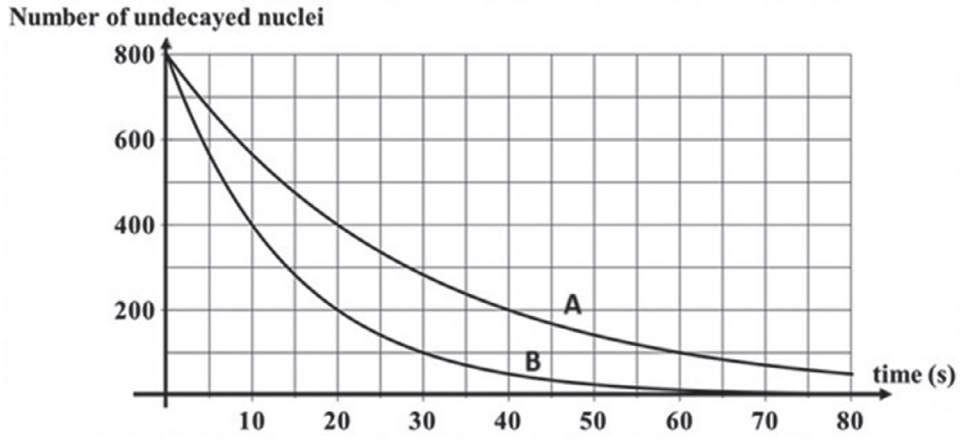
a. The mass defect (Δm) of ($^{235}_{92}U$). (2 marks)

b. The binding energy of ($^{235}_{92}U$) in MeV. (2 marks)

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Question 2 continued

26) The figure below shows the radioactivity against time for two different samples **A** and **B**.



a. Calculate the number of nuclei remaining from sample (**B**) when (t = 100 s).

(3 marks)

b. If (λ_A) is the decay constant for sample (A) and (λ_B) is the decay constant for sample (B), prove that ($\lambda_A = 2\lambda_B$). (3 marks)

[End of Examination]

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Formulas and constants

Magnetic fields and electromagnetism	$F_m = BIl\sin\theta$	$F_m = qvB\sin\theta$	$\frac{e}{m_e} = \frac{2V}{B^2r^2}$
	$V_H = \frac{BI}{ntq}$	$\nu = \frac{E}{B}$	
Electromagnetic induction	$E = \frac{-\Delta(N\Phi)}{\Delta t}$	$\Phi = BA\sin\theta$	$A = \pi r^2$; $r = \frac{mv}{Bq}$
Alternating currents	$x = x_o\sin(\omega t)$	$\omega = 2\pi f$	$P = I^2R$
	$I_{r.m.s} = \frac{I_o}{\sqrt{2}}$	$V_{r.m.s} = \frac{V_o}{\sqrt{2}}$	$P = IV$
	$X_L = 2\pi fL$	$X_C = \frac{1}{2\pi fC}$	$\Delta V_{r.m.s} = I_{r.m.s}R$
	$\Delta V_{r.m.s} = I_{r.m.s}Z$	$\Delta V_{r.m.s} = I_{r.m.s}X_L$	$\Delta V_{r.m.s} = I_{r.m.s}X_C$
	$Z = \sqrt{R^2 + (X_L - X_C)^2}$	$\tan\varphi = \frac{X_L - X_C}{R}$	
	$\Delta V_{max} = \sqrt{\Delta V_R^2 + (\Delta V_L - \Delta V_C)^2}$		$\tan\varphi = \frac{\Delta V_L - \Delta V_C}{\Delta V_R}$
	$\frac{V_s}{V_P} = \frac{N_s}{N_P} = \frac{I_P}{I_S}$	$f_r = \frac{1}{2\pi\sqrt{LC}}$	
Quantum Physics	$E = hf = \frac{hc}{\lambda}$	$\frac{1}{2}m_e v_{max}^2 = e\,V_o$	$\phi = hf_o$
	$hf = hf_o + \frac{1}{2}m_e v_{max}^2$		$KE_{max} = hf - \phi$
Particle and Nuclear physics	$E = \Delta mc^2 = \frac{934\ MeV}{u}$	$A = \frac{-\Delta N}{\Delta t} = N\lambda$	
	$\lambda = \frac{0.693}{t_{\frac{1}{2}}}$	$X = X_0e^{-\lambda t}$	
Constants	$c = 3\times10^8 m\,s^{-1}$ $m_e = 9.11\times10^{-31}Kg$ $q_e = 1.60\times10^{-19}C$	$h = 6.63\times10^{-34}\,J.s$ $m_p = 1.67\times10^{-27}Kg$ $u = 1.66\times10^{-27}Kg$	

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GENERAL EDUCATION DIPLOMA EXAMINATION

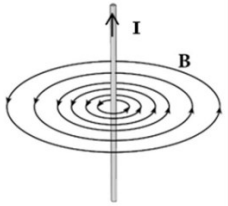
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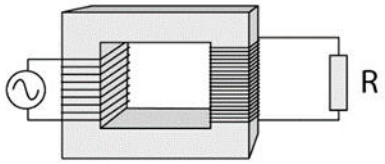
Physics 2nd Semester, 2nd Session 2024-2025

Marking Guide

Note: the marking guide in (12) pages Full marks: (70)

ANSWERS TO MULTIPLE CHOICE QUESTIONS :(14 marks)

Item	Answer	Mark	C.L	Ob	P.N
1		1	K	1.1B	8
2	0.043 N	1	A	1.2B	13
3	1.136×10^{-4} m	1	A	1.3D	19
4	10 V	1	A	2.1F	27&32
5	be doubled.	1	R	2.1F	32

Item	Answer	Mark	C.L	Ob	P.N
6		1	K	3.3A	49
7	Transformer: b; N_p: 1000; N_s: 10; V_s: 240	1	A	3.3-B	51
8	$6.90 \times 10^{-7}\ m$	1	A	4.2-C	55&64
9	2.5 eV	1	R	4.2-F	60-61
10	A: Electron; B: Proton; C: Neutron	1	K	5.1-B	66
11	They have the same number of protons but a different number of neutrons.	1	K	5.1-D	68
12	$_{-1}^{0}e$	1	A	5.2-C	71
13	3.6×10^{10}	1	A	5.3-C	91-92
14	7.28 MeV	1	R	5.2-A	80

ANSWERS TO EXTENDED QUESTIONS :(56 marks)

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
15	(a)	**Factors Affecting the Hall Voltage:** 1. Electric Current (I) 2. Magnetic Field Strength (B) 3. Thickness of the Material (t)	3	K	1.3C	24	Accept the symbols too
	(b)	$V_H = \frac{BI}{ntq}$ $V_H = \frac{0.9 \times 6.0}{6.0 \times 10^{28} \times 0.15 \times 10^{-3} \times 1.6 \times 10^{-19}}$ $= 3.75 \times 10^{-6}\,V$	1 1	A	1.3C	24	
	(c)	$F_E = F_B$ or $F_E + F_B = 0$ $qE = qvB$ $E = vB$ $v = \frac{E}{B}$	1 1	R	1.3H	21,22	

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
16	(a)	$F = BIl$ $F=4.2\times10^{-5}\times0.40\times0.03$ $F=5.04\times10^{-7}$ N	1 1	A	1.2B	13	
	(b)i	$F = Bqv$ $F=0.02\times1.6\times10^{-19}\times2.5\times10^{7}$ $F=8.0\times10^{-14}$ N	1 1	A	1.3B	21	
	(b)ii	The force on the electron is directed out of the page	1	R	1.3A	13	Accept a drawing in the figure as a dot

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
17	(a)	Faraday's law of electromagnetic induction Definition: **The e.m.f. induced is proportional to the rate of change of magnetic flux linkage.** Two factors that affect its magnitude: **(1) Rate of change of magnetic flux (ΔΦ/Δt)**; **(2) Number of turns in the coil (N)**; **(3) Strength of the magnetic field (B)**; **(4) Area of the coil (A)**	1 2	K	2.1D 2.1F	30	Any two factors

	(bi)	$A = \pi r^2 = \pi\,(0.05)^2$ $A = 7.85\times10^{-3}\ m^2$ $\Phi = BA = 0.08\times7.85\times10^{-3}$ $\Phi = 6.28\times10^{-4}\ Wb$ $N\Phi = 120\times6.28\times10^{-4}$ $N\Phi = 0.0754\ Wb$ $E = -\Delta(N\Phi)/\Delta t = 0.0754/0.02$ $E = 3.77\ V$	1 1 1 1	A	2.1F	32	
	bii	A Because induced e.m.f in the closed ring will oppose the movement of magnet B.	1	R	2.1g	31	Magnet A will not be affected due to no induced e.m.f

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
18	a	10 V	1	K	3.1-A	35	
	b	$100\pi\ rad\ s^{-1}$	1	K	3.1-D	37	Accept 314.16 $rad\ s^{-1}$
	c	$2f = 100$ $f = 50\ Hz$	1	K	3.1-B	40-41	

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
19	a	$I_{max} = \frac{\Delta V_{max}}{R}$ the circuit in resonance $I_{max} = \frac{110}{48}$ $I_{max} = 2.29\ A$	1 1	R	3.2-B	46	
	b	$f = \frac{1}{2\pi\sqrt{LC}}$ $f = \frac{1}{2\pi\sqrt{0.38 \times 27 \times 10^{-6}}}$ f =49.7 Hz	1 1	A	3.2-D	46	

Item	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
20			A	3.2-B	43-46	

Inductive Reactance (Ω)	Capacitive reactance (Ω)	Resistance (Ω)	Phase relationship between current and voltage (use the verbs **lags, leads** or **in phase**)	Mark
94	57	20	**Current lags the applied voltage Or Voltage leads the current**	1
48	48	26	**Current and the applied voltage are in phase**	1

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
	a			K			

Term	Definition	Mark	Ob	P.N
Photon	A quantum of energy in form of electromagnetic radiation.	1	4.1-B	55
Work function	**The minimum amount of energy necessary for an electron to escape from the surface of the metal.**	1	4.2-A	60
Stopping potential	The applied voltage against the motion of the photoelectrons to stop their movment.	1	4.2-H	59

21	b(i)	$E_{photon} = \frac{hc}{\lambda}$ $E_{photon} = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{1.40 \times 10^{-7}}$ $E_{photon} = 1.42 \times 10^{-18} J$	1 1	A	4.2-F	60	
	b(ii)	$\phi = 1.25 \times 1.6 \times 10^{-19}$ $\phi = 2 \times 10^{-19} J$ $KE_{max} = E_{photon} - \phi$ $KE_{max} = 1.42 \times 10^{-18} - (2 \times 10^{-19})$ $KE_{max} = 1.22 \times 10^{-18} J$	1 1 1	A	4.2-F	61	Accept If the student does all the calculation in one step give two marks

Item	Answer	Mark	C. L	Ob	P.N	ADDITIONAL INFORMATION
22	$E_{photon}(eV) = \frac{hf}{e} = \frac{6.63 \times 10^{-19} \times 8.0 \times 10^{14}}{1.6 \times 10^{-19}}$ $E_{photon}(eV) = 3.315\ eV$ Only Calcium will emit photoelectrons because the energy of the incident light is more than the work function of Calcium.	 1 1	R	4.2-E	60	Accept: If the student calculates the threshold frequency of Zinc and Calcium: $f_{Zinc} = 8.68 \times 10^{14} Hz$ $f_{Calcium} = 7.0 \times 10^{14} Hz$ (one mark)

						Only Calcium will emit photoelectrons because the frequency of the incident light is more than the threshold frequency of Calcium. (One mark)

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
23	a	Process (**a**): fission Process (**b**): fusion	1 1	K	5.2-G	83	Accept if the student writes the answer in the figure
	b	For nucleus stability	1	K	5.2-G	82-83	

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
24	a	**Atomic number**: The number of protons in the nucleus of an atom. **Mass number**: The number of protons together with the number of neutrons in the nucleus.	1 1	K	5.1-C	67	
	b	b: $_{1}^{0}e$ or (-β) or negative beta c: $_{2}^{4}$He or (α) or alpha	1 1	A	5.2-C	71-75	Accept the answer in equations

Item	Part	Answer	Mark	C.L	Ob	P.N	ADDITIONAL INFORMATION
25	a	$\Delta m = \{(92 \times 1.00728 + 143 \times 1.00867) - 235.00\}$ $\Delta m = 1.9157\ u$	1 1	A	5.2-D	79	
	b	$E = \Delta m.c^2$ $E = 1.9157 \times 934$ $E = 1789.3\ Mev$	1 1	A	5.2-A	80	

Item	Part	Answer	Mark	CL	Ob	P.N	ADDITIONAL INFORMATION
26	a	$\lambda_B = \frac{0.693}{t_{\frac{1}{2}_B}} = \frac{0.693}{20}$ $\lambda_B = 0.03465\ s^{-1}$ $N = N_\circ\ e^{-\lambda t}$ $N = 800 \times e^{-(0.03465 \times 100)}$ $N = 25$	1 1 1	A	5.3-D&F	93-94	$t = 5\ t_{1/2}$ (one mark) $800 \rightarrow 400 \rightarrow 200 \rightarrow 100 \rightarrow 50 \rightarrow 25$ One mark for any correct arrow One mark for the final answer
	b	$\frac{t_{\frac{1}{2}_A}}{t_{\frac{1}{2}_B}} = \frac{\frac{0.693}{\lambda_A}}{\frac{0.693}{\lambda_B}}$ $\frac{10}{20} = \frac{\lambda_B}{\lambda_A}$ $\frac{1}{2} = \frac{\lambda_B}{\lambda_A}$ $\lambda_A = 2\lambda_B$	1 1+1	R	5.3-F	94	One mark for $\frac{\lambda_B}{\lambda_A}$ and One mark $\frac{10}{20}$

End of Marking Guide