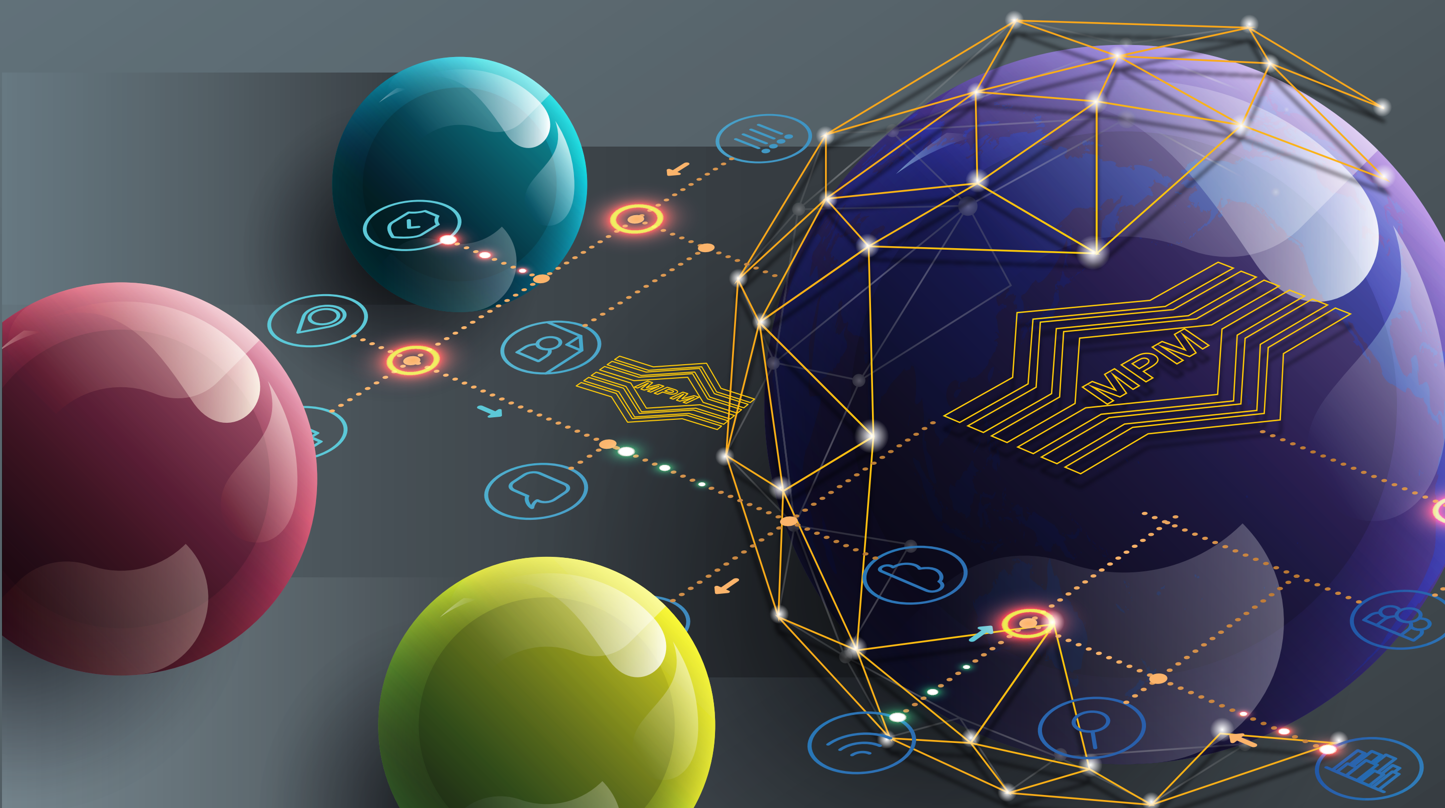
MAJLIS PEPERIKSAAN MALAYSIA

SASBADI

LAPORAN PEPERIKSAAN STPM & MUET 2021

Physics (960)



CONTENTS

PHYSICS (960/1)

OVERALL PERFORMANCE

For Semester 1, 1 777 candidates sat for the examination of this subject and 67.82% of them obtained a full pass.

The achievement of the candidates for this subject according to grades is as follows:

Grade	A	A–	B+	B	B–	C+	C	C–	D+	D	F
Percentage	11.25	6.42	9.40	8.95	12.61	10.07	9.12	4.45	4.28	4.33	19.13

RESPONSES OF CANDIDATES

SECTION A: *Multiple-Choice*

Answer Keys

Question number	Key	Question number	Key	Question number	Key
1	**B**	6	**D**	11	**B**
2	**B**	7	**C**	12	**C**
3	**A**	8	**C**	13	**A**
4	**B**	9	**C**	14	**D**
5	**A**	10	**A**	15	**D**

General comments

More than 70% of the candidates answered Questions 10, 11, 13 and 14 correctly. Question 15 was very difficult for the candidates to answer with less than 30% of the candidates answering it correctly. The rest of the questions were in the medium range with 30% to 70% of the candidates obtaining the correct answers.

SECTION B AND C: *Structured and Essay Questions*

General comments

In general, the performance of the candidates was good in quantitative questions. Most candidates were able to use the correct formula and presented the final answer with the correct significant figures and units. The steps for calculations were well organised and presented systematically. However, there were some candidates who still rounded off the intermediate answer in their calculations early, thus leading to inaccurate final answer. The performance of the candidates was satisfactory in qualitative questions. Candidates showed less ability in understanding physics concepts and explaining it in their own words. Many candidates were also not clear with the difference between free body diagram and forces acting on an object (vector diagram).

Comments on the individual question

Question 16

In part (*a*), most candidates performed well. The candidates had the knowledge to use the equation, $u_p^2 = u^2 + 2as$, or conservation of energy equation to calculate the velocity of object P before colliding with object Q. Some candidates did not convert the value of height of track into unit metre in their calculations.

In part (*b*), most candidates were able to apply the law of conservation of momentum equation to determine the velocity of object P after the collision.

In part (*c*), most candidates were not able to determine the type of collision correctly. The candidates wrongly compared the velocity before collision and after collision instead of comparing kinetic energy before collision and kinetic energy after collision.

Answers: (*a*) 1.879 m s^{-1}, (*b*) 0.469 m s^{-1}

Question 17

In part (*a*), most candidates were able to describe heat transfer by radiation. Most candidates were able to state that no medium is required to transfer heat and energy transfer is at the speed of light. However, there were several candidates who answered that heat is transferred only in a vacuum, and this is a wrong fact as heat can be transferred through medium also.

In part (*b*)(i), most candidates were able to use the formula, $P = e\sigma AT^4$, to determine the power radiated by the sphere. However, some candidates made the mistakes of using a wrong formula of surface area of sphere as πr^2 and $\frac{4}{3}\pi r^3$ instead of $4\pi r^2$. The other mistake was using ΔT^4.

In part (*b*)(ii), most candidates were able to use the correct formula for the net rate of heat transfer, $P = \sigma Ae(T_o^4 - T_s^4)$. However, there were candidates who mistakenly used the formula as $P = \sigma Ae(T_o - T_s)^4$. Some candidates also made the mistake by substituting the temperature in degree Celsius instead of in Kelvin.

In part (*b*)(iii), most candidates were able to state the correct answer as power radiated increases when the radius of the sphere is increased. This showed that the candidates knew the power radiated is proportional to the radius of the sphere. Some candidates made mistakes due to misunderstanding between power radiated and power density.

Answers: (*b*)(i) 41.35 W; (*b*)(ii) 11.97 J s^{-1}

Question 18

In part (*a*), many candidates were able to define Newton's law of universal gravitation. They stated that the attractive force between the two particles is directly proportional to the product of the masses of the particles and inversely proportional to the square of the distance between them. The most common mistake made by the candidates, they did not state clearly the attraction/gravitational force. They only mentioned it as force. The other mistake was that the candidates stated radius between two masses instead of distance between two masses.

In part (*b*), almost all candidates were not able to able to explain the relation between high tides phenomenon and the position of the Earth which aligns between the Moon and the Sun. Some of them did not answer at all. The candidates, who answered, did not state that the closest distance when relating the gravitational force with the distance between Earth and Moon, $F = G\frac{M_E M_M}{r_{EM}^2}$. They stated closer or close distance, which was not acceptable. The other mistake was that the candidates explained relating to the influence of Sun gravity rather than Moon gravity.

In part (*c*)(i) most candidates were able to determine the radius of the orbit using the equation $\frac{GMm}{r^2} = \frac{4\pi^2 mr}{T^2}$. However, some candidates mistakenly substituted the wrong value of mass of the Earth which should be from the data given, 5.97×10^{24} kg.

In part (*c*)(ii), most candidates were able to calculate the weight of the satellite using the formula $W = F_g = mg$ and substitute $F_g = \frac{GMm}{r^2}$. The most common mistake made by the candidates was that they substituted the value of r to the radius of the Earth instead of the radius of the orbital satellite.

In part (*c*)(iii), most candidates were able to determine the potential energy of the satellite correctly. They used the formula for potential energy, $U = -\frac{GMm}{r}$. However, most candidates did not include the negative sign in the formula resulting in the wrong final answer.

Answers: (*c*)(i) 7.29×10^6 m; (*c*)(ii) 4.12×10^4 N; (*c*)(iii) -3.00×10^{11} J

Question 19

In part (*a*), most candidates were able to differentiate between static friction and kinetic friction. The candidates stated that static friction acted on the stationary object on a surface whereas kinetic friction acted on moving object sliding in a surface and the value of static friction was bigger than kinetic friction.

In part (*b*), most candidates were able to determine the angle θ at the instant of the box just about to slide. The candidates managed to resolve the forces into the horizontal and vertical component and solve it to get the answer. However, some candidates did not consider the box was at an inclined plane, thus provided a wrong frictional force formula as $f_s = \mu mg$. A few candidates also directly used the equation $\tan\theta = \mu_s$, which was accepted but the mark only awarded for the final mark as they did not started with the physics concept.

In part (*c*)(i), not many candidates managed to score full marks in sketching labelled free body diagram of the box at the inclined plane. Most candidates sketched forces acting on the box (vector diagram) rather than providing a free body diagram. Some candidates lost marks because they wrongly located the correct position of normal force and frictional force. Many candidates also did not label a frictional force in their diagrams.

In part (*c*)(ii), the candidates who only correctly sketched a free body diagram in (*c*)(ii) were able to calculate the minimum tension in the string. They produced the equation as $T_{min} + f_s = mg\sin 35°$. Again, the candidates forgot that the box was at an inclined plane, thus provided a wrong frictional force formula as $f_s = \mu mg$ instead of $f_s = \mu mg\cos 35°$.

In part (*c*)(iii), the performance of the candidates was poor. Most candidates were not able to determine the acceleration of the box if the string was cut. The candidates were not able to produce the resultant forces as $mg\sin\theta - \mu mg\cos\theta = ma$. This showed that the majority of candidates did not understand the concept of forces in equilibrium.

Answers: (*b*) 22.8°, (*c*)(ii) 22.52 N; (*c*)(iii) 2.81 m s^{-2}

Question 20

In part (*a*), most candidates performed well. Most candidates were able to describe the thermodynamic change in isothermal expansion and adiabatic expansion. However, some of them lost one or two marks because they did not explain that the heat was supplied/absorbed during isothermal expansion and temperature/ internal energy decreases during adiabatic expansion.

In part (*b*)(i), most candidates were able to use ideal gas equation $PV = nRT$ to determine the initial temperature and equation $T_i V_i^{\gamma-1} = T_f V_f^{\gamma-1}$ to determine the final temperature of the gas. Some of the candidates failed to determine the final temperature because they assumed that the final pressure was unchanged.

In part (*b*)(ii), most candidates were able to write the formula of change in internal energy $\Delta U = \frac{f}{2}nRT$ but some candidates lost mark for the answer because they wrongly subtracted the value for temperature difference. Many candidates ignored the negative sign convention for ΔU and some of them gave the wrong significant figure in their final answer.

*Answer*s: (*b*)(i) $T_i = 435.4$ K, $T_f = 202.2$ K; (*b*)(ii) -1.696×10^4 J

SEMESTER 1

PHYSICS (960/2)

OVERALL PERFORMANCE

For Semester 2, 1 764 candidates sat for the examination of this subject and 61.79% of them obtained a full pass.

The achievement of the candidates for this subject according to grades is as follows:

Grade	A	A–	B+	B	B–	C+	C	C–	D+	D	F
Percentage	11.90	5.05	4.08	4.48	11.90	13.38	11.00	4.82	6.58	4.25	22.56

RESPONSES OF CANDIDATES

SECTION A: *Multiple-Choice*

Answer Keys

Question number	Key	Question number	Key	Question number	Key
1	D	6	C	11	A
2	C	7	B	12	D
3	A	8	A	13	B
4	C	9	B	14	A
5	C	10	B	15	C

General comments

More than 70% of the candidates answered Questions 10, 12 and 14 correctly. The rest of the questions were in the medium range with 30% to 70% of the candidates obtaining the correct answers.

SECTION B AND C: *Structured and Essay Questions*

General comments

Generally, most candidates showed low capability in answering the questions that involved explanation and describing the fundamental concepts of physics. The performance of the candidates was satisfactory especially in answering qualitative questions and derivation of expression using physics laws and principles. Most candidates were able to present their quantitative answers systematically with suitable formulae and showed the substitution of correct data. The candidates also realised the importance of writing unit and final answer in suitable number of significant figures. However, some candidates rounded off the intermediate answer in their calculations early, thus leading to inaccurate final answer.

Some candidates also did not write the correct conventional units in their final answer and some candidates used mixed units in their calculation, for example, the unit for electric field strength in N C^{-1} instead of V m^{-1}.

Comments on the individual questions

Question 16

In part (*a*), the performance of candidates in this question was moderate. The candidates were able to determine the force between two separate charges using the formula, $F = \frac{1}{4\pi\varepsilon_0}\frac{Q_1Q_2}{r^2}$. Quite a number of candidates gave the answer with more than the required significant figures.

In part (*b*), most candidates were able to calculate the magnitude and direction of the resultant electric field at point X using equation $E = E_1 + E_2$. Then, the candidates used the formula of electric field, $E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$ to solve the equation. Some candidates were confused with the formula of electrostatic force in part (*a*). Some candidates also failed to state the direction of the electric field.

In part (*c*), many candidates failed to predict a possible position of a point where the resultant electric field was zero. Some candidates only guessed that the point was in the middle of the charges, which was wrong. Only a handful of candidates were able to predict at a point on the left of the negative charge and some candidates supported the prediction by calculating the exact point, which was 33.8 cm from negative charge.

Answers: (*a*) 825.8 N, (*b*) 7.119×10^8 N C^{-1}

SEMESTER 2

Question 17

This question was testing the understanding of candidates on the behavior of the charged capacitors. The situation of the problems changes in three stages where the capacitor was charged then was connected to another capacitor, and finally both capacitors were discharged through a resistor. In part (*a*), majority of the candidates were able to determine the amount of charge in the capacitor using the equation $Q = CV$.

In part (*b*)(i), most candidates were not able to get the correct final answer for the potential difference. This was because most candidates thought that the capacitors were connected in series. Only a few candidates were able to identify that the connection of capacitors were changed into parallel. In this case, the candidates should draw the diagram for a better understanding.

In part (*b*)(ii), most candidates were able to calculate the total energy for both capacitors by using the formulae $U = \frac{1}{2}CV^2$ or $U = \frac{1}{2}QV$ or $U = \frac{1}{2}\frac{Q^2}{C}$. Candidates who used the correct formula, but substituted the wrong value of potential difference from (*b*)(i), scored full mark because of error carry forward.

In part (*c*), most candidates were able to state that the change in total charge stored in the system with time was decreasing but did not explain that it was exponentially decreasing. However, quite a number of candidates thought that the charge stored was increasing with time.

Answers: (*a*) 5.0×10^{-3} C, (*b*)(i) 100 V; (*b*)(ii) 0.25 J

Question 18

In part (*a*)(i), most candidates were able to identify the presence of magnetic field, but they could not identify the use of the magnetic field as centripetal force, which was directed to the centre of the circular path. Only a handful were able to correctly describe the circular path of the electron when it moved perpendicular to the magnetic field starting with the existence of magnetic force $F = qv \times B$. A few of them wrongly described the path as parabolic path.

In (*a*)(ii), almost all candidates knew that there was no magnetic force as the electron entered in parallel with the direction of magnetic field so that the electron moved in a straight line with a constant velocity.

In part (*b*)(i), most candidates were able to determine the position where the resultant magnetic field in between the wires was zero using the equation $B = \frac{\mu_o I}{2\pi r}$. The candidates understood that resultant magnetic field came from the wire P and wire Q, thus producing the relationship $B_T = B_P + B_Q$.

In part (b)(ii), only a few candidates were able to score full marks when sketching the graph of the variation of the resultant magnetic field with distance between the wires, P and Q. Some candidates lose marks by not identifying wire P and wire Q by distance itself.

Answer: (b)(i) 1.875 cm

Question 19

In part (a), candidates had a difficulty in explaining the phenomenon of mutual inductance. Candidates were able to state the induced e.m.f. on the secondary coil as current changes in primary coil but they failed to explain in detail about the change of magnetic field in primary coil, the linkage of magnetic flux with secondary coil and also the magnitude of the e.m.f. induced based on Faraday's law. A few candidates were confused between the magnetic field and electric field thus losing some marks.

In part (b)(i), most candidates were able to correctly determine the magnitude of the induced e.m.f. in the coil using the formulae, $E = -\frac{d\Phi}{dt}$ or $E = -M\frac{dI}{dt}$, with the correct substitution.

In part (b)(ii), most candidates were also able to correctly determine the mutual inductance of the coil.

In part (c)(i), most candidates failed to derive an equation of induced e.m.f. for different situations such as the turning of a metal rod in magnetic field. Candidates could not identify the magnetic flux change due to the area changed in a circle which gave $A = nL^2$ within the radial frequency of rod. The candidates were too focus on the sin or cos as the change of magnetic flux such as in motor generator.

In (c)(ii), only some candidates got the correct answer. Many candidates did not recognise the higher potential was at point Q as the direction of induced current flows in the metal rod.

Answers: (b)(i) 1.974×10^{-3} V; (b)(ii) 1.974×10^{-5} H

SEMESTER 2

Question 20

In part (a), most candidates were able to state the meaning of alternating current correctly, but there were some candidates who did not mention the keywords periodic or the alternate change in the direction of the current, thus losing marks in this part.

In part (b)(i), most candidates were able to derive the expression of current through the capacitor using equation $Q = CV$ and $I = \frac{dQ}{dt}$. A few of them only memorised the final answers instead of knowing how to derive them.

In part (b)(ii), only a handful of candidates were able to correctly sketch a graph of voltage, V, and current, I, against time, t, by showing that I lead V.

In part (b)(iii), most candidates were only able to state that the average power was zero but many did not able to explain that it was due to the energy given back to the system.

In part (c)(i), almost all candidates were able to determine the impedance correctly using the equation, $Z = \sqrt{R^2 + X_c^2}$ where $X_c = \frac{1}{\omega C}$.

In part (c)(ii), most candidates were able to determine the maximum current flow in the circuit using the formula, $I_{max} = \frac{V_{max}}{Z}$. However, a few candidates wrongly used the reactance of the capacitor instead of the impedance of the circuit.

In part (c)(iii), most candidates were able to draw a phasor diagram for voltage supply and the current with I leads V. However, some lose marks due to not putting the angle sign in between I and V. Some candidates also did not provide the correct phasor diagram of current with resultant voltage, as most of them were only drawing the phasor diagram of current with potential difference across capacitor only and caused them to lose marks.

Answers: (c)(i) 122 Ω; (c)(ii) 0.41

PHYSICS (960/3)

OVERALL PERFORMANCE

For Semester 3, 1 754 candidates sat for the examination of this subject and 63.78% of them obtained a full pass.

The achievement of the candidates for this subject according to grades is as follows:

Grade	A	A–	B+	B	B–	C+	C	C–	D+	D	F
Percentage	12.54	6.27	7.35	7.01	10.15	10.43	10.03	5.13	3.48	3.88	23.72

RESPONSES OF CANDIDATES

SECTION A: *Multiple-Choice*

Answer Keys

Question number	Key	Question number	Key	Question number	Key
1	**D**	6	**C**	11	**D**
2	**C**	7	**A**	12	**A**
3	**C**	8	**A**	13	**D**
4	**B**	9	**C**	14	**B**
5	**D**	10	**B**	15	**B**

SEMESTER 3

General comments

More than 70% of the candidates answered Questions 1 and 5 correctly. The rest of the questions were in the medium range with 30% to 70% of the candidates obtaining the correct answers.

SECTION B AND C: *Structured and Essay Questions*

General comments

In general, the performance of the candidates was satisfactory in answering qualitative questions and derivation of expression using physics laws and principles. In solving quantitative problems, most candidates were able to present their answers systematically with suitable formulae and showed the substitution of correct data. Most candidates also knew the importance of writing the answers in suitable number of significant figures and unit. Only a few candidates still wrote their final answer to more than four significant figures. However, there were still candidates who were rounded off the intermediate answer in their calculations early, thus leading to inaccurate final answer.

Comments on the individual questions

Question 16

In part (a), most candidates were able to determine the sound intensity from the sound source using formula, $I = \frac{P}{A}$, and then calculate the level of sound intensity at that point using formula, $\beta_1 = 10\log_{10}\frac{I_1}{I_0}$. However, some candidates wrongly calculated the area by using area of a sphere, causing the final answer to be incorrect.

In part (b), most candidates knew to write the relationship between the distance and the intensity, $I\alpha\frac{1}{r^2}$, and then calculate the change in the level of sound intensity at two different points, $\Delta\beta = \beta_2 - \beta_1$. Some candidates failed in calculating the change in the level of sound intensity by deducting the initial value to the final value.

In part (c), most candidates answered this part as the sound intensity had increased. A handful candidates were able to state that the sound intensity was doubled.

Answers: (a) 76.02 dB, (b) 3.025 dB

Question 17

In part (a), most candidates were able to determine the maximum speed of the photoelectrons using the relationship $\frac{1}{2}mv^2{}_{\text{max}} = eV_s$. The candidates did not have problem to substitute the value of stopping potential from the graph and the value of electrons and mass of the electrons from the value of constant given in the question paper.

In part (b), most candidates easily calculated the threshold frequency of the incident radiation. The candidates could get the answer using the relationship $\frac{hc}{\lambda} = W + eV_s$ and substitute $W = hf_0$, but some of the candidate wrongly wrote the relationship as $W = \frac{hc}{\lambda} + eV_s$.

In part (c), most candidates were not able to sketch the curve of current against voltage for the light of shorter wavelength. The candidates did not know that the current was higher at $V = 0$ and the stopping potential were higher than 3.0 V at the negative-x axis. However, the candidates understood that the saturation current was at 6.0 mA, and thus, only one mark was rewarded to the candidates. Some candidates lose marks, as there was no comparison from the initial wavelength given in the graph.

Answers: (a) 1.027×10^6 m s^{-1}, (b) 4.76×10^{14} Hz

Question 18

In part (a), most candidates were able to state the differences between the progressive wave and the standing wave. The candidates knew that in progressive wave, the energy was transferred while in standing wave the energy was not transferred. In progressive wave, the wave profile had moved and had no nodes and antinodes while in standing wave, the wave profile had not moved and had nodes and antinodes. Some candidates misunderstood and compared between transverse wave and longitudinal wave. Some candidates also just stated the characteristic of the progressive wave and the standing wave without comparing them to each other.

In part (b)(i), only a few candidates were able to determine the expression of the progressive wave completely. The most common mistake made by the candidates was that they did not simplify the symbol for π in the answer. Most of them knew how to calculate the wave number using formula $k = \frac{2\pi}{\lambda}$, and angular frequency using formula $W = 2\pi f$.

In part (b)(ii), most candidates were able to determine the velocity of the wave using formula $v = f\lambda$.

In part (b)(iii), most candidates were able to sketch a graph for the displacement against distance of the wave at t =0 with a sinusoidal shape. However, some candidates did not label the wavelength and the amplitude of wave.

In part (b)(iv), some candidates were able to derive the expression for the resultant waves using the resultant displacement, $Y = y_1 + y_2$. Again, the most common mistake made by the candidates was they left the wave number and angular frequency in terms of π.

Answer: (b)(ii) 3.34 m s $^{-1}$

Question 19

In part (a), the performance of the candidates was not satisfactorily. Majority of the candidates were not able to calculate the image distance correctly because they were using incorrect formula instead of using $\frac{n_1}{u} + \frac{n_2}{v} = \frac{n_1 - n_2}{r}$. Furthermore, most of them failed to relate the position of the first image and then placed it correctly as the second object. Some candidates also failed to add the diameter of the glass ball to the second image distance.

In part (b), most candidates were not able derive the formula to show the relationship between distance of the object, distance of the image and focal length as $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$. Only a handful of candidates were able to correctly attempt this part with full marks.

In part (c)(i), most candidates were not able to use the lens maker equation, $\frac{1}{f} = (n - 1)\left(\frac{1}{r_1} \pm \frac{1}{r_2}\right)$, to determine the distance of the image. Most candidates did not realise that the focal length of the lens was the radius of the curvature, which could be used to determine the image distance of the object.

In part (c)(ii), most candidates were able to determine the characteristic of the image formed as real, diminished and inverted.

Answers: (a) 18.75 cm, (c)(i) 20.0 cm

Question 20

In part (a), almost all candidates were able to state the law of conservation of nucleon number.

In part (b)(i), most candidates were able to write the decay of the Ra-226 into alpha particle and Rn-222 as ${}^{226}_{88}\text{Ra} \rightarrow {}^{226}_{86}\text{Ra} + {}^{4}_{2}\text{He} + (\text{Q})$.

In part (b)(ii), most candidates were able to calculate the energy released during the reaction for the radioactive decay using formula $E = \Delta mc^2$.

SEMESTER 3

In part (*b*)(iii), only a few candidates were able to calculate the velocity of the emitted alpha particle using $K = \frac{1}{2}mv^2$ correctly. This was because most of the candidates had round off the conversion of mass into kg or MeV into Joule early. There were also many candidates wrongly converted the energy from MeV to Joule, and to mass from atomic mass unit to kilogram. This resulted an incorrect final answer.

In part (*c*)(i), most candidates were able to explain the chain reaction in the nuclear reactor. They did explain the release of neutron but a few of them did not mention about the repeating process.

In part (*c*)(ii), most candidates were able to state the functions of moderator and control rod with examples respectively. However, some candidates could hardly give the correct example.

Answers: (*b*)(ii) 4.87 MeV; (*b*)(iii) 1.53×10^7 m s^{-1}

PAPER 960/5 (WRITTEN PRACTICAL TEST)

Comments on the individual questions

Question 1

In part (*a*), most candidates were able to define specific heat of water, *c*, as heat which is required to raise the temperature of 1 kg of a substance to 1 degree.

In part (*b*), most candidates were able to state the reasons of using the polystyrene container in the experiment as to prevent heat lost to the surrounding and heat not taken up by the container.

In part (*c*)(i), most candidates were able to calculate the gradient of the graph with the triangle size covering more than 1/3 of the graph paper.

In part (*c*)(ii), almost all candidates were not able to determine the maximum error in the calculated gradient.

In part (*d*), most candidates recognised that the gradient of the graph was equal to $\frac{gH}{mc}$ and were able to calculate the value of *c* correctly.

In part (*e*), most candidates were not able to explain how heat loss affects the value of *c*.

In part (*f*), most candidates were not able to suggest the method to improve the accuracy of the experiment.

In part (*g*), a few candidates were able to calculate the percentage error as $\frac{4380 - 4200}{4200} - 100\%$.

Answers: (*c*)(i) 1.12×10^{-2}°C kg^{-1} ; (*c*)(ii) 8×10^{-4}°C kg^{-1} , (*d*) 4380 J kg^{-1}°C^{-1} , (*g*) 4.3%

Question 2

In part (*a*), most candidates were able to state the different values of IP_{rms} that could be obtained by using the rheostat.

In part (*b*), most candidates were able to plot a large graph of $E_{Q\mathrm{rms}}$ against $I_{P\mathrm{rms}}$ with the correct labelled axes and all the points were marked correctly. Most candidates were also able to draw a best fit curve through the plotted points.

SEMESTER 3

In part (c)(i), most candidates were able to determine the gradient of graph correctly and hence in part (c)(ii), the candidates were able to determine M using the formula $M = \dfrac{E_{Qrms}}{2\pi f I_{Prms}}$.

In part (d), most candidates were not able to explain the effect if coil P was not completely inserted into coil Q. The answer was the induce e.m.f. in coil Q is smaller and the mutual inductance also is smaller or the magnetic flux linkage between the two coils is weaker.

In part (e), only a few candidates were able to state that there was no effect of M if higher voltage was used because the mutual inductance only depends on the number of turn of coil P and coil Q, the radius of the coils, and the permeability.

In part (f), most candidates were able to state the precaution that should be taken in the experiment, which was all magnetic materials should be put far away from the set up and the positions of coil P and coil Q once aligned, should not be moved through out the experiment.

In part (g), most of candidates successfully suggest oscilloscope as another instrument to replace digital voltmeter to measure r.m.s. voltage.

Answers: (c)(i) 51.4 mV A^{-1}; (c)(ii) 0.164 mH

Question 3

In part (a), most candidates correctly stated the type of interference as constructive interference.

In part (b), most candidates were able to calculate $\dfrac{1}{a}$ and the mean value of x using the correct significant figures of secondary data.

In part (c), most candidates were also able to plot a graph of $\overline{x}$ against $\dfrac{1}{a}$ with the correct labelled axes and all the points were marked correctly.

In part (d)(i), the candidates were able to determine the gradient of graph correctly and hence in part (d)(ii), the candidates were able to determine the value of l using the formula, $x = \lambda D\dfrac{1}{a}$.

In part (e), many candidates were able to state the sources of errors that affect the accuracy of the experiment as the circles might not be drawn concentric, the anti-nodal lines might not passed through all constructive interference positions and parallax error.

In part (f), many candidates were not able to suggest the methods that should be taken to improve the accuracy of the experiment. The answers was longer the value of D and used the thin ruler to reduce parallax error.

Answers: (d)(i) 10.5 cm^2; (d)(ii) 0.525 cm

SEMESTER 3

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