Section A / Bahagian A
[60 marks / 60 markah]

1	**(a)**	☐ $X \rightarrow Y \rightarrow Z$ ☑ $Y \rightarrow X \rightarrow Y \rightarrow Z \rightarrow Y$ ☐ $Z \rightarrow Y \rightarrow X \rightarrow Y$ [1 mark]
	(b)	**(i)** 30.28 s [1 mark] **(ii)** 1.514 s [1 mark]
	(c)	The period of oscillation will increase [1 mark]

2	**(a)**	Impulsive force [1 mark]
	(b)	Can reduce the impulsive force by lengthening the time of impact

	(c)	Magnitude of force, $F = m(v - u)/t$
		                 $= 45(10 - 0)/2$ [1 mark]
		                 $= 225$ N [1 mark]

3	**(a)**	Is the produce of induced current due to the movement of magnet bar into the solenoid and there is no physical contact between the magnet and solenoid [1 mark]
	(b)	**(i)** North pole [1 mark] **(ii)** Lenz's law [1 mark]
	(c)	**(i)** **(ii)** [2 marks]
	(d)	Use more turn // increase the speed of movement of magnet bar towards solenoid // use stronger magnet //use soft magnet [1 mark]
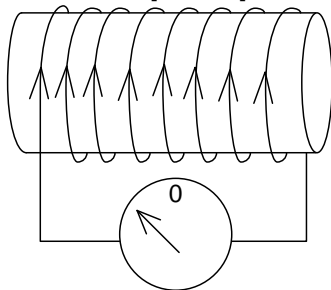
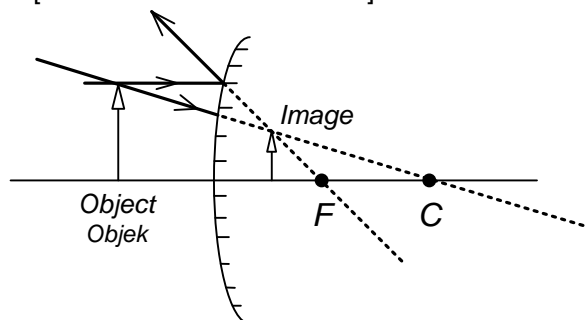|		
4	**(a)**	Convex mirror [1 mark]
	(b)	**(i)** Reflection [1mark] **(ii)** Upright, virtual, diminished [either two answer 2marks]
	(c)	 Diagram 4.2 / Rajah 4.2
		(i) Draw lines to show the intersection [1 mark] Show image [1 mark] **(ii)** Has wider view of vision [1 mark]

5	**(a)**		Resistance [1 mark]
	(b)	**(i)**	Diameter of wire P is thinner than wire Q. [1mark]
		(ii)	Gradient of graph in Diagram 5.1 is higher than in Diagram 5.2. [1mark]
		(iii)	Resistance of wire *P* is higher than wire *Q*. [1mark]
	(c)	**(i)**	*V* is directly proportional to *I*. [1mark]
		(ii)	Ohm's law [1 mark]
	(d)	**(i)**	Decreases [1 mark]
		(ii)	Total effective resistance decreases [1 mark]

6	**(a)**		Interference [1 mark]
	(b)	**(i)**	Distance between two dippers in Diagram 6.1 is nearer than in Diagram 6.2. [1 mark]
		(ii)	Distance between two consecutive antinodal lines in Diagram 6.1 is more than in Diagram 6.2. [1 mark]
	(c)		Smaller distance between two dippers, higher the distance between two consecutive antinodal lines. [1 mark]
	(d)	**(i)**	Nodal line – destruction between the crest with trough [1 mark]
			Antinodal line – construction between the crest with crest or trough with trough [1 mark]
		(ii)	Principle of superposition [1 mark]
	(e)		Increases [1 mark]

7	**(a)**		Because it is not stable
	(b)		*x*: 224
			y: 86 [2 marks]
	(c)	**(i)**	Mass defect = 226.025406 a.m.u – 222.017574 a.m.u – 4.002603 a.m.u [1 mark]
			$\qquad$ = 0.005229 a.m.u
			$\qquad$ = 0.005229 × 1.67 × 10^{-27} kg
			$\qquad$ = 8.73243 × 10^{-30} kg [1 mark]
		(ii)	Energy released = mc^2
			$\qquad$ = 8.73243 × 10^{-30} × $(3 × 10^8)^2$ [1 mark]
			$\qquad$ = 7.86 × 10^{-13} J [1 mark]
	(d)	**(i)**	Is the time taken for half of the radioactive substance to disintegrate [1 mark]
		(ii)	100% → 50% →25% [1 mark]
			So, half life = 2 x 5600 years
			$\qquad$ = 11 200 years [1 mark]

8	**(a)**		Archimedes' principle
	(b)	**(i)**	Material of basket is the elastic basket [1 mark]
			Does not hurt the passenger upon landing [1 mark]
		(ii)	Position of the parachute valve is at the top [1 mark]
			Is the location when the air rises up and release [1 mark]
		(iii)	Volume of air displaced must be big [1 mark]
			Gain more buoyant force to lift the balloon [1 mark]
		(iv)	Hot air balloon *A* [1 mark]
	(c)	**(i)**	Upthrust, F = ρVg
			$\qquad$ = 1.23 x 400 x 10 [1 mark]
			$\qquad$ = 4920 N [1 mark]
		(ii)	Hot air balloon cannot move upwards [1 mark]
			The weight of balloon is bigger than the upthrust. [1 mark]

9	**(a)**	Archimedes' principle [1 mark]

(b) Volume of air trapped in submarine P is higher than Q [1 mark]
Volume of water that can be filled in the ballast tank in submarine P is more than Q [1 mark]
Total depth that can be submerged in sea in submarine P is more than Q [1 mark]
Volume of water that can be filled by the ballast tank is directly proportional to the depth submerged [1 mark]
Physics principle is the buoyant force / Archimedes' principle [1 mark]

(c) Submarine float when the ballast tank is filled with air
The valves open to let in the water, the weight of submarine increases and causes the submarine to sink
Depth of submarine sank depends on the volume of water being filled
When the water in ballast tank is pushed out, the submarine gains the buoyant force to float again [4 marks]

(d)

Suggestion	Reason
High thickness	Withstand the water pressure from crack
Use high strength	Withstand the pressure acting to the ship
Light density of material for the wall	Gain more buoyant force to float as light
Streamline	Reduce water friction while sailing
High volume of ship	More air trapped and thus increases the buoyant force to float

[10 marks]

10	**(a)**	Produce of magnet when electric flow around iron core coil [1 mark]

(b) Number of turns in solenoid in Diagram 10.1 is more than in Diagram 10.2 [1 mark]
Amount of current flowing for both diagrams are same [1 mark]
Number of paper clips attracted to the solenoid in Diagram 10.1 is more than in Diagram 10.2 [1 mark]
Higher number of turns in solenoid, higher number of paper clips being attracted [1 mark]
Higher number of turns of coils, higher strength of the magnet being produced. [1 mark]

(c) When current flows to the soft iron core with coils, it produces electromagnet
The magnet produced will causes the iron armature magnetized
Iron armature will be attracted to the gong.
Hitting between gong and hammer happens to produce sound.
Once hitting, the current is cut off between contact and iron armature. [4 marks]

(d)

Suggestion	Reason
Use soft hair spring	The spring is more sensitive to move
Use cylindrical core	Produce radial magnetic force
Use soft core	Can be magnetized and demagnetised easily
Use uniform ammeter scale	Easy to read by direct observation
Use more coils	More magnetic flux cut

[10 marks]

11	(a)	(i)	Is the amount of heat required to change the temperature of 1 kg of object by 1ºC without change in its physical state [1 mark]

		(ii)	Sea breeze occurs during daylight During daylight, the land which has lower specific heat capacity than water will become hot faster Hot air from land will rise up creating a low air pressure High air pressure from the sea will move to the land [4 marks]

	(b)		

Characteristics	Reason
Use low density	The electric kettle will be lighter
Use high melting point	The electric heater can withstand high temperature without getting melt
Use low oxidation rate	The heater can last longer without getting rust
Use low specific heat capacity	Can get hot faster

So, the type S is chosen because it has low density, high melting point, low oxidation rate with low specific heat capacity

[10 marks / markah]

	(c)	(i)	Amount of heat supplied by the electric heater = Pt

$$= 1000 \times 60$$
$$= 60\ 000\ J \qquad [1\ mark]$$

		(ii)	Amount of heat absorbed by the water = mcθ

$$= 0.5 \times 4200 \times 25 \qquad [1\ mark]$$
$$= 52\ 500\ J \qquad [1\ mark]$$

		(iii)	Amount of heat lost to the surrounding = 60000 J – 52 500 J [1 mark]

$$= 7\ 500\ J \qquad\qquad\qquad [1\ mark]$$

12	(a)	Is the unstable nucleus which has same proton number but different nucleon number [1 mark]

	(b)	The beta ray is used The beta ray will penetrate through the paper to be detected by the GM tube The rate of penetration depends on the thickness of paper High paper thickness, low reading of GM tube The GM tube will trigger the roller to compress the paper again [4 marks]

	(c)	

Characteristics	Reason
Use Boron as control rod	Can slow down fast neutron during the nuclear fission process
Use graphite as rod moderator	Can absorb some of the neutron//slow down the rate of fission process
Use heavy water	Heavy water has high specific heat capacity which can absorb more heat released by the nuclear reaction process
Use concrete shield	Stronger material which can prevent the leakage of radiation from the radiator core

So, design R is chosen because it has Boron as control rod, use graphite as rod moderator, use heavy water and use concrete shield

[10 marks / markah]

	(d)	(i)	Energy released = mc^2

$$= 0.19575 \times 1.66 \times 10^{-27} \times (3 \times 10^8)^2$$
$$= 2.92 \times 10^{-11}\ J$$

		(ii)	Power generated = Energy/Time

$$= (2.92 \times 10^{-11})/\ 10$$
$$= 2.92 \times 10^{-12}\ W$$

[5 marks]

END OF QUESTION PAPER / KERTAS SOALAN TAMAT