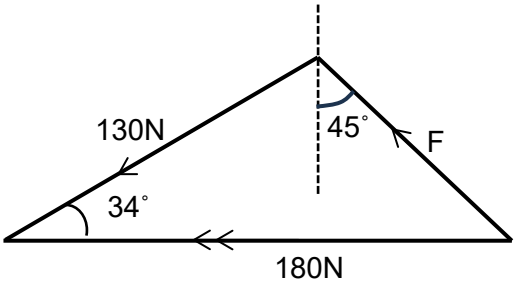
Section A (70 marks)

1	(a)	(i)	power, energy, current	1
		(ii)	m, d, k, M, T	1
	(b)	(i)	measuring tape	1
		(ii)	total mass = 3.45 × 75 / 1000 = **0.259 Mg**	1
		(iii)	 appropriate drawing labels + directions of forces resultant = **180 N ± 5%** (171 N to 189 N) {ans mark is given only if correct ray diagram is drawn}	M1 1 1

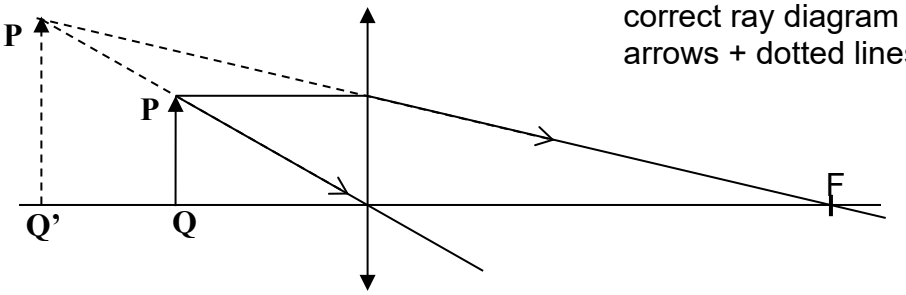
2	(a)	(i)	The gravitational force acting on per kg mass on Mars is 3.7 N.	1
		(ii)	weight = *mg* = 25.5 × 3.7 = **94.4 N**	1
	(b)	(i)	**String A** will break. As string B pulled slowly with increasing force, the tension in the string A will not be able to balance the weight and the additional increasing force.	1 1
		(ii)	**String B** will break. When string B is pulled with quick and rapid downward force, due to the large mass and hence large inertia, it tends to remain at rest and resist the sudden change in motion. {an explanation in terms of inertia is required}	1 1

3	(a)	{An answer indicating the change in the energy store is required} From A to bottom of ramp: GPE store decreases and KE store and Internal Energy (heat) store increases. From bottom of ramp to highest point: KE store decreases and GPE store increases.	 1 1
	(b)	GPE = mgh = 0.80 × 10 × 13.0 = **104 J**	1 1

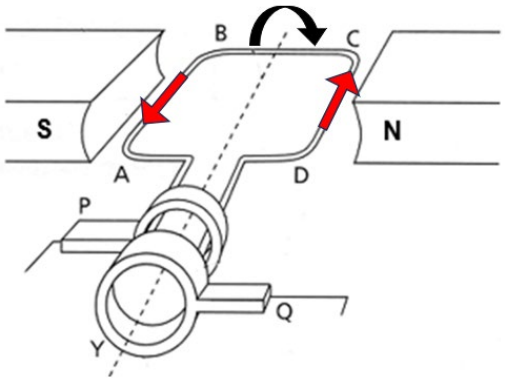
	(c)	total energy at A = total energy at final position + heat lost mgh + KE = 104 + 10.7 KE = 104 + 10.7 – (0.8 × 10 × 7.5) = **55 J**	 1 1

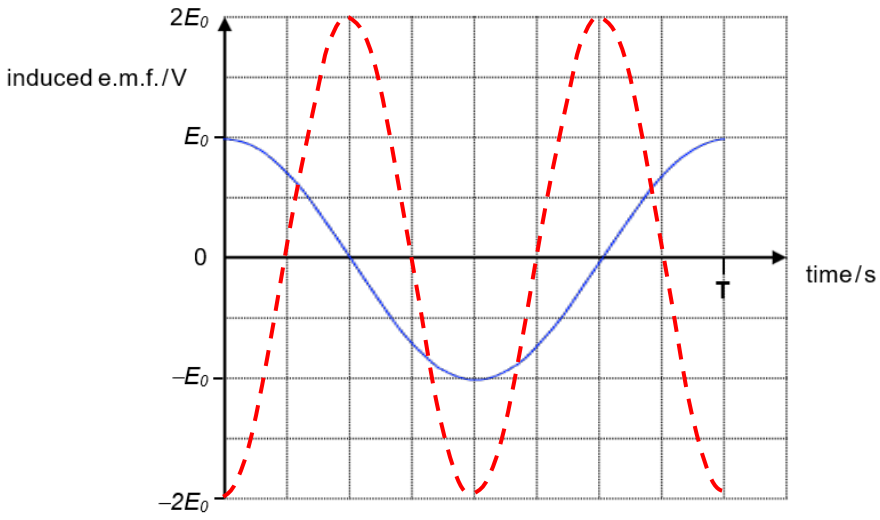
4	(a)	manometer		1
	(b)	(i)	pressure = $1.0 \times 10^5 - h\rho g$ $= 1.0 \times 10^5 - (1.9)(1000)(10)$ = **81 kPa**	1 1
		(ii)	P0 = Pg + Pm 100 000 = 81 000 + (13 600 x 10 x h) h = **0.14 m**	 1 1

5	(a)	(i)	λ = 16.0 / 4 = **4.0 m**	1
		(ii)	v = f λ = 50/60 × 4.0 = **3.3 m/s**	 1 1
	(b)	(i)	An imaginary line joining all adjacent points that are in phase.	1
		(ii)	becomes shallower	1
		(ii)	Waves **travel slower** in shallower water	1
	(c)		radio waves | **microwave** | **infrared red radiation** | visible light | **ultraviolet** | **x-ray** | gamma ray (2 correct – 1 mark)	A2

6	(a)		 correct ray diagram arrows + dotted lines Focal length = 6.0 cm – 7.5 cm. (based on student's ray diagram)	M1 M1 1
	(b)	(i)	Image will be **further away** from the lens and **more magnified**.	1
		(ii)	Image will be **dimmer**.	1

7	(a)	Drawing of positive charges at the top of foil and **equal number** of negative charges at the bottom of foil	1
	(b)	charging by induction mentioned Negative charges are repelled to the bottom of foil leaving the positive charge at the top of foil.	1 1
	(c)	The foil will be attracted to the rod and will lift up The force of attraction between the top of foil and rod due to unlike charges. Is more than the force of repulsion between the bottom of foil and rod due to like charges	1 1 1

8	(a)	When the **<u>coil is parallel to the magnetic field,</u>** the **<u>rate of change of magnetic flux is a maximum</u>**, resulting in a maximum induced emf of E_0.	1 1
	(b)	(i) current moving anticlcokwise in coil.  	1
		(ii) The **slip rings** provide the electrical contact with the brushes so that electric current can flow continuously **or** the slip rings ensure that the ends of the rotating rectangular coil do not get twisted.	1
	(c)	AC current allows the voltage to be stepped up **via transformers** to **reduce power loss** in the cables.	1

	(d)			
		(ii)	2 waves that are inverse of original wave maximum emf of $2E_0$	1 1

9	(a)	(i)	alpha particles have a very short range in air/ they cannot travel 30 cm in air/ they get absorbed by air.	1
		(ii)	beta and gamma rays gamma rays are present, and they travel undeflected and are picked up by the GM tube at position P. Graph B shows a drop in value from 1000 c.p.m to 450 c.p.m beta particles are present as they have been deflected downwards by the magnetic field and are picked up by the GM tube at position Q. (graph C)	1 1 1
		(iii)	The sum does not add up as background radiation (a value of 100 c.p.m.) is recorded at both positions P and Q. [note : not because of random nature of radiation]	1
	(b)	(i)	Half Life is the time taken for half the no. of radioactive atoms in a sample to decay.	1
		(ii)	considering the background count, the corrected count rates are as follows: • 80 counts per minute ⇒ 80 – 20 = 60 counts per minute • 35 counts per minute ⇒ 35 – 20 = 15 counts per minute 60 c.p.m $\xrightarrow{t_{1/2}}$ 30 c.p.m $\xrightarrow{t_{1/2}}$ 15 c.p.m (suitable working) age of specimen = 2 half-life = 2 × 5700 years = **11 400 years**	1 1

	(c)	Xenon-133 Xenon is a gas, and it can be easily inhaled in lungs. (Or) Xenon has a short-half life, no long-term risks for patients.	1 1

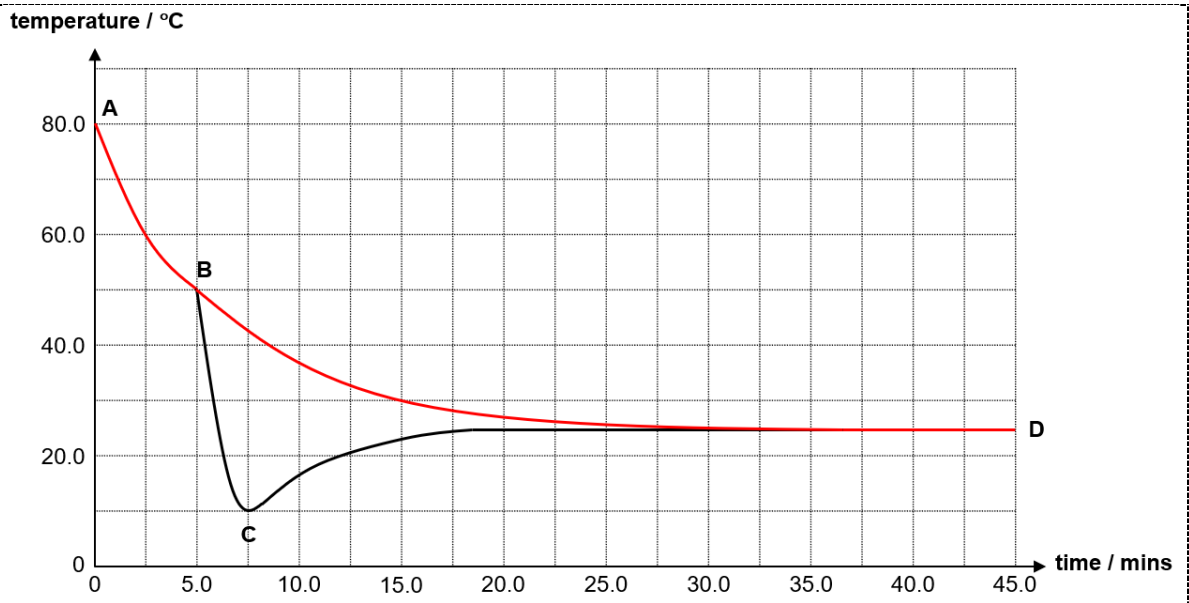
10	(a)	(i)	average speed = (100 ÷ 1000) km / (9.69 ÷ 3600) hr (suitable working) = **37.2 km/h**	1 1
		(ii)	(all entries correct)	1

20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
0.91	**0.87**	**0.85**	**0.82**	**0.82**	**0.82**	**0.83**	**0.90**

		(iii)	human reaction time needed to respond to gun blast **(Or)** athlete needs time to overcome inertia and accelerate from rest	1
		(iv)	50 m to 80 m mark of the race. A constant time of 0.82 s recorded for every 10 m.	1 1
	(b)	(i)	weight and normal reaction marked correctly and labelled	1
		(ii)	The athlete (foot) pushing the track backwards and the track pushing the athlete forwards, with an equal force in the opposite direction.	1 1
		(iii)	$F_{net} = m \times a$ $890 = m \times (8.4 - 0) / 0.89$ $m =$ **94 kg**	1

Section B (10 marks)

11	(a)	More thermal energy is needed to break the intermolecular forces of attraction between the water molecules. Energy is also required for the molecules to **overcome external atmospheric pressure** to escape into the atmosphere.	1 1
	(b)	$Q = mc\Delta\theta$ $Q = (0.25)(4200)(50 - 10)$ $Q =$ **42000 J**	1 1
	(c)	heat loss from tea = heat gain by ice $Q = m l_f + mc\Delta\theta$ $42000 = m (3.36 \times 10^5) + m (4200) (10)$ $m =$ **0.11 kg**	1 1

	(d)		
		same graph as original graph from A to B smooth cooling curve from B to 25 °C	1 1
	(e)	E = P t E = (0.50 kW) (10/60 × 30 h) E = 2.5 kWh cost of electricity = 2.5 kWh × 30 cents = **75 cents**	 1 1

12	(a)	When the temperature falls, R_t increases V_{out} increases which increases the heating of the room. {a vice-versa answer is also acceptable}			1 1
	(b)	(i)	V = W/Q 6 = 720/Q Q = **120 C**		 1 1
		(ii)	I = Q/t I = 120/(60) = 2.0 A	V = I R = 2 × 2 = **4.0 V**	1 1
		(iii)	R = V/I = (6 – 4)/2 = **1.0 Ω** temperature = **15.0 °C** (from graph)		 1 1
	(c)	For the same environment temperature, pd across thermistor will reduce, hence amount of thermal energy supplied by heating element **will decrease.**			1 1

Answer for Preliminary Examination Physics P1

1	2	3	4	5	6	7	8	9	10
C	B	A	B	A	A	A	C	C	B

11	12	13	14	15	16	17	18	19	20
D	B	C	B	B	A	C	D	C	C

21	22	23	24	25	26	27	28	29	30
B	B	D	B	C	B	B	C	A	C

31	32	33	34	35	36	37	38	39	40
B	C	B	D	A	A	B	D	B	D