Whitley Secondary School
Marking Scheme

Assessment: 2019 Prelim
Level and Paper: 4E Pure Phy

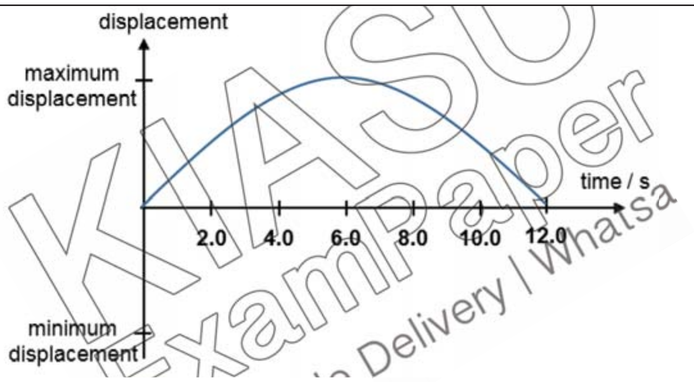
Paper 1

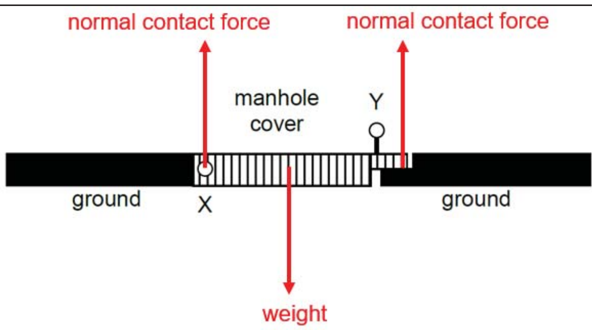
1	C	**11**	B	**21**	C	**31**	B
2	C	**12**	A	**22**	B	**32**	D
3	D	**13**	B	**23**	A	**33**	C
4	B	**14**	A	**24**	B	**34**	A
5	D	**15**	D	**25**	D	**35**	A
6	D	**16**	B	**26**	C	**36**	B
7	C	**17**	D	**27**	D	**37**	A
8	B	**18**	A	**28**	B	**38**	C
9	B	**19**	D	**29**	D	**39**	A
10	D	**20**	C	**30**	A	**40**	D

Paper 2

Deduct 1 mark for the following errors: • Wrong / missing units • Numerical ans not expressed in 3 s.f • Answers expressed in fractions Maximum of 2 marks deduction in a paper (due to any error above).

Section A

Q No.		Answers	Marks
1	(a)	6.0 s	1
	(b)	$acc = \frac{0 - 15.0}{6.0 - 0}$ $= -2.5\ m/s^2$	1 1
	(c)	Total distance travelled $= \frac{1}{2}(10)(4.0) + \frac{1}{2}(15)(6.0)$ $= 65\ m$ Average speed $= \frac{65}{10.0}$ $= 6.5\ m/s$	 1 1
	(d)	 • Correct shape with max displacement at t = 6.0 s • Decreasing gradient from t = 0.0 s to t = 6.0 s and increasing gradient from t = 6.0 s to t = 12.0 s	 1 1

Q No.			Answers	Marks
2	(a)			

			3 correct forces – **B2** 1 or 2 correct forces – **B1** 0 correct force – **B0**	1+1
	(b)	**(i)**	The product of the force and its perpendicular distance from the pivot to the line of action of the force	1
		(ii)	The perpendicular distance from the pivot to the line of action of the force is the longest when the pulling force at **Y** is normal to the manhole cover Force required to apply to the manhole cover will hence be the smallest, in order to produce the same anti-clockwise moment as the clockwise moment due to the weight of the manhole cover	1 1
		(iii)	CW moment = ACW moment $30.0 \times 45.0 = 55.0 \times F$ $F = 24.54545$ $\approx 24.5\ N$ upward	 1 1

Q No.		**Answers**	**Marks**
3		Correctly drawn parallelogram method - Solid lines with arrows and labels for forces - Dotted lines for construction - Double-headed arrow for resultant force - Length of arrows drawn for according to stated scale - Correct measurement of angle between the forces Suitable scale - 1 cm : 50 N or 1 cm : 25 N – **B1** T_1 = 275 N (260 N ~ 290 N) T_2 = 175 N (160 N ~ 190 N)	1+1 1 1 1

Q No.			**Answers**	**Marks**
4	**(a)**		There is greater temperature difference of 14 °C between outside the house and the bedroom than that between the main room and the bedroom which is a temperature difference of 4 °C / The greater the temperature difference, the faster the rate of transfer of thermal energy	1
	(b)	**(i)**	It needs to be placed at the top of the bedroom	1
		(ii)	As the air around the air conditioner cools, it contracts and becomes denser and sinks to the bottom of the room The warmer air, being less dense, rises to the top of the room to be cooled by the air conditioner A convection current is created from top to bottom of room which helps to cool the room efficiently	1 1 1
		(iii)	total thermal energy $= 4.5 \times 10^4 + 2.3 \times 10^6 + 1.1 \times 10^6 + 2.0 \times 10^5$ $= 3\ 645\ 000\ J$ $P = \frac{E}{t}$ $= \frac{3\ 645\ 000}{60 \times 60}$ $= 1012.5$ $\approx 1010\ W$	1 1

		(iv)	Any reasonable assumption: • There is no thermal energy entering or leaving the room other than what is stated. • The window and door is kept closed throughout. • The temperature outside the bedroom remains as stated.	1

Q No.		Answers	Marks
5	(a)	The amount of thermal energy required to change unit mass (1 kg) of the substance from solid state to liquid state, without a change in temperature	1
	(b)	<table><tr><td></td><td>Setup 1</td><td>Setup 2</td></tr><tr><td>mass of empty beaker / g</td><td>60</td><td>60</td></tr><tr><td>mass of beaker with melted ice / g</td><td>192</td><td>85</td></tr><tr><td>mass of melted ice / g</td><td>192 – 60 = 132</td><td>85 – 60 = 25</td></tr></table>	1
	(c)	Heat energy supplied by the surroundings to melt the ice can be determined / temperature changes in the environment affect both setups in the same way	1
	(d)	$E = IVt$ $= (10)(12)(5 \times 60s)$ $= 36\ 000\ J$	1 1
	(e)	Mass of melted ice due to power supply $= 132 - 25$ $= 107\ g$ $E = ml$ $36\ 000 = (107)(l)$ $l = 336.44859$ $\approx 336\ J/g$ $336\ J/g = 336\ 000\ J/kg$	1 1 1
	(f)	The mass of melted ice due to the power supply should be higher than 107 g. There was additional transfer of thermal energy from setup 1 to setup 2, causing more ice to melt in setup 2 / Mass of melted ice in setup 1 should be more	1

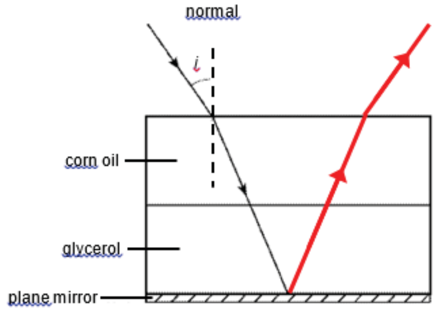
Q No.		Answers	Marks
6	(a)	The electrons from the plastic rod are transferred to the cloth. Hence there are now more electrons than protons, the rod therefore becomes positively charged	1
	(b)	The negative charges (electrons) move towards the rod, leaving positive charges on the left	1
	(c)	The negative charges in the ball are attracted to the positively charged rod The forces of attraction between the unlike charges are stronger than the forces of repulsion between like charges, hence the ball swings towards the charged rod due to the net force to the right	1 1
	(d)	Negative charges (electrons) flow up from earth to the ball through the wire to neutralise the induced positive charges The ball becomes negatively charged	1 1

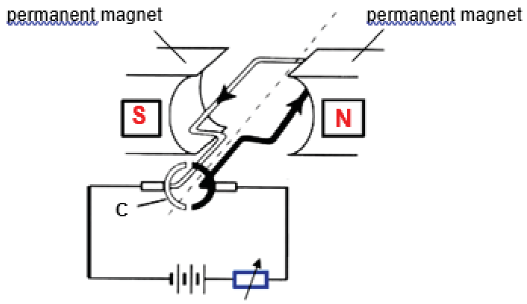
Q No.			Answers	Marks
7	**(a)**		$V = IR$ $= (0.025)(600)$ $= 15\,V$	 1 1
	(b)		$V = IR$ $20 - 15 = (0.025)(R)$ $R = 200\ \Omega$	 1 1
	(c)	**(i)**	Ammeter reading <u>increases</u> Resistance of thermistor <u>decreases</u> when its temperature increases which <u>decreases the overall effective resistance</u> of the circuit, hence current increases	1 1
		(ii)	voltmeter reading <u>increases</u> Resistance of thermistor <u>decreases</u> when its temperature increases hence its potential difference <u>decreases</u> and the potential difference of fixed resistor increases	1 1

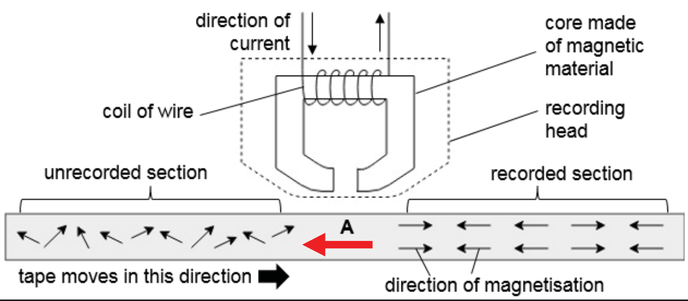
Section B

Q No.		Answers	Marks
8	(a)	$P = h\rho g$ $= (15)(800)(10)$ $= 120\ 000\ Pa$	 1 1
	(b)	Atmospheric pressure = 100 000 Pa Net pressure acted at tap Q $= 120\ 000 - 100\ 000$ $= 20\ 000\ Pa$ $P = \frac{F}{A}$ $20\ 000 = \frac{F}{0.03}$ $F = 600\ N$	 1 1 1
	(c)	Pressure due to the oil depends <u>on the height of the oil column above the tap **P**</u> As level of oil falls in the tank decreases, the pressure due to the oil <u>decreases</u> The difference in pressure between oil and the atmosphere at P <u>decreases</u> Hence rate of flow of oil decreases	1 1 1
	(d)	Aluminium tap The <u>larger</u> the cross-sectional area of the tap, the <u>larger</u> is the force applied (due to $P = \frac{F}{A}$)	1 1

Q No.		Answers	Marks
9	(a)	$n = \frac{\sin i}{\sin r}$ $1.48 = \frac{\sin 35}{\sin r}$ $r = 22.80224$ $\approx 22.8^o$	 1 1
	(b)	Corn oil and glycerol have the <u>same refractive index</u> There is <u>no change</u> in the <u>speed</u> of light ray as it travels from corn oil to glycerol	1 1
	(c)	$\sin c = \frac{1}{n}$ $c = \sin^{-1}\frac{1}{1.48}$ $= 42.50664$ $\approx 42.5^o$	 1 1
	(d)	Angle of incidence will <u>not be greater</u> than critical angle / angle of incidence will be <u>smaller</u> than critical angle The maximum angle of incidence at corn oil-air interface is <u>equal</u> to the maximum angle of refraction at air-corn oil interface which has a maximum value of 42.5°	1 1

	(e)		
		• correct reflected ray at mirror (*i* = *r* with no bending at glycerol-corn oil interface) • correct refracted ray (*r* for ray leaving corn oil is 35°)	1 1

Q No.		Answers	Marks
10E	(a)		1
	(b)	Split ring commutator Function: <u>Changes the direction</u> of the current flow in the coil <u>every half a revolution</u> so that coil can rotate continuously	1 1
	(c)	Current in coil <u>produces a magnetic field</u> This field <u>interacts</u> with the permanent magnetic field to produce a force at the side of coil The forces at two sides are acting in <u>opposite directions</u> hence produces a moment about the axle to rotate coil	1 1 1
	(d)	As the slider shifts to the right, current has to flow through <u>longer</u> section of the resistance wire resistance <u>increases</u> and current <u>decreases</u> The force on the sides of coil due to the current and magnetic field <u>decrease</u> Hence speed of rotation <u>decreases</u>	1 1 1 1

Q No.			Answers	Marks
10O	(a)			1
	(b)	(i)	<u>Soft magnetic materials</u> form temporary magnets while <u>hard magnetic materials</u> form permanent magnets Soft magnetic materials are <u>easily magnetised and demagnetised</u> while hard magnetic materials are <u>hard to be magnetised and demagnetised</u>	1 1

		(ii)	Hard magnetic material	1
	(c)		As the magnetised tape approaches the recording head, there is a change in magnetic flux linking through the magnetic core to the coil of wire By Faraday's Law, an emf is induced in the coil of wire which is proportional to the rate of change of the magnetic flux (magnetic field lines linking the coil) Hence an electrical signal in the form of an induced current is produced	1 1
	(d)		The cassette player sends a strong alternating current to the coil of wire This produces a strong alternating magnetic field which causes the magnetisation on the tape to be disrupted as the tape passes the recording head **OR** The cassette player sends a strong direct current to the coil of wire This produces a strong magnetic field which causes the magnetisation on the tape to be reset to a single direction as the tape passes the recording head	1 1 **OR** 1 1
	(e)		• The cassette is exposed to heat causing the tape inside to be demagnetised • The cassette has been dropped / subjected to physical impact causing the tape inside to be demagnetised • Over time, Earth's magnetic field causes the direction of magnetisation to change • Different parts of the tape with different direction of magnetisation will affect one another, causing the directions to be altered *Any two*	1+1

– End of Paper –