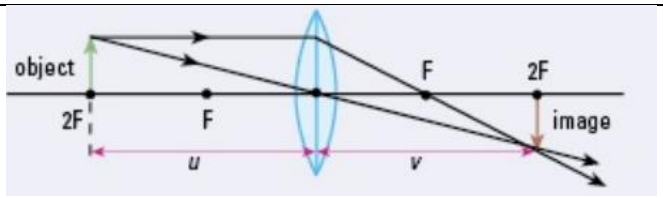
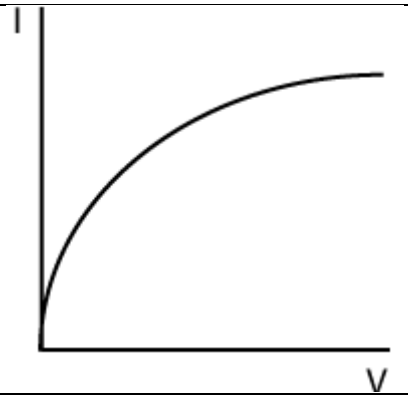
YTSS 4E PHYSICS PRELIM ANS KEY

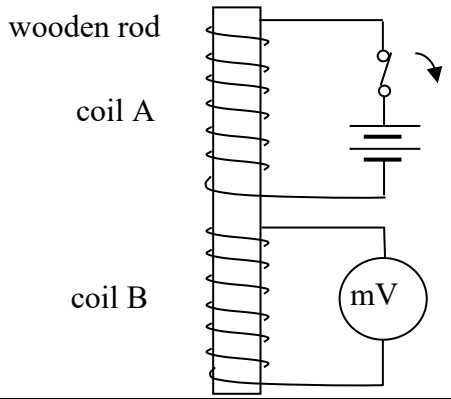
Ques	Ans		Ques	Ans		Ques	Ans		Ques	Ans
1	D		**11**	C		**21**	C		**31**	D
2	C		**12**	A		**22**	B		**32**	D
3	B		**13**	D		**23**	B		**33**	D
4	C		**14**	A		**24**	B		**34**	C
5	A		**15**	A		**25**	B		**35**	A
6	C		**16**	D		**26**	D		**36**	D
7	C		**17**	C		**27**	A		**37**	D
8	A		**18**	D		**28**	A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

		To award for answers based on intermediate working so long physics concept shown is correct / logical -1 max for sf (per question) -1 max for unit (per question)	
1	**(a)**	4.5 cm [1]	
	(b)	Digital calipers or vernier calipers [1]	Digital micrometer is not accepted.
	(c)	Do not agree with student B. [1] The instrument could be more precise but not necessarily accurate. [1]	Award zero if agree with student B
2	**(ai)**	Acceleration = (8.8 – 0) / (3.0 – 2.1) [1] a = 9.8 m/s^2 [1]	Award 1m for any correct value of time or velocity
	(aii)	Initial height = 0.5 x 10.8 x 1.1 [1] = 5.9 m [1]	Award 1m if show idea of area of triangle AND at least time or velocity is correct.
	(aiii)	new max height = 0.5 x 8.8 x 0.9 = 4.0 m [1] displacement = 5.9 – 4.0 = 1.9 m [1]	If new max height is incorrect, max 1m for showing difference in heights.
	(b)	The gradient of the graph is constant, showing that air resistance does not affect the acceleration. Do not just accept acc is constant	**[1]** Ans MUST have reference to fig.
3	**(ai)**	It states that, The sum of CW moments about a pivot is equal to the sum of ACW moments **about the same pivot**	**[1]**

		For a system/object to be in equilibrium	**[1]**
	(aii)	F x 1.5 = 150 x 0.75 [1] F = 75 N [1]	Award max 1m if ans wrong but one side of eqn correct.
	(b)	There is a normal contact force upwards on the pivot. Therefore, weight will balance out with normal contact force AND the force F.	[1] [1]
4	**(ai)**	Pdiff = 1000 x 10 x 0.09 m [1] = 900 Pa [1]	Max 1m if didn't convert cm to m.
	(aii)	New height difference = 0.10 m Hence, right side must rise by 0.05 cm, left side drops by 0.05 cm. Right side, 25.5 cm, left side, 15.5 cm Accept RHS, 26, LHS, 16 ONLY if 25.5 and 15.5 is shown in working	[1] [1]
	(b)	It cannot (give BOD to student even if explanation wrong) The pressure due to water (or oil) is not enough to balance out the pressure due to gas (or manages to explain that most of the pressure balance comes from Patm)	[1] [1]
5	**(a)**	It is a disturbance in which the **direction of vibration** of particles is **perpendicular** to the direction of wave travel.	[1] Do not accept move perpendicular
	(b)	The wave travels 1.0 cm in 2 seconds. Hence, speed = 0.50 cm/s	 [1]
	(c)	Wavelength = 6.0 cm Speed = 0.50 cm/s Period = 6.0 / 0.50 = 12 s	[1] [1]
	(d)	Y is directly above X, displacement of 2.0 cm	[1]
6	**(a)**	Sound that cannot be heard by humans. With a frequency above 20kHz	[1] [1]
	(b)	v = 2d / t 340 = 2d / 0.030 d = 5.1 m Max 1m if forgot distance multiply by 2, or forgot to convert ms	 [1] [1]
7	**(a)**	Changes: velocity or speed Remains constant: frequency	[1] for both correct
	(b)	1.80 = sin 32 / sin r r = 17° angle of deviation = 90 – 58 – 17 = 15 °	[1] [1] [1]

	(c)		[1] all rays sketched correctly [1] image must be same size as object and object at 2F
8	**(a)**	-ve charges on left side of K ONLY +ve charges on right side of L ONLY	[1] need to balance at least the spheres, +ve and -ve
	(b)	K becomes negatively charged.	[1]
	(c)	The rod remains positively charged. (BOD even if student explain wrong) Electrons are not able to move freely in an insulator.	[1] [1]
	(d)	By bringing the rod to a humid environment. OR Exposing it to ionized air OR Discharge by friction / rubbing	[1] Do not accept heating as its not practical
9	**(ai)**	Isotopes are atoms with the same no. of protons but different no. of neutrons	[1]
	(aii)	Sodium 24 will have 1 more neutron than sodium 23.	[1]
	(bi)	Electron	[1]
	(bii)	$^{24}_{11}\text{Na} \rightarrow {}^{0}_{-1}\beta + {}^{24}_{12}\text{Mg}$	[1] for beta particle [1] for magnesium
	(c)	A half life of 15 hours is a relatively short time and the isotope will decay quickly. (or doesn't stay radioactive) This limits the amount of time of radiation exposure, or less ionizing over time	[1] [1]
10	**(a)**	KE = ½ mv^2 = 0.5 x 0.025 x 56^2 [1] = 39 J [1]	Max 1m for forgetting conversion, or square of velocity
	(b)	a = (v-u)/t = (0 – 56)/0.02 [1] = –2800 m/s^2 Deceleration = 2800 m/s^2 [1] F = ma = 0.025 x 2800 = 70 N [1]	Must show understanding of final-initial velocity
	(c)	work done = F x d = 70 x 0.12 [1] = 8.4 J [1]	

	(d)	By the Principle of Conservation of Energy KE = WD+ GPE 39 = 8.4 + GPE [1] GPE = 30.6 J (Since GPE = mgh) 30.6 = mgh h = (30.6) / (0.025 + 8.0)(10) = 0.384 m (theoretical value) [1]	Max 1m for effort to show difference in experimental and theoretical values (CASE BY CASE)
11	**(ai)**	Vout = 12 x 6000 / 8000 [1] Vout = 9.0 V [1]	
	(aii)	I = V / R I = 12 / 8000 [1] I = 0.0015 A [1]	1m max for failure to convert kilo ohm
11	**(b)**	When the brightness decreases, the resistance of the LDR will increase. Since the LDR and resistor are in series, the ratio of resistance of LDR : fixed resistor will increase, resulting in a smaller reading in the voltmeter. (award 1m for correct understanding of how V is related to R of resistor)	[1] [1] Or similar explanation. If stu just write V is larger, max 1m
	(ci)	An automatic lighting system	[1]
	(cii)		[1]
	(ciii)	The I-V graph for a fixed resistor would be a straight line graph <u>passing through the origin OR mention current is directly proportional to voltage</u> As the fixed resistor would follow Ohm's law	[1] [1]
12	**(ai)**	Conduction	[1]
	(aii)	Water near the element gains heat, becomes less dense and starts to rise. The cooler water above starts to sink due to density differences. This bulk movement of fluid sets up a **<u>convection current</u>**, heating the water throughout.	[1] [1]
	(aiii)	It should be white, as white is a poor emitter of heat.	[1]

	(bi)	$L_f = ml_f$ = 100 x 334 = 33000 J	 [1] [1] Can award 1m for conversion if the other parts wrong
	(bii)	heat gained by ice = heat loss by water $33400 + m_{ice}c_{water}T = m_{water}c_{water}(100 – T)$ 33400 + 100 x 4.2 x T = 200 x 4.2 (100 – T) 33400 + 420 T = 84000 – 840T $T = 40^o$ C	 Max 1m for ans wrong, 1side of eqn correct [1] [1]
	(biii)	E = 2 kW x 5/60h E = 0.17 kWh Cost = 0.17 x 0.26 = \$0.044	[1] [1]
13	**(a)**	The millivoltmeter will first show an emf reading	[1]
		And the reading will then return to zero.	[1]
	(bi)		Arrows on coil B to the right
	(bii)	Coil A initially has a S pole nearest to coil B. When the switch is opened, the change in magnetic field causes the coil B to have a N pole induced at the end closer to coil A to oppose the change. (attract it back) Using right-hand grip rule, we can determine the direction of the induced current drawn in b (i).	[1] [1]
	(c)	Current in lamp = 24 / 12 = 2.0 A $V_s/V_p = I_p/I_s$ $12/16 = I_p/2$ $I_p = 1.5$ A	[1] [1]
	(di)	Input power = VI = 16 x 1.7 = 27 W	[1]
	(dii)	Power loss = 27.2 – 24 = 3.2 W	[1]
	(diii)	There will be some energy loss in the form of heat due to resistance.	[1]