G

Presenting Centre No.	Subject No.	Level	Paper No.	Group No.	Marker's No.
	3220				

K & U	PS
Total	Marks
illai	iviains

## 3220/101

SCOTTISH CERTIFICATE OF EDUCATION 1997 THURSDAY, 15 MAY 9.30 AM - 11.00 AM

PHYSICS STANDARD GRADE General Level

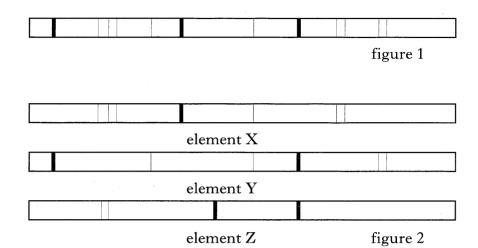
Fill in these boxes and read what is printed belo	w.
Full name of school or college	Town
First name and initials	Surname
Date of birth Day Month Year Candidate number	Number of seat
1 All questions should be answered.	
2 The questions may be answered in any order but legibly in this book.	ut all answers must be written clearly and
3 For questions 1-9, write down, in the space panswer you think is correct. There is only <b>one</b> co	
4 For questions 10–23, write your answer where provided after the question.	indicated by the question or in the space
5 If you change your mind about your answer yo space provided at the end of the answer book.	ou may score it out and replace it in the
6 Before leaving the examination room you must on not, you may lose all the marks for this paper.	give this book to the invigilator. If you do

						K&U	PS
				1 .1	Marks		
	1.		e part of a radio which picks up all radio signals from the air is call	ed the			
		A	modulator				
		B	amplifier				
		C	tuner				
		D	aerial				
		E	decoder.  Answer		(1)		
	2.	Th	e instrument used to detect sounds produced within the human	body is			
		A	an oscilloscope				
		В	an endoscope				
		C	a stethoscope				
		D	a thermogram				
		E	a spectroscope.				
			Answer		(1)		
	3.	Wh	nich of the following particles are in orbit around the nucleus of an	atom?			
	ο.	A	Electrons only	atom.			
		В	Protons only				
		C	Electrons and protons				
		D	Protons and neutrons				
		E	Protons, neutrons and electrons				
		15	Answer		(1)		
			L				
•	4.	Wh	nich of the following is the circuit symbol for a light emitting diode	(LED)?			
		A					
		В					
		C					
		D					
		E	Answer		(1)		
					` '		
[3	3220	0/10	1] Page two				

							K&U	PS
_						Marks		
5.			_		<b>ble</b> sources of energy?			
	A	solar	wind	coal				
	В	water	solar	wind				
	С	coal	oil	gas				
	·D	coal	water	gas				
	E	oil	wind	water	Answer	(1)		
					Answer	(1)		
6.	In	which of tl	he following v	vould a voltage <b>not</b>	be induced in a coil of wire?			
	A	Rotating	the coil of wi	re between the poles	s of a magnet			
	В	Moving a	a magnet in ar	nd out of the coil of	wire			
	C	Rotating	the coil of wi	re near to a magnet				
	D	Holding	a magnet stati	onary within the co	il of wire			
	E	Rotating	a magnet nea	r to the coil of wire				
			•		Answer	(1)		
_	_			_				
7.		_		icross country, the igher voltage using a	electricity produced at a power			
	A	transisto	r					
	В	transforn	ner					
	$\mathbf{C}$	relay						
	D	thermisto	or					
	$\mathbf{E}$	variable 1	esistor.		4	(1)		
					Answer	(1)		
8.	Pla	nets are ob	ojects which a	re in orbit around				
	A	moons						
	В	galaxies						
	C	meteors						
	D	stars						
	$\mathbf{E}$	comets.			[ <del></del> ]			
					Answer	(1)		net.
					[Turn	over		
[322	0/10	1]		Page three				

K&U	PS
I La	1 2

**9.** Figure 1 shows the spectral lines of the radiation from a star. Figure 2 shows the spectral lines of three elements X, Y and Z.



The elements which are present in the star are

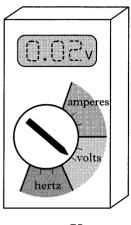
- A X only
- B Y only
- C X and Y only
- D Y and Z only
- E X, Y and Z.

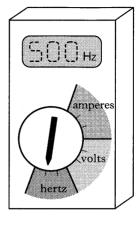
Answer (1)

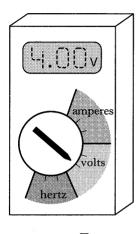
(a)	Marks A space probe of mass 25 kilograms is launched from a space craft. The
` /	probe is accelerated by a small rocket engine which produces a thrust of 200 newtons.
	Calculate the acceleration of the probe.
	Space for working and answer
	(2)
(b)	The probe is designed so that it will leave the craft with as small a kinetic energy as possible.
	Complete the following sentence by inserting the word <b>large</b> or <b>small</b> in each space.
	In order to make sure that the space probe has a small kinetic energy the
	mass of the probe is made and its speed is made
<i>c</i> )	The probe passes through a planet's atmosphere.
	Why does the probe heat up?
	(1)
	[Turn over

11. An electrical signal is applied to the input of an audio amplifier. A pupil measures the frequency and voltage of the electrical signal. The output voltage from the amplifier is also measured.

Three meters X, Y and Z are used in the measurements. The readings on the meters are shown in the diagram below.







meter X

meter Y

meter Z

(a) Which meter is used to measure the output voltage from the amplifier?

(b) Calculate the voltage gain of the amplifier.

Space for working and answer

(3)

**(1)** 

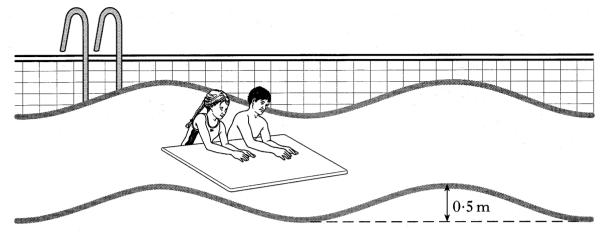
(c) What is the frequency of the

- (i) input signal to the amplifier; .....

**(2)** 

**(2)** 

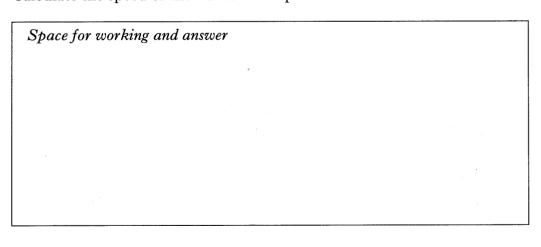
12. The diagram shows children using a large float in the swimming pool of a sports complex. A wave machine in a swimming pool generates 24 waves per minute on the surface of the pool.



(a) Show that the frequency of the wave machine is 0.4 hertz.

Space for working and answer		

(b) The wavelength of the waves in the pool is 4.0 metres. Calculate the speed of the waves in the pool.

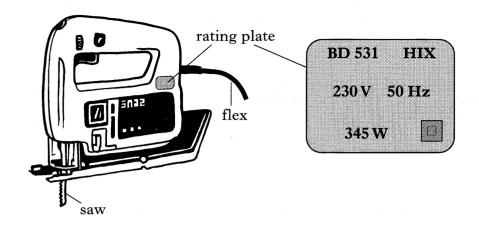


(c) The large float moves up and down on the waves. The vertical distance through which the float rises is 0.5 metres.

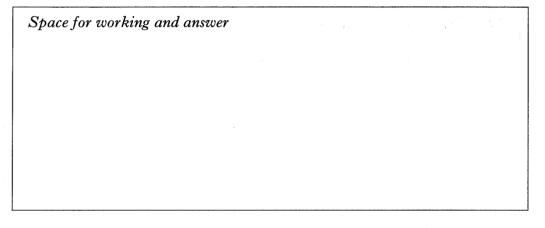
What is the amplitude of the waves?

[3220/101] Page seven [Turn over

13. The rating plate of an electric saw is shown below.



(a) Calculate the current drawn from a 230 V supply.



**(2)** 

(b) How many wires are there in the flex connecting the saw to the supply?(c) Name the wires in the flex.

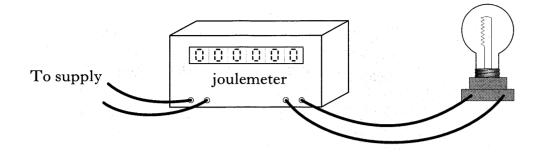
.....(1)

(d) State the colours of the insulation on the wires in the flex.

You must indicate clearly which colour applies to each wire.

(1)

**14.** The diagram below shows a joulemeter being used to measure the electrical energy transferred by a lamp.



(a) The joulemeter display is set at zero. The power of the lamp is 24 watts. The lamp is switched on for five minutes.

What is the reading on the joulemeter at the end of the five minute period?

Space for working and answer	

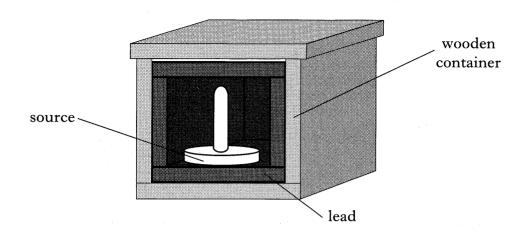
(2)

**(2)** 

(b) The filament lamp is replaced by a fluorescent tube, which also has a power of 24 watts. The fluorescent tube is run for five minutes.

How does the amount of light energy emitted by the fluorescent tube compare with that given out by the filament lamp? Explain your answer.

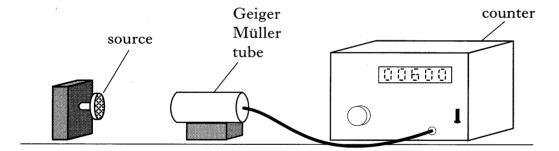

15. Radioactive sources are often stored in lead lined containers as shown.



(a	)	Explain	why the	container	is	lead-lined.
ľ	,	DAPIGITI	willy tile	Contamer	13	icau-illicu.



- (b) Describe **two** safety precautions which should be taken when using the source.
  - (1) .....
  - (2) ...... **(2)**
- (c) The source is placed in front of a Geiger Müller tube and counter as shown below.



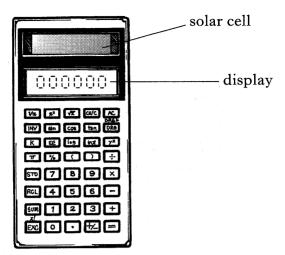
The counter registers 600 counts in one minute.

An identical experiment is repeated two years later using the same source. The reading on the counter is now 500 counts in one minute.

Explain why the count rate has decreased.

.....(1)

16. The diagram below shows a calculator which is powered by a solar cell.



(a) State the energy transfer occurring in the solar cell.

.....(1)

(b) The circuit powered by the solar cell has a resistance of 100 ohms. The solar cell produces a voltage of 0.5 volt.

Calculate the current in the solar cell circuit.

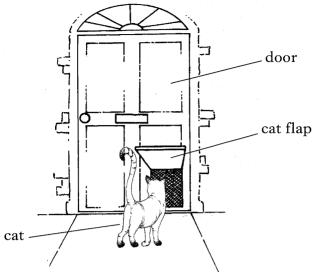
Space for working and answer

**(2)** 

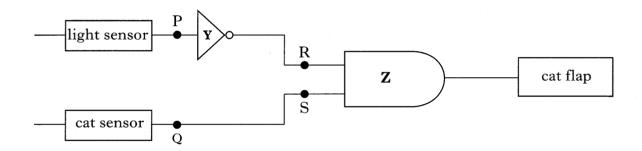
(c) Name a suitable output device which could be used in the display of the calculator.

......(1)

17. A pupil designs an electronic system to control the opening and shutting of a cat flap in a door. The flap opens when the cat approaches the door in daylight.



The diagram below shows the electronic system which is used by the pupil.



When the cat approaches, the logic level at Q changes from logic 0 to logic 1.

In daylight, the logic level at P is logic 0.

In darkness, the logic level at P is logic 1.

The cat flap opens when the output from Z goes to logic 1.

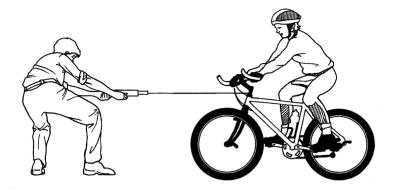
(a) Name the logic gate Z.



Space for table  (1)  (2) Explain why the NOT gate Y is required.  (2)  [Turn over	<i>(b)</i>	In the space below, o	lraw the truth ta	able for logic gate Z.			
(1) Explain why the NOT gate Y is required.  (2) [Turn over		Space for table					
(c) Explain why the NOT gate Y is required.  (2)  [Turn over							
(c) Explain why the NOT gate Y is required.  (2)  [Turn over							
(c) Explain why the NOT gate Y is required.  (2)  [Turn over							
(c) Explain why the NOT gate Y is required.  (2)  [Turn over			•				
(c) Explain why the NOT gate Y is required.  (2)  [Turn over							
						(1)	
[Turn over	(c)	Explain why the NO	T gate Y is requ	ired.			
[Turn over							
						. (2)	
					[Tur	n over	
					[Tur		
							1
							The state of the s
, ,							A CONTRACTOR OF THE PERSON OF

**(3)** 

18. (a) Two pupils wish to investigate the force of friction affecting their mountain bike. One pupil sits on the bike, without pedalling, while the other pulls the bike along at a steady speed.



	(i)	How do the pulling force and the frictional force on the bike compare when the bike moves at a steady speed?	
			(1)
	(ii)	Name an instrument which could be used to measure the pulling force.	
			(1)
(b)		pupils are supplied with a measuring tape and a stopwatch. Describe they could measure the average speed with which one of them rides bike.	
	•••••		
	•••••		
	•••••		

## 18. (continued)

(c) The pictures below show three possible positions X, Y and Z which the pupils could use when free wheeling down a hill.







Position X

Position Y

Position Z

(i)	Which of the three positions would give the rider the greatest speed at the bottom of the hill?	
		(1)
ii)	Why does this position give the greatest speed?	
		(1)

19. An assistant is pushing a long row of trolleys across the car park of a garden centre. The trolleys are pushed at a steady speed along the horizontal ground for a distance of 50 metres using a force of 400 newtons.



(a) Calculate the work done in moving the trolleys.

Space for working and answer

**(2)** 

(b) The assistant pushes the trolleys for 80 seconds.Calculate the average power produced by the assistant.

Space for working and answer

**(2)** 

## 20. Read the following passage about the Cruachan pumped storage system.

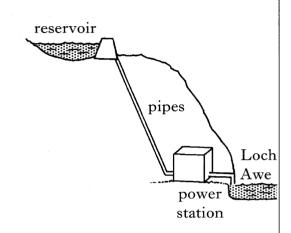
Here's how the Cruachan pumped storage system works.

Water is stored in a high level reservoir on Ben Cruachan. At times of peak demand for electricity, water from the reservoir is released through pipes to the power station 400 metres below.

The powerful surge of water spins turbine blades which turn generators to produce electrical power.

The National Grid distributes the electrical power throughout Scotland by means of transmission lines.

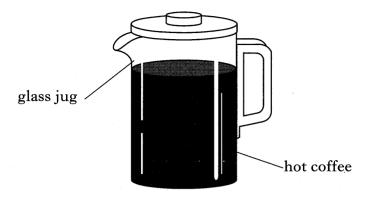
At times of low demand, electrical power from other sources is taken from the National Grid and is used to pump water from Loch Awe back up to the reservoir.



The water stored in the reservoir is then used to generate electricity at times of peak demand.

(a)	State the form of energy gained by the water after it has been raised to the reservoir.	
		(1)
(b)	State the direction in which water flows in the pipes at times of low demand.	
		(1)
(c)	What is the reason for pumping water to the reservoir?	
		(1)
(d)	Name the device used to produce electrical power.	
		(1)
(e)	What is the purpose of the National Grid?	
		(1)

**21.** A glass jug contains coffee at 80 degrees celsius. The coffee is found to cool quickly.



/ \	TT	1	C	. 1	C 11	•	1	complete	41		1 1
(a)	I SE	WOTAS	trom	the	talla	າໝາກຕ	LIST TO	complete	the	sentence	neiow
(4)	$\sim$ $^{\circ}$ C	WOIGS	11 0111	LIIC	TOIL	7 44 1112	1136 60	Complete		SCIICCIICC	DCIOW.

temperature energy gains loses

(b) The jug contains 0.5 kilogram of coffee which has cooled to 20 degrees celsius.

Calculate how much heat energy is required to raise the temperature of the coffee from 20 degrees celsius to 80 degrees celsius.

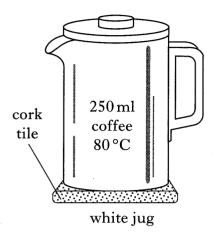
[specific heat capacity of coffee = 4000 joules per kilogram per degree celsius]

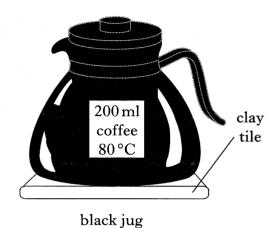
Space for working and answer

**(2)** 

## 21. (continued)

(c) It is decided to investigate whether the colour of the jug affects the cooling of the coffee. Two jugs are filled with coffee as shown in the diagrams below.





The temperature of the coffee is noted at the start and after ten minutes. Give **two** reasons why this is not a fair test.

(1)	
(2)	
	(2)

dist	irework display is held at Edinburgh Castle. People in the street, some rance away, see a firework explode before they hear the sound from the losion.	Marks	
(a)	Explain why there is a delay between seeing the explosion and hearing the sound.		
		(1)	
(b)	The people see the explosion and 3.0 seconds later they hear the sound.		
	Calculate the distance between the exploding firework and the people.		
	[speed of sound in air = 340 metres per second]		
	Space for working and answer		
		(2)	
(c)	In the firework display, the fuse of a rocket is lit.		
(-)	Gas is released from the rocket and the rocket rises into the air.		
	Complete the passage below by selecting words from the following list.		
	gas ground rocket upwards downwards		
	The rocket exerts a force on the		
	and the exerts a force on the		
	rocket which accelerates upwards.	(2)	
( <i>d</i> )	The rocket gets to the top of its flight and then falls back to the ground.		
	If the effects of air resistance are ignored, what is the acceleration of the rocket on the way down?		
			1

Page twenty

[3220/101]

								Marks		
(a)	A solar system consists of a star and orbiting planets.									
	Name the star at the centre of our solar system.									
				• • • • • • • • • • • • • • • • • • • •				(1)	ļ	
(1.)	T C		1	abeain ad b	li44in.	m tha limbt	fuore the			
(0)	<ul><li>(b) Information about stars can be obtained by splitting the light from the stars into different colours.</li><li>(i) Name a piece of apparatus which is used to do this.</li></ul>									
		•••••		• • • • • • • • • • • • • • • • • • • •	••••••		• • • • • • • • • • • • • • • • • • • •	(1)		
	(ii) '	What name is give	en to the p	attern of co	loured line	es obtained	?		İ	
								(1)		
(-)	Th.	tabla balany airea	in forms ati	on obout o	ome of the	nlanata in				
(c)	syste	table below gives m.	informati	on about so	ome of the	pianets in	our solar			
			17	E	71.0	8				
			Venus	Earth	Mars	Jupiter				
		Time for one complete spin	5832	24	24.5	10				
		(hours)	3032	21	2,13					
		Diameter								
		(kilometres)	12 000	12750	7000	140 000				
		Number of	0	1	2	more than 20				
		moons	. ,			than 20				
	(i) <sup>1</sup>	Which <b>two</b> plane	ts have alm	ost the san	ne diamete	er?				
	(1)	, viner eve prane						(1)		
	(ii) Which <b>two</b> planets have almost the same length of day?									
	(iii) Explain why moons are called satellites.									
			•••••	• • • • • • • • • • • • • • • • • • • •				(1)		
		[EN	D OF QU	ESTION I	PAPER]					

Page twenty-one

[3220/101]

K&U PS

YOU MAY USE THE SPACE ON THIS PAGE TO REWRITE ANY ANSWER YOU HAVE DECIDED TO CHANGE IN THE MAIN PART OF THE ANSWER BOOKLET. TAKE CARE TO WRITE IN CAREFULLY THE APPROPRIATE QUESTION NUMBER.

[BLANK PAGE]

[BLANK PAGE]