2008 Physics

Standard Grade − General

Finalised Marking Instructions

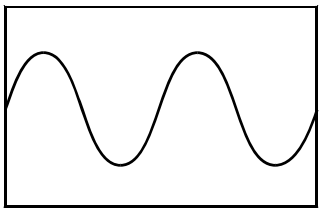
Physics – Marking Issues

The current in a resistor is 1·5 amperes when the potential difference across it is 7·5 volts. Calculate the resistance of the resistor.

	Answers	**Mark + Comment**	**Issue**
1.	V=IR 7·5=1·5R R=5·0 Ω	(½) (½) (1)	Ideal answer
2.	5·0 Ω	(2) Correct answer	GMI 1
3.	5·0	(1½) Unit missing	GMI 2 (a)
4.	4·0 Ω	(0) No evidence/wrong answer	GMI 1
5.	_____ Ω	(0) No final answer	GMI 1
6.	$R = \frac{V}{I} = \frac{7·5}{1·5} = 4·0\,\Omega$	(1½) Arithmetic error	GMI 7
7.	$R = \frac{V}{I} = 4·0\,\Omega$	(½) Formula only	GMI 4 and 1
8.	$R = \frac{V}{I} =$ _____ Ω	(½) Formula only	GMI 4 and 1
9.	$R = \frac{V}{I} = \frac{7·5}{1·5} =$ _____ Ω	(1) Formula + subs/No final answer	GMI 4 and 1
10.	$R = \frac{V}{I} = \frac{7·5}{1·5} = 4·0$	(1) Formula + substitution	GMI 2 (a) and 7
11.	$R = \frac{V}{I} = \frac{1·5}{7·5} = 5·0\,\Omega$	(½) Formula but wrong substitution	GMI 5
12.	$R = \frac{V}{I} = \frac{75}{1·5} = 5·0\,\Omega$	(½) Formula but wrong substitution	GMI 5
13.	$R = \frac{I}{V} = \frac{7·5}{1·5} = 5·0\,\Omega$	(0) Wrong formula	GMI 5
14.	V = IR 7·5 = 1·5 × R R = 0·2 Ω	(1½) Arithmetic error	GMI 7
15.	V = IR $R = \frac{I}{V} = \frac{1·5}{7·5} = 0·2\,\Omega$	(½) Formula only	GMI 20

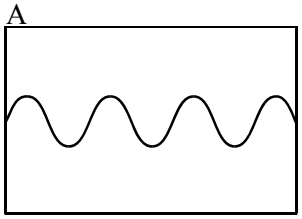
	K&U	PS
Marks		

1. When a student whistles a note into a microphone connected to an oscilloscope, the following pattern is displayed.

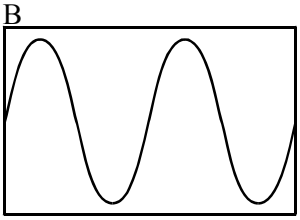


Without changing the oscilloscope controls, another student whistles a quieter note of higher frequency into the microphone. Which of the following shows the pattern which would be displayed on the screen?

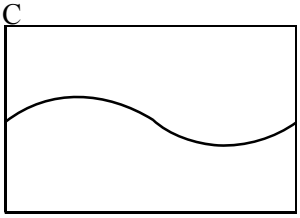
A



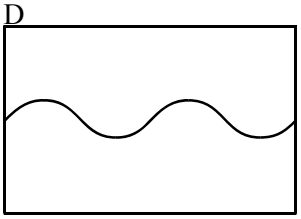
B



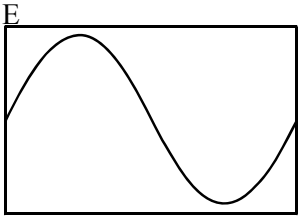
C



D



E



Answer **A** **1**

2. The weather information satellite NOAA-15 has a period of 99 minutes and an orbital height of 833 kilometres.

The geostationary weather information satellite Meteosat has a period of 1440 minutes and an orbital height of 35 900 kilometres.

Which of the following gives the period of a satellite that has an orbital height of 20 000 kilometres?

A 83 minutes
B 99 minutes
C 720 minutes
D 1440 minutes
E 1750 minutes

Answer **C** **1**

NOTES

Question Nos 1 and 2

	K&U	PS
Marks		

3. Which row in the table describes the correct configuration for an atom?

	orbiting the nucleus	*inside the nucleus*
A	protons only	electrons and neutrons
B	electrons and protons	neutrons only
C	neutrons and protons	electrons only
D	electrons only	neutrons and protons
E	neutrons only	electrons and protons

Answer **D** **1**

4. The time taken for light to reach us from the Sun is approximately

A 1 second
B 8 seconds
C 1 minute
D 8 minutes
E 1 hour.

Answer **D** **1**

5. Two objects are dropped from the same height. Both objects fall freely.

Object X has a mass of 10 kilograms.
Object Y has a mass of 1 kilogram.
Object X accelerates at 10 metres per second per second.
The acceleration of object Y, in metres per second per second is

A 0·1
B 1·0
C 10
D 100
E 1000.

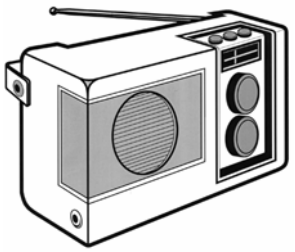
Answer **C** **1**

NOTES

Question Nos 3, 4 and 5

	K&U	PS
Marks		

6. A student is listening to a radio.



(a) Complete the passage below using words from the following list.

sound **amplifier** **light** **microphone**
aerial **battery** **tuner** **decoder** **electrical**

The **aerial** of a radio receiver detects signals from many different stations and converts them into electrical signals.

The **tuner** selects one particular station from many.

The **amplifier** increases the amplitude of these electrical signals.

The energy required to do this is supplied by the **battery**.

The loudspeaker in a radio receiver converts **electrical** energy into **sound** energy. **3**

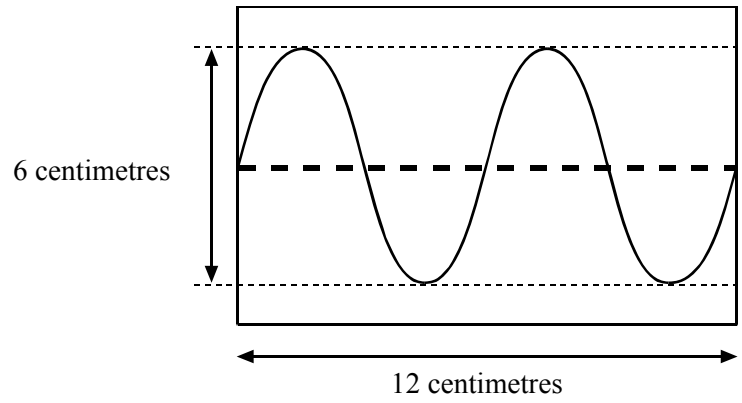
(½) each correct

NOTES

Question No 6 (a)

	K&U	PS
Marks		

(b) Electrical signals are displayed as waves on an oscilloscope.



(i) Calculate the wavelength of the waves.

Space for working and answer

2 waves in 12 cm

1 wave in $\frac{12}{2} = 6$ cm (1)

deduct (½) if no/wrong unit

1

(ii) Calculate the amplitude of the waves.

Space for working and answer

2 amplitudes in 6 cm

1 amplitude in $\frac{6}{2} = 3$ cm (1)

deduct (½) if no/wrong unit

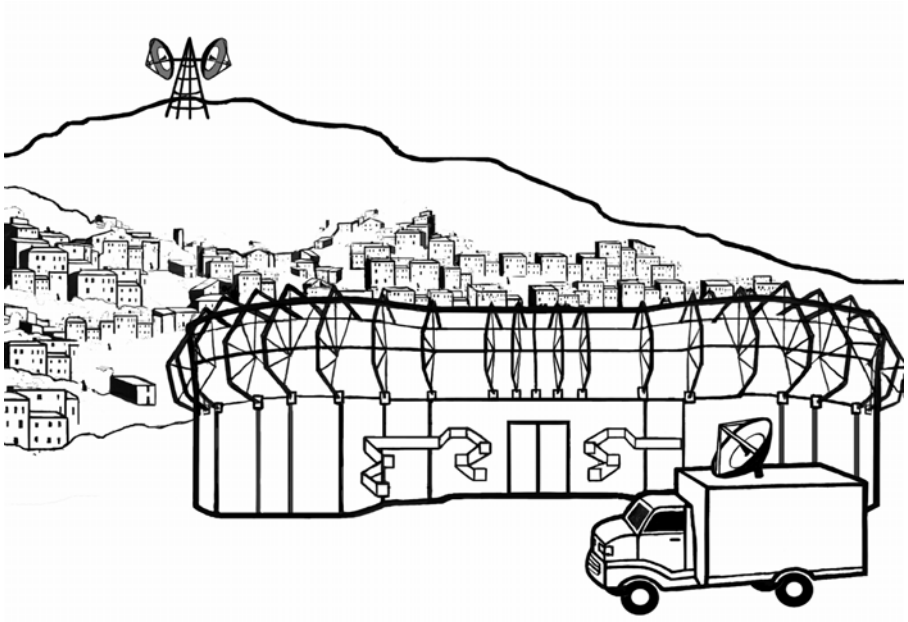
1

NOTES
if there is a clear arithmetic mistake then can award (½) eg $\frac{12}{2} = 3$ cm award (½) **if unit is <u>also</u> missing then 0 marks** **if v = f λ – wrong physics 0 marks**

	K&U	PS
Marks		

7. A football match is being broadcast live from Dundee. Signals from the football stadium are transmitted to a television studio in Glasgow via a relay station on top of a nearby hill.

At the relay station, a curved reflector is placed behind a detector of the television signals.



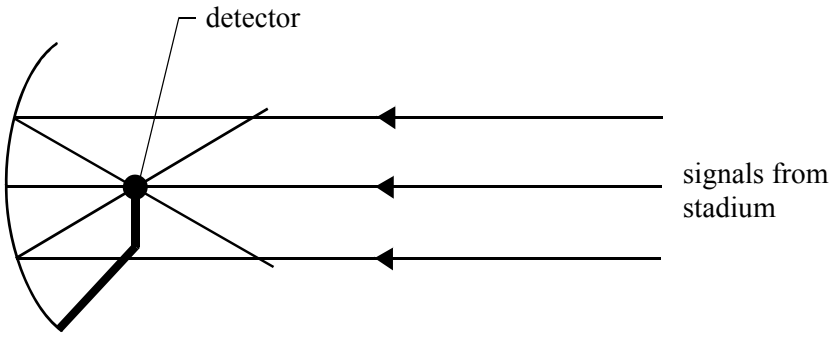
(a) (i) State the purpose of the curved reflector.

increases (amplitude of) received signal

OR

collects/gathers more signals **1**

(ii) Complete the diagram below to show the effect of the curved reflector on the signal at the relay station.



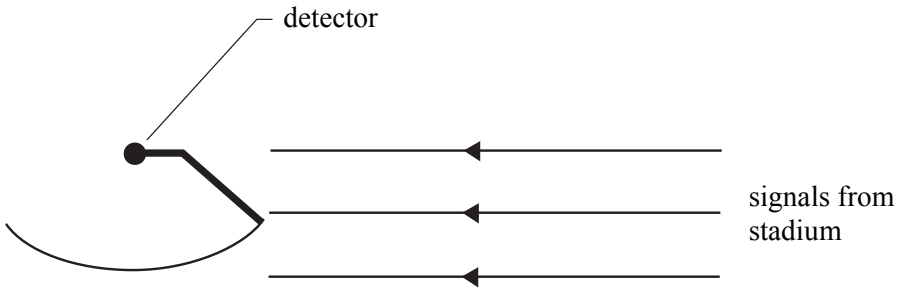
(1) for completing parallel signals

(1) for reflection through detector **2**

NOTES
Accept: focus signals to one point **look for indication of: "reflection" on to detector** **"concentration"** **eg to concentrate/focus signal on to detector** **to give a more powerful signal** **NOT: simply 'bouncing' or 'reflecting' – only if goes on to mention detector** **Do NOT accept:** • **'to amplify the signal'** • **give stronger signal** • **provides a wide surface area** • **gather more waves** **rays need not continue beyond detector after reflection** **must show completion of at least 2 rays** **further direction arrows not required**

	K&U	PS
Marks		

(b) During the match, strong winds cause the reflector to move to a new position as shown.



State the effect this has on the signal received at the detector.

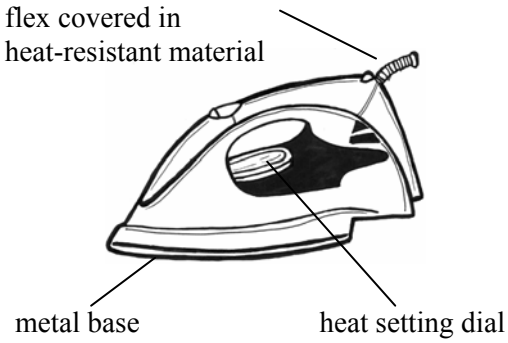
(amplitude of) signal is reduced **1**

NOTES
Accept: • **signals will not be reflected to a point** • **weaker signal received** • **not so strong signal** **Do NOT accept:** • **smaller signal** • **less signal** • **lower signal** • **only one signal is received**

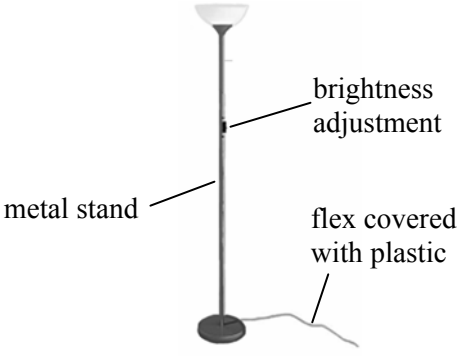
		K&U	PS
	Marks		

8. Two household electrical appliances, a 1500 watt electric iron and a 300 watt uplighter lamp, are shown below.

electric iron



uplighter lamp



(a) The brightness of the uplighter lamp can be changed.

State an electrical component that could be used to change the brightness of the uplighter lamp.

variable resistor/resistance **1**

(b) Explain why the flex for the iron is covered with a heat-resistant material.

heat from iron could melt flex **1**

NOTES

Accept:
- **rheostat**
- **potentiometer**
- **thyristor**
- **'iron could melt flex'**

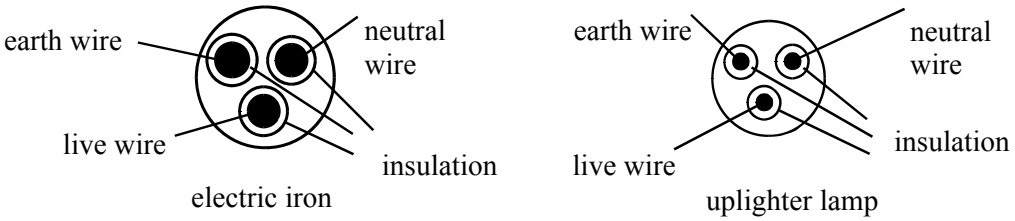
Do not accept:
- **'dimmer switch'**
- **resistor**

Answer should indicate that heat from the iron will heat/melt flex/damage flex

Do not accept:
- **dangerous**
- **danger of shock**
- **safer**

	K&U	PS
Marks		

(c) A cross-section of the flex for each appliance is shown.



(i) State the colour of the insulation of the live wire.

brown (do not accept red) **1**

(ii) State the purpose of the earth wire.

safety device OR prevents shock/electrocution **1**

(iii) Explain why the wires in the flex for the electric iron are thicker than those for the uplighter lamp.

(requires) more current OR (requires) more power OR more energy **1**

NOTES

(ii) the answer should be 'qualified' with an indication of a fault

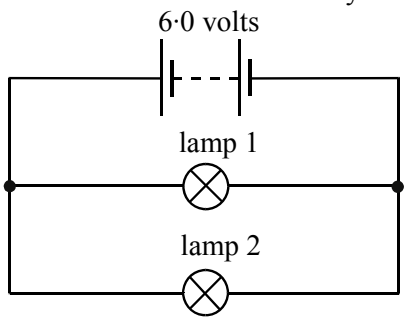
eg
- **takes current away from appliance if there is a fault**
- **to blow a fuse if there is a fault (not 'to blow a fuse' alone)**

accept: **stops** { **object** / **casing** } **from** { **becoming** / **staying** } **live**

not:
- **more electricity**
- **thicker insulation**
- **more watts**
- **more wattage**

		K&U	PS
	Marks		

9. Two identical lamps are connected to a 6·0 volt battery as shown in circuit 1.



circuit 1

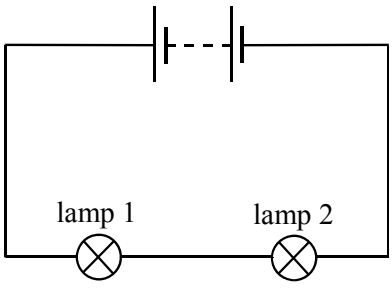
(a) The battery supplies a current of 0·40 ampere to the circuit.

Complete the following table to show the current in each lamp and the voltage across each lamp.

	Lamp 1	**Lamp 2**
Current (amperes)	**0·2**	**0·2**
Voltage (volts)	**6**	**6**

(1) for each correct row
no (½) marks **2**

(b) The two lamps are now connected as shown in circuit 2.



circuit 2

State the voltage of the battery required to light the lamps with the same brightness as in circuit 1.

12 V (1) or (0) unit required **1**

(c) In which of the two circuits, circuit 1 or circuit 2, would lamp 2 still be on when lamp 1 is removed?

circuit 1 **1**

NOTES

Question No 9

	K&U	PS
Marks		

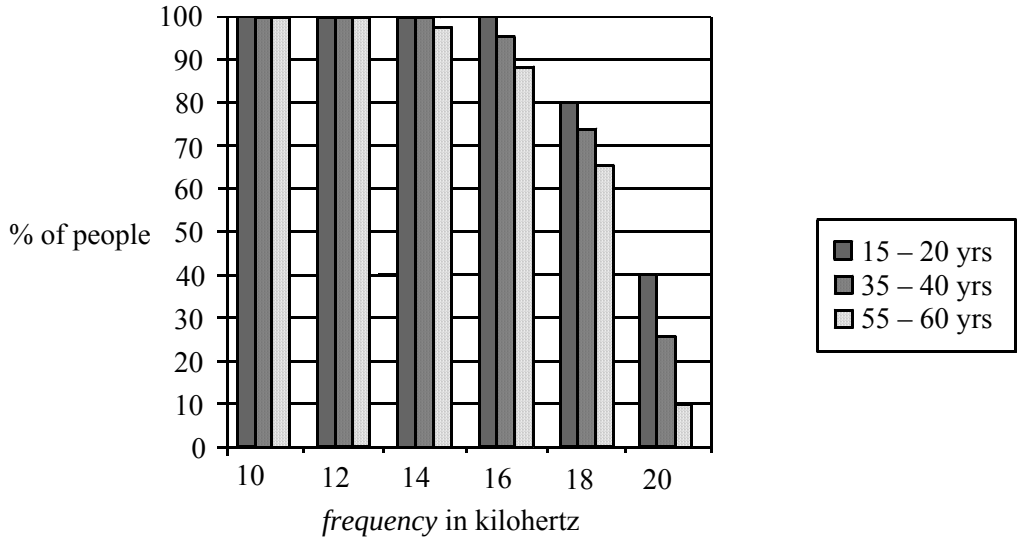
10. (a) A drummer in a rock band is exposed to sound levels of up to 110 decibels.

Explain why ear protectors are used to reduce the sound level experienced by the drummer.

(sound levels above 80 dB) can damage hearing **1**

(b) A medical researcher is measuring the upper range of hearing of people in different age groups.

The bar graph below shows the frequencies of sound detected by these people.



(i) State **two** conclusions which can be made from this bar graph about the hearing of different age groups.

See Notes for Question No 10

2

(ii) What is the name given to sound frequencies greater than 20 kilohertz?

ultrasound/ultrasonic **1**

NOTES

(a) **Do not accept 'dangerous' alone – must be qualified**
eg danger } to hearing/eardrum but not: 'damage to ears'
damage }

Accept: can cause deafness/hearing loss

(b) **(i)** **Accept 2 sensible <u>independent</u> answers based on these 3 points:**

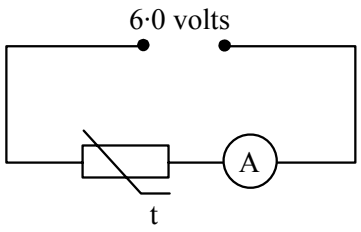
- **'all can hear sound frequencies up to 10 or 12 KHz'**
- **'hearing loss increases with age'**
- **'hearing loss increases with frequency'**

Accept converses eg: 'not everyone can hear above 12 KHz'
Accept: 15-20 year olds have <u>better</u> hearing than 35-40 year olds
Do not accept: no one hears above 20 KHz
Do not accept: simple quotation of numbers without a comparison

Watch out for a 'restating' of the first reason.

	K&U	PS
Marks		

11. (a) A thermistor is connected to a 6·0 volt supply in circuit 1. The table gives some information about the thermistor.



circuit 1

temperature (degrees Celsius)	*resistance* (ohms)
20	1000
30	600
40	400

Calculate the reading on the ammeter when the thermistor is placed in a beaker of water at 40 degrees celsius.

Space for working and answer

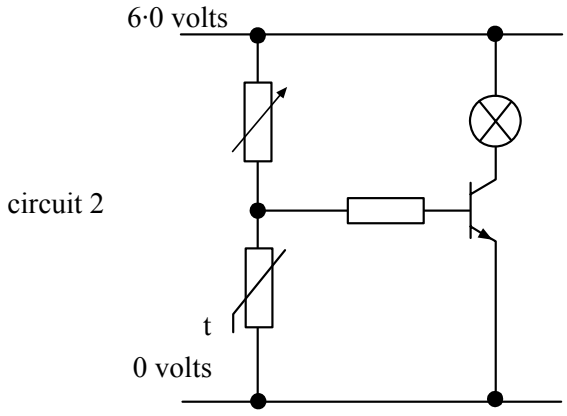
$\mathbf{I = \frac{V}{R}}$ **(½)** **Select R = 400(Ω) (1)**

$\mathbf{= \frac{6}{400}}$ **(½)**

= 0·015 A **(1)**

3

(b) The thermistor is now connected as shown in circuit 2 and placed in a tropical fish tank. The circuit provides a warning when the temperature of the water in the tank becomes too low.



circuit 2

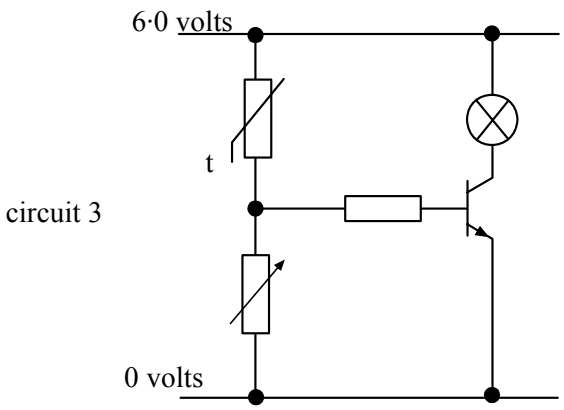
(i) What is the purpose of the transistor in circuit 2?

(electronic) switch **1**

NOTES
If any other value for R from table is selected then can get (2) max (but lose selection mark) **any other value for R – max (½) for formula** **600 Ω → 0·01 A** **1000 Ω → 0·006 A** **Accept: 'turns on when voltage > 0·7 V'** **Do not accept:** • **'to control the flow of current'** • **'to amplify current'** • **'activate'**

	K&U	PS
Marks		

(ii) The same components are used to construct circuit 3.



State how the operation of circuit 3 differs from the operation of circuit 2.

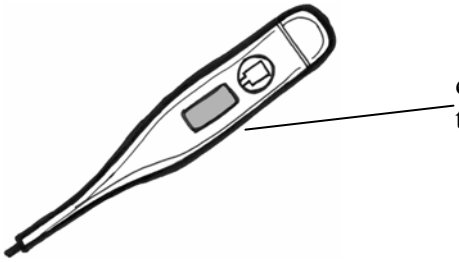
warning provided
OR lamp lights } **when water temperature becomes too high**
OR lamp indicates

1

NOTES
Accept: • **lamp lights when water too hot** • **'works in an opposite way' (shows understanding)** • **'light/lamp will go off when T is too low'** • **watch out for use of 'setting off' to mean 'to switch on'**

	K&U	PS
Marks		

12. (a) A nurse uses a clinical thermometer to measure the body temperature of a patient. The temperature of the patient is 39 degrees celsius.



(i) Give **two** reasons why a clinical thermometer is used instead of an ordinary thermometer when measuring the body temperature of the patient.

Any two correct (1) each:

more accurate reading

OR smaller range OR reading remains constant (until reset) **2**

(ii) Why does the nurse conclude that the patient is unwell?

(patient's) temperature is above average or above normal **1**

(b) Radioactive sources are used in the treatment of many illnesses. The table below gives some properties of three radioactive sources used in medicine.

Name of Source	*Type of Source*	*Half-life of Source*
Radium – 226	Alpha	1600 years
Iodine – 131	Beta	8 days
Technetium – 99	Gamma	6 hours

(i) One type of treatment requires a source that produces high ionisation.

Which source should be used?

radium (-226) OR alpha OR 1600 years **1**

(ii) Which source would be most suitable for use in diagnostic tests where a tracer is injected into the body?

technetium (-99) OR gamma OR 6 hours **1**

(iii) Which source should not be stored in an aluminium box for safety reasons?

technetium (-99) OR gamma OR 6 hours **1**

NOTES

(i) **Accept:**

- **more sensitive**
- **narrower column**
- **has a kink**
- **reads to more** { **(sig) figs** / **dec places**

Do not accept:

- **'Δ shape'**
- **'magnifies scale'**
- **'smaller scale'**
- **'easier to use'**
- **'quicker'**
- **'less dangerous'**

(ii) **Accept:**

- **'the temperature is above 37°C/(too) high'**
- **if candidate states value of normal temperature is 36°C (or other) then can <u>still</u> get mark by making comparison with 39°C**

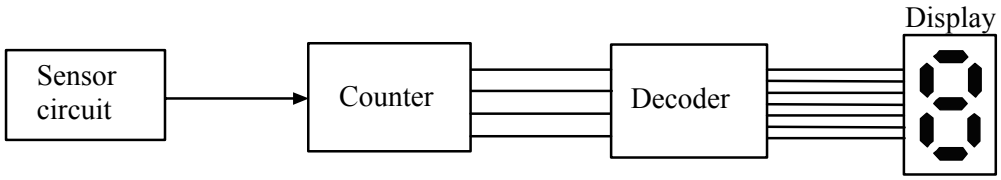
(b) **If 2 different answers given eg radium (-226), Beta – 0 marks**

	K&U	PS
Marks		

13. An electronic system is designed to count the number of vehicles that enter a car park.

When a vehicle enters the car park it cuts through a beam of light and a sensor circuit produces a digital pulse. The number of pulses produced by the sensor circuit is then counted and decoded before being displayed. The display consists of a number of illuminated sections.

A diagram for part of this system is shown.



(a) (i) Select a suitable device **from the list below** to be used as an input for the sensor circuit.

LDR **thermistor** **microphone** **capacitor**

LDR **1**

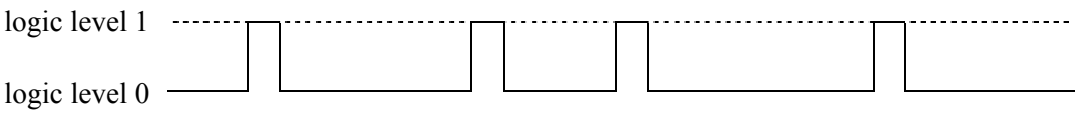
(ii) Complete the sentence below by circling the correct answer.

The output of the counter is analogue / **binary** / decimal **1**

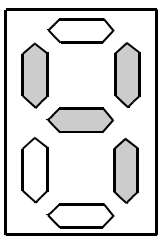
(iii) Name the device used to display the number of vehicles that enter the car park

seven-segment display **1**

(b) The counter is reset to zero. Over a period of time, the sensor circuit then produces the following signal.



On the diagram of the display below, shade in the sections that should be illuminated to show the number of vehicles that have entered the car park during this time.



1

NOTES

(iii) **Accept:**

- **LCD, array of LEDs**

Do not accept:

- **LED**
- **computer screen**

		K&U	PS
	Marks		

14. A walker wears a pedometer. A pedometer is an instrument that measures the distance walked by counting the number of steps taken. The walker measures the distance of one step as 0·8 metres, and enters it into the pedometer.

(a) The walker completes 9000 steps during a walk.

Calculate the distance travelled.

Space for working and answer

distance = number of steps × step length

= 9000 × 0·8

= 7200 m (1)
deduct (½) if no/wrong unit

1

(b) The walker completes his walk in 80 minutes.

What is the average speed of the walker in **metres per second**?

Space for working and answer

average speed = $\frac{\text{total distance}}{\text{total time}}$ (½)

= $\frac{7200}{80 \times 60}$ (½) + (½) for conversion to seconds

= 1·5 (m/s) (½)

2

(c) Give a reason why the distance measured by the pedometer may not be accurate.

step length may vary **1**

NOTES

if working <u>shown</u> then arith slip then can still get (½)
eg 9000 × 0·8 = 7000 m (½) but if also no/wrong unit – 0 marks
but (must be a clear arith error)

(b) **if no conversion into seconds the (1) max eg**

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}} \quad (½)$$

$$= \frac{7200}{80} \quad (½) \text{ stop}$$

$$= \text{- - - - - -}$$

if there is a wrong <u>attempted</u> conversion then unit error (-½)

(c) **Accept:**

- **pedometer may (be too sensitive/insensitive) measure too many/few steps**
- **if walker gets tired – must explain about step length**

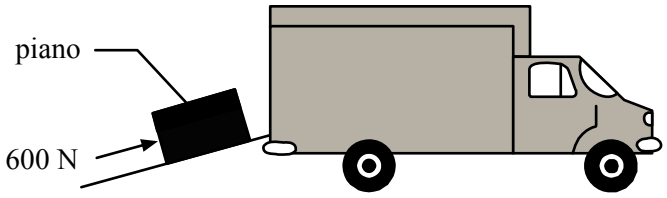
Do not accept:

- **battery running down**
- **'uphill/downhill' alone – must state effect on distance**

		K&U	PS
	Marks		

15. A piano of mass 250 kilograms is pushed up a ramp into a van by applying a constant force of 600 newtons as shown.

The ramp is 3 metres long and the van floor is 0·75 metres above the ground.



(a) (i) Calculate the weight of the piano.

Space for working and answer

W = mg (½)

= 250 × 10 (½)

= 2500 N (1)

2

(ii) What is the minimum force required to lift the piano vertically into the van?

2500 N deduct (½) if no/wrong unit **1**

(b) Calculate the work done pushing the piano up the ramp.

Space for working and answer

E_w = Fd (½)

= 600 × 3 (½)

= 1800 J (1)

2

(c) How can the force required to push the piano up the ramp be reduced?

Use trolley OR use rollers under piano OR lubricate piano wheels **1**

NOTES

Do not accept answers based on 'mgh' or 'weight × height'

(c) **Accept:**

- **make ramp longer**
- **lower ramp angle/steepness**
- **get lower lorry**
- **make floor less than 0·75 m high**
- **use pulley**
- **reduce friction**
- **lubricate (ramp)**

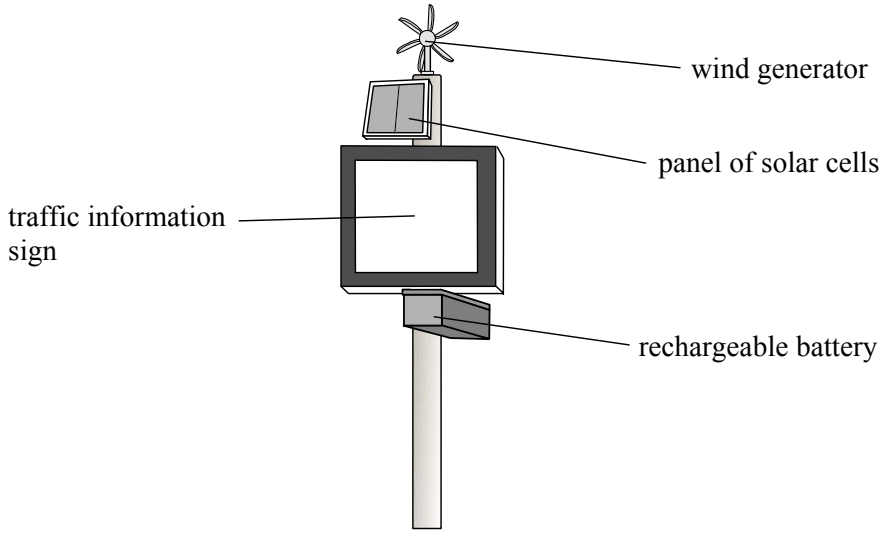
Do not accept:

- **use more people**

		K&U	PS
	Marks		

16. A traffic information sign is located in a remote area.

The sign is supplied with energy by both a panel of solar cells and a wind generator. The panel of solar cells and the wind generator are connected to a rechargeable battery.



(a) One square metre of solar cells can generate up to 80 watts.

The panel of solar cells has an area of 0·4 square metres.

(i) State the energy change that takes place in the solar cells.

light to electrical (energy) accept 'electric' not 'electricity' **1**

(ii) Calculate the maximum power produced by the panel of solar cells.

Space for working and answer

power = area × power per square metre

= 0·4 × 80

= 32 W (1)
deduct (½) if no/wrong unit

1

NOTES

Accept:

- **light – electrical (without arrow in correct order)** **NOT: heat → electrical**
- **$E_L \rightarrow E_E$**

if working shown then arith slip can still get (½) eg

= 0·4 × 80

= 30 W

(½) max

		Marks	K&U	PS

(b) The following table shows the power produced by the wind generator at different wind speeds.

wind speed (metres per second)	*power output of wind generator* (watts)
2	8
4	16
6	
8	32
10	40

(i) Suggest the power produced when the wind speed is 6 metres per second.

16 W < 24(W) < 32 W **accept any value within range** **1**

(ii) At a wind speed of 10 metres per second the voltage produced by the wind generator is 16 volts.

Calculate the current produced by the wind generator.

Space for working and answer

$$\mathbf{I = \frac{P}{V}} \quad \textbf{(½)}$$

$$\mathbf{= \frac{40}{16}} \quad \textbf{(½)}$$

$$\mathbf{= 2{\cdot}5\ A} \quad \textbf{(1)}$$

2

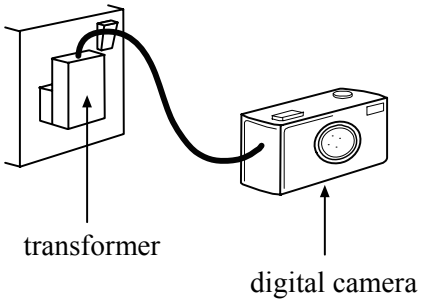
(c) Explain why a rechargeable battery is also required to supply energy to the traffic information sign.

it may not be windy, it may not be sunny (½) each answer **1**

NOTES
Accept correct answer in table **Single value only** **Unit not required but wrong unit deduct (½)** **Any other value of P than 40 W (½) max** **2 reasons required** **Accept alternatives eg 'calm day', 'night time', 'cloudy'**

	K&U	PS
Marks		

17. (a) A digital camera contains a rechargeable battery. The battery requires a voltage of 5·75 volts to be recharged. The battery is recharged using a transformer connected to the mains supply. The transformer is used to step down the 230 volt a.c. mains supply to 5·75 volts.



The transformer has 2000 turns on the primary coil.

(i) Calculate the number of turns on the secondary coil.

Space for working and answer

$$\frac{N_S}{N_P} = \frac{V_S}{V_P} \quad (½)$$

$$N_S = \frac{5 \cdot 75 \times 2000}{230} \quad (½)$$

$$= 50 \quad \textbf{(1) 'turns' not required}$$

2

(ii) Give **one** reason why a transformer cannot be used to charge the camera battery from a 12 volt d.c. car battery.

transformers only work with a.c. OR transformers do not work with d.c. (OR batteries) **1**

(b) Complete the following passage.

In the National Grid, **step-up** transformers are used to increase the 25000 volts from a power station to 132000 volts for transmission

This reduces **energy/power loss** in the transmission lines.

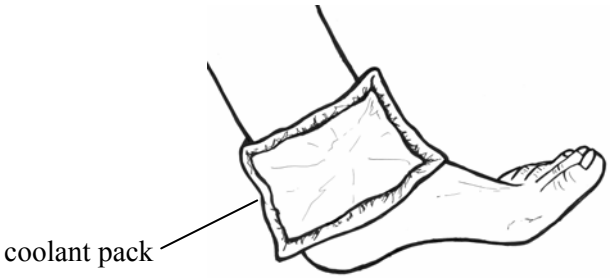
The voltage is then decreased to 11000 volts for industry and 230 volts for domestic use using **step-down** transformers.

(1) for each correct answer. **3**

NOTES
(i) unit penalty if unit is given (other than 'turns') **(ii) Do not accept:** • **battery must be ac** • **turns ratio wrong** • **'it is dc'** • **'would not work' alone – must include reason** **Accept:** • **current/heat/heat loss/overheating/voltage loss/I^2R loss** **Do not accept:** • **'current loss'**

	K&U	PS
Marks		

18. A coolant pack is used to treat an injured player at a hockey match.



Before use the coolant pack is stored in a refrigerator at 2 degrees celsius.

The coolant inside the pack changes state from liquid to solid.

The coolant has a melting point of 7 degrees celsius and a mass of 0·5 kilograms.

The coolant pack is removed from the refrigerator and placed on the injured ankle of the player.

(a) (i) Calculate the energy required to raise the temperature of the coolant pack from 2 degrees celsius to its melting point.

(specific heat capacity of coolant = 2100 joules per kilogram per degree celsius)

Space for working and answer

$\mathbf{E_H = cm\Delta T}$ **(½)**

$\mathbf{= 2100 \times 0 \cdot 5 \times 5}$ **(½)**

= 5250 J (1)

ΔT = 5°C (1)
attempted subtraction

if ΔT = 2° or 7° then (½) max

3

(ii) Where does most of the energy required to raise the temperature of the coolant pack come from?

player's ankle **1**

(b) Having reached its melting point the coolant pack then remains at the same temperature for 15 minutes.

What happens to the coolant during this time?

(coolant) changing state (or melting) **1**

(c) One of the other players suggests insulating the coolant pack and ankle with a towel.

Why should this be done?

to reduce heat transfer from surroundings NOT to reduce heat transfer <u>to</u> surroundings **1**

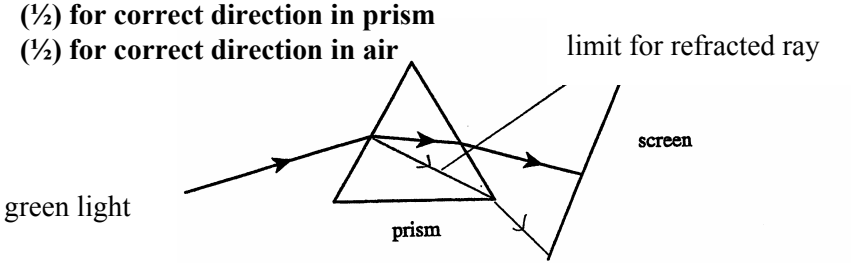
NOTES
(i) **If separate calculations using** $\Delta T = 2$ / $\Delta T = 7$ **followed by subtraction then (½) max for formula**
(ii) **Accept:** • **body** • **from player** **Do not accept:** • **'body temperature'**
(b) **Accept:** • **turning/changing into a liquid** • **liquifying** **Do not accept:** • **liquidising** • **thawing**
(c) **Accept:** • **so pack stays cold for longer** • **to stop coolant melting too fast** **Do not accept:** • **if answer implies towel is between ankle/pack** • **to stop heat flowing to pack – too ambiguous**

			Marks	K&U	PS
19.	Read the following passage about a space mission to the moons of Jupiter. The spacecraft will use a new kind of engine called an ion drive. The ion drive will propel the spacecraft away from Earth on its journey to the moons of Jupiter, although for much of the journey the engine will be switched off. The spacecraft will first visit the moon Callisto. Callisto is only slightly smaller than the planet Mercury. Next, the spacecraft will visit Ganymede, the largest moon in the Solar System, before travelling on to Europa. The radiation around Europa is so intense that the spacecraft will not be able to operate for long before becoming damaged beyond repair. The spacecraft will eventually burn up in the atmosphere of Jupiter.				
(a)	(i)	Name one object, **mentioned in the passage**, which orbits a planet. **Callisto OR Ganymede OR Europa OR moon OR 'the moon' OR 'moons'**	**1**		
	(ii)	State what is meant by the term Solar System. **a star/the sun and its (orbiting) planets**	**1**		
(b)	(i)	The ion drive engine exerts a backward force on small particles called ions. Explain how the ion drive engine is propelled forwards. **ions exert a forward force on (ion drive) engine**	**1**		
	(ii)	The mass of the spacecraft is 1200 kilograms and the thrust produced by the engine is 3 newtons. Calculate the maximum acceleration produced by the ion drive engine. *Space for working and answer* **a = $\frac{F}{M}$ (½)** **= $\frac{3}{1200}$ (½)** **= 0·0025 metres per second per second (1)**	**2**		
(c)		State why the ion drive engine need not be kept on for most of the journey from Earth to Jupiter. **there are no frictional forces in space**	**1**		

NOTES
NOT: spacecraft **look for 'ions' mentioned in answer** **Not: 'Newton 3' alone – must be explained** **(c) Accept:** • **'no air friction'** • **'no air resistance'** **Do not accept:** • **answers based on gravity/no gravity** • **'no unbalanced forces'**

			Marks	K&U	PS
20.	(a)	A ray of green light strikes a triangular prism as shown.			

(½) for correct direction in prism
(½) for correct direction in air



	(i)	Complete the diagram to show the path of the ray of green light as it passes through the prism and on to the screen.	**1**		
	(ii)	The green light is now replaced by white light Describe what is now observed on the screen			
		(visible) spectrum (or (visible) colours (plural))	**1**		
	(iii)	State **one** colour which has a longer wavelength than green light.			
		any correct colour/red/orange/yellow	**1**		
	(b)	Light from a star produces a line spectrum. What information is obtained about the star from this spectrum?			
		information about atoms (or elements) present OR age of star OR distance to star OR speed of star OR type of star OR temperature of star	**1**		

[END OF MARKING INSTRUCTIONS]

NOTES

direction arrows not necessary
refracted ray in prism – not beyond apex of Δ

(ii) **Accept:**
- **rainbow (colours)**
- **ROYGBIV (or equivalent)**

Do not accept:
- **colour**
- **RGB**

(b) **Accept:**
- **gases (identified)**
- **chemicals (identified)**
- **'what it is made of'**

Do not accept:
- **position**
- **radiation**