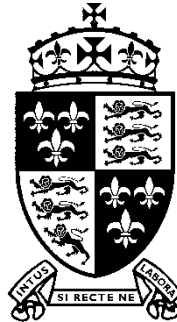


First name:

Surname:

Current School:



SHREWSBURY SCHOOL

SIXTH FORM ENTRANCE EXAMINATION 2016

PHYSICS

(50 marks)

(1 hour)

Instructions to candidates:

Attempt all questions.

Please tear off the Multiple Choice Answer sheet at the back of the exam paper before you start.

Spend about 20 minutes on section A and 40 minutes on section B.

Assume $g = 10 \text{ m/s}^2$

Section A: Multiple Choice (Spend about 20 min. on this section.)

Question 1:

This information was attached to an electric washing machine:

230V	50Hz
2 kW	

The correct size of fuse which should be fitted is

- A** 3 A
- B** 5 A
- C** 10 A
- D** 13 A

Question 2:

Which line in the table below gives the correct units for all of the physical quantities?

	Pressure	Moment	Velocity	Energy
A	Pa	kgm/s	m/s	N
B	Pa	Nm	m/s	J
C	N	N/m	m/s	J
D	W	kgm/s	m/s ²	N

Question 3:

The wavelength of red light is 700 nm and the wavelength of violet light is 300 nm.

What is the likely value of the wavelength of yellow light?

- A** 250 nm
- B** 350 nm
- C** 600 nm
- D** 750 nm

Question 4:

Which of the following statements about sound is **not** true?

- A can be refracted by layers of air
- B can be reflected
- C can travel through solid substances
- D is a transverse wave

Question 5:

Which of these is used for sterilising the instruments used in operating theatres?

- A infra-red waves
- B radio waves
- C gamma rays
- D X-rays

Question 6:

The half life of a radioactive isotope is 12 hours. What fraction of the original isotope remains after 48 hours?

- A $1/4$
- B $1/16$
- C $1/8$
- D $1/6$

Question 7:

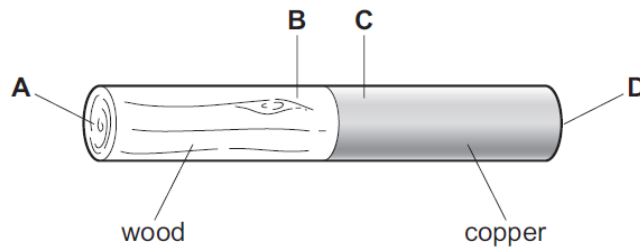
A sledge is pulled a distance of 5 km with an average force of 50 N. How much work is done?

- A 250 J
- B 100 J
- C 250 kJ
- D 100 KJ

Question 8:

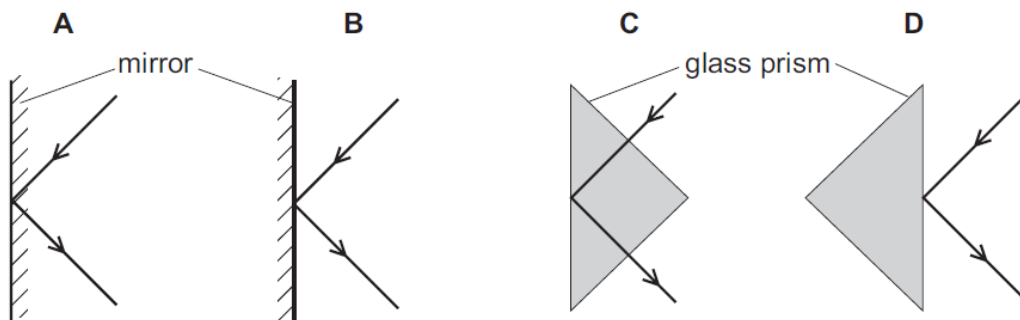
A rod is made up of copper and wood joined together.

After the rod is heated at the join in the centre for about a minute, where would the lowest temperature be?



Question 9:

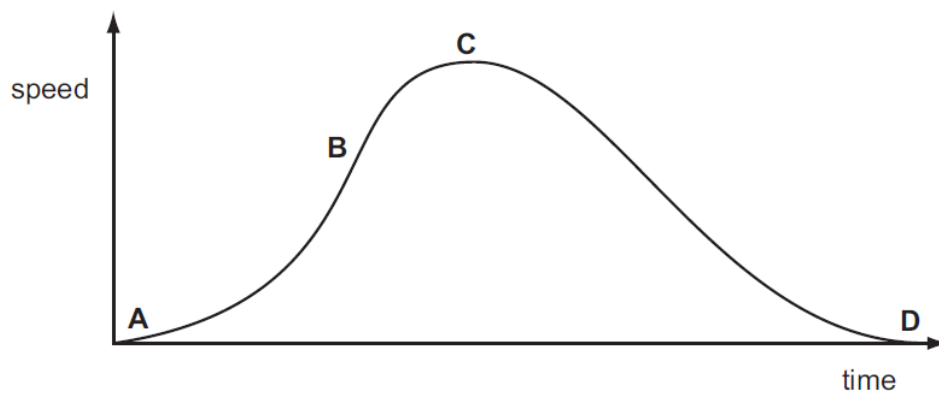
Which diagram shows total internal reflection of light?



Question 10:

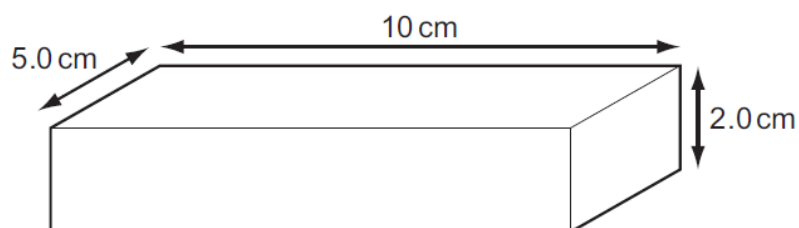
The speed-time graph shown is for a bus travelling between stops.

Where on the graph is the acceleration of the bus the greatest?



Question 11:

The diagram shows a rectangular metal block measuring 10 cm × 5.0 cm × 2.0 cm.



Its mass is 250 g.

What is the density of the metal?

- A** 0.20 g/cm³ **B** 0.40 g/cm³ **C** 2.5 g/cm³ **D** 5.0 g/cm³

Question 12:

A ship sends a pulse of ultrasound vertically downwards to the sea bed. An echo is heard 0.4 seconds later.

If the speed of sound in water is 1200 m/s, how deep is the water below the ship ?

- A** 240m **B** 480m **C** 1500m **D** 3000m

Question 13:

A radioactive source emits alpha, beta and gamma radiation.

Which row in the table is correct ?

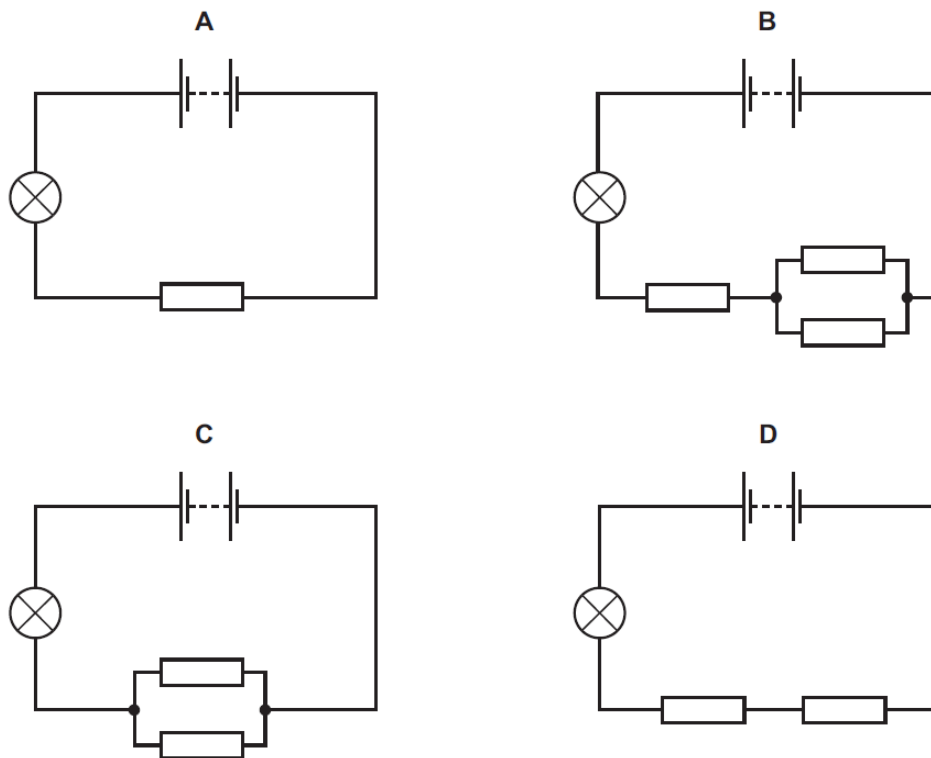
Deflected by a magnetic field ?			
	Alpha	Beta	Gamma
A	No	No	Yes
B	Yes	Yes	No
C	No	Yes	No
D	Yes	Yes	Yes

Question 14:

A lamp is connected in four circuits in turn, each using identical batteries.

The resistors are all identical.

In which circuit will the lamp be brightest?



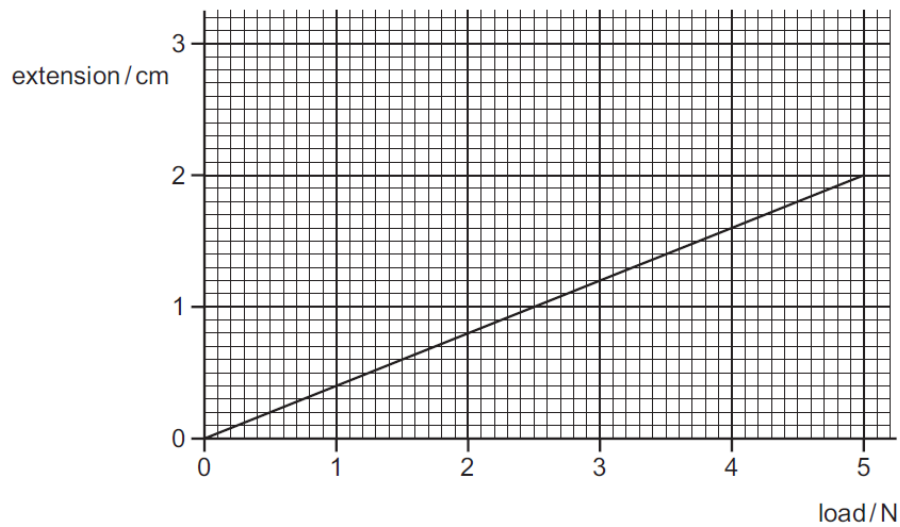
Question 15:

A glass rod becomes positively charged when rubbed with a piece of wool. Which one of the following statements is TRUE ?

- A** Electrons move from the glass rod to the wool.
- B** Protons move from the wool to the glass rod.
- C** Electrons move from the wool to the glass rod.
- D** Protons move from the glass rod to the wool.

Question 16:

The extension/load graph for a spring is shown. The unloaded length of the spring is 15.0 cm.



When an object of unknown weight is hung on the spring, the length of the spring is 16.4 cm.

What is the weight of the object?

- A** 0.55 N **B** 0.67 N **C** 3.5 N **D** 4.1 N

Question 17:

Which energy resource is used to generate electricity without using any moving parts?

- A** geothermal
B hydroelectric
C solar
D nuclear

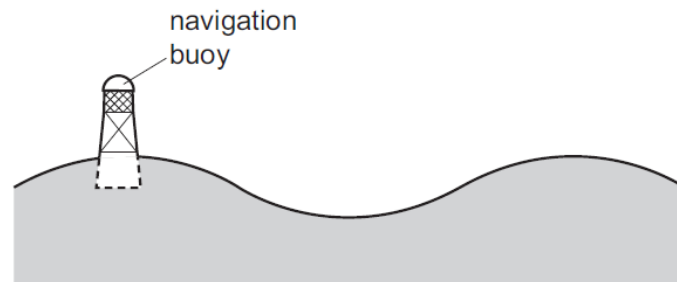
Question 18:

What is an advantage of transmitting electricity at a high voltage?

- A** It is faster.
B It is safer.
C Less energy is wasted.
D Less equipment is needed.

Question 19:

A navigation buoy floating on the sea oscillates up and down as a wave passes.



In exactly two minutes, six complete wavelengths pass the buoy.

What is the frequency of the waves?

- A** 0.050 Hz **B** 0.33 Hz **C** 3.0 Hz **D** 20 Hz

Question 20:

A car moves along a level road.

The diagram shows all of the horizontal forces acting on the car.



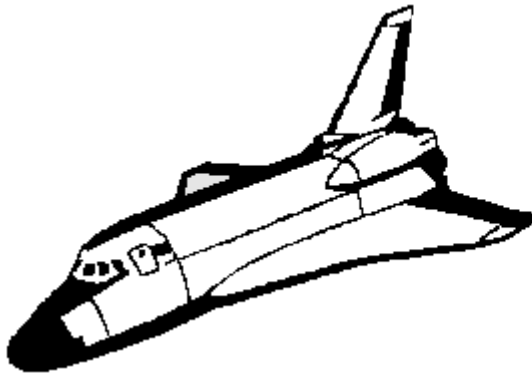
Which statement is correct?

- A** The car is slowing down.
B The car is speeding up.
C The car is moving at a constant speed.
D The car is moving backwards.

Section B

Question 21:

From 1981 – 2011 NASA operated the Space Shuttle program. The diagram shows an orbiter, the reusable part of a space shuttle. The data refers to a typical flight.



Orbiter data	
Mass	78 000 kg
Orbital speed	7.5 km/s
Orbital altitude	200 km
Landing speed	100 m/s
Flight time	7 days

- (a) (i) What name is given to the force which keeps the orbiter in orbit around the Earth?

.....

(1)

- (ii) Use the following equation to calculate the kinetic energy, in joules, of the orbiter while it is in orbit.

$$\text{kinetic energy} = \frac{1}{2} mv^2$$

.....

.....

$$\text{Kinetic energy} = \text{.....} \text{ joules}$$

(2)

- (iii) What happens to most of this kinetic energy as the orbiter re-enters the Earth's atmosphere?

.....

.....

(1)

(b) After touchdown the orbiter decelerates uniformly coming to a halt in 50 s.

(i) Give the equation that links acceleration, time and velocity.

.....

(1)

(ii) Calculate the deceleration of the orbiter. Show clearly how you work out your answer and give the unit.

.....

.....

Deceleration =

(2)

(c) (i) Give the equation that links acceleration, force and mass.

.....

(1)

(ii) Calculate, in newtons, the force needed to bring the orbiter to a halt. Show clearly how you work out your answer.

.....

.....

Force = newtons

(1)

(Total 9 marks)

Question 22:

Nuclear fission and nuclear fusion are two processes that release energy.

- (a) (i) Use the correct answer from the box to complete each sentence.

Geiger counter	nuclear reactor	star
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Nuclear fission takes place within a

Nuclear fusion takes place within a

(2)

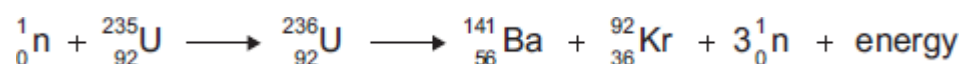
- (ii) State **one** way in which the process of nuclear fusion differs from the process of nuclear fission.

.....

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(1)

- (b) The following nuclear equation represents the fission of uranium-235 (U-235).



Chemical symbols:

Ba - barium

Kr – krypton

- (i) Use the information in the equation to describe the process of nuclear fission.

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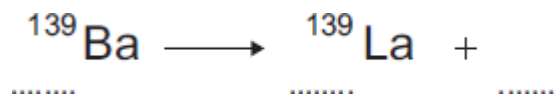
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(4)

- (ii) An isotope of barium is Ba-139.
Ba-139 decays by beta decay to lanthanum-139 (La-139).

Complete the nuclear equation that represents the decay of Ba-139 to La-139.



(3)

(Total 10 marks)

Question 23:

Electrical circuits have resistance.

- (a) Draw a ring around the correct answer in the box below to complete the following sentence.

When the resistance of a circuit increases, the current in the circuit

decreases.
increases.
stays the same.

(1)

(b) Use the correct answer from the box below to complete each sentence.

a filament bulb	an LED	an LDR
------------------------	---------------	---------------

An electrical component which has a resistance that increases as the temperature increases is

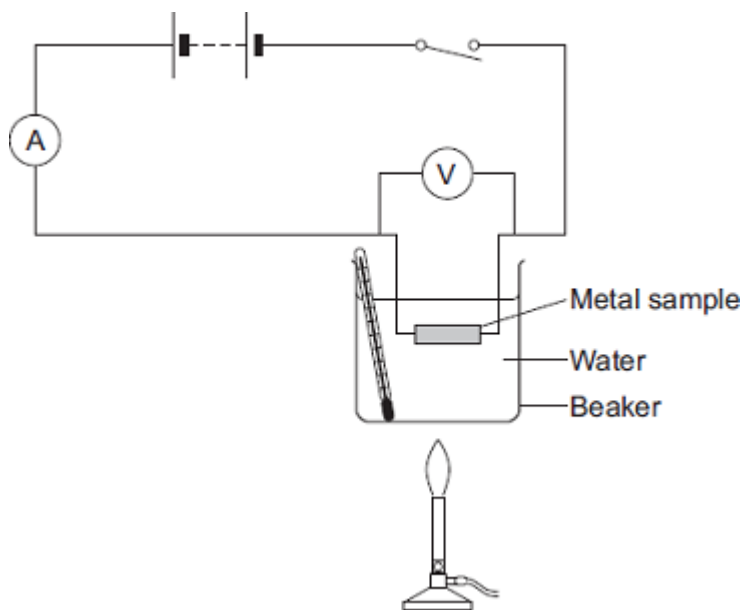
An electrical component which emits light only when a current flows through it

in the forward direction is

(2)

(c) When some metals are heated the resistance of the metal changes.

The equipment for investigating how the resistance of a metal changes when it is heated is shown in the diagram.



Describe an investigation a student could do to find how the resistance of a metal sample varies with temperature. The student uses the equipment shown.

Include in your answer:

- how the student should use the equipment
- the measurements the student should make
- how the student should use these measurements to determine the resistance
- how to make sure the results are valid.

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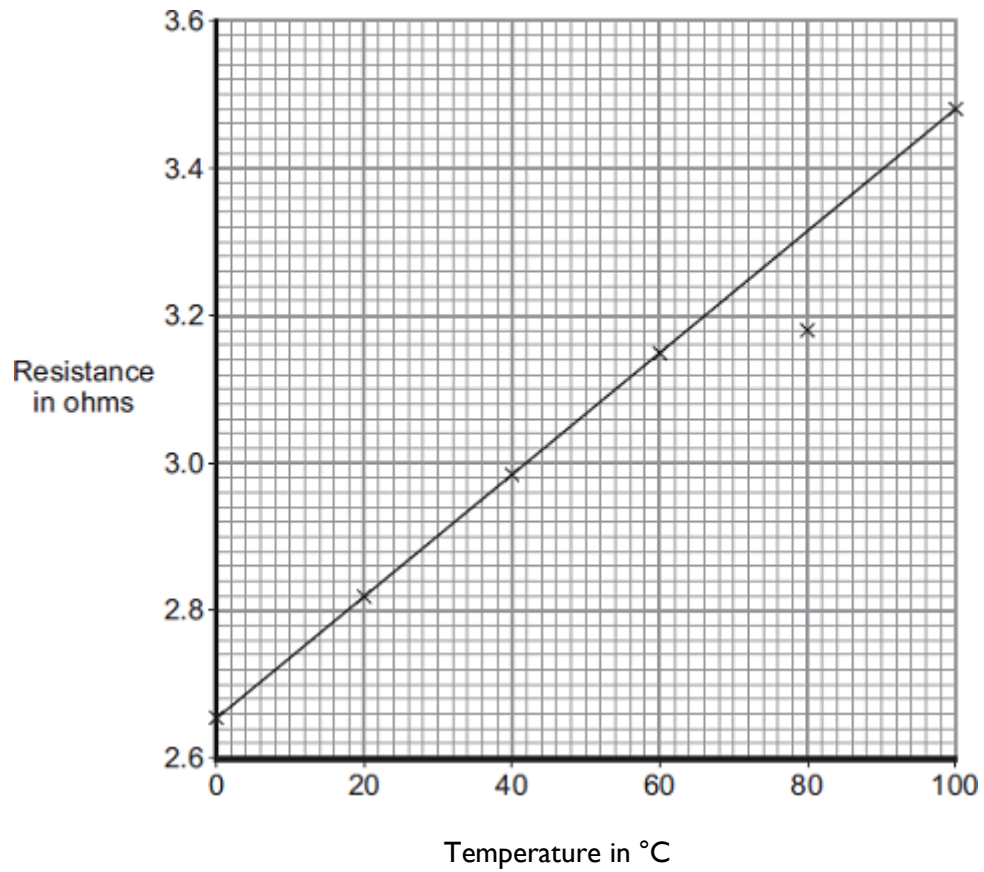
(6)

(d) The table on the next page shows some data for samples of four metals **P**, **Q**, **R** and **S**.

The metal samples all had the same cross-sectional area and were the same length.

Metal sample	Resistance at 0°C in ohms	Resistance at 100°C in ohms
P	4.05	5.67
Q	2.65	3.48
R	6.0	9.17
S	1.70	2.23

A graph of the results for one of the metal samples is shown.



(i) Which metal sample gives the largest change in resistance between 0°C and 100°C ?

(1)

(ii) Which metal sample has the data shown in the graph?

(1)

(Total 11 marks)

END OF QUESTION PAPER

NAME:

Multiple Choice Answer Sheet

For each question **circle** just one answer.

- | | | | | |
|-------------|----------|----------|----------|----------|
| Q.1 | A | B | C | D |
| Q.2 | A | B | C | D |
| Q.3 | A | B | C | D |
| Q.4 | A | B | C | D |
| Q.5 | A | B | C | D |
| Q.6 | A | B | C | D |
| Q.7 | A | B | C | D |
| Q.8 | A | B | C | D |
| Q.9 | A | B | C | D |
| Q.10 | A | B | C | D |
| Q.11 | A | B | C | D |
| Q.12 | A | B | C | D |
| Q.13 | A | B | C | D |
| Q.14 | A | B | C | D |
| Q.15 | A | B | C | D |
| Q.16 | A | B | C | D |
| Q.17 | A | B | C | D |
| Q.18 | A | B | C | D |
| Q.19 | A | B | C | D |
| Q.20 | A | B | C | D |