

Candidate Name

Candidate Number

Centre Name

Centre Number


**Paper 2:**

**Sample paper**

(2 hours)

It is necessary to respond on the answer sheets provided alongside this question paper. Additionally, you must have a soft pencil (preferably of type B or HB), a clean eraser and a dark blue or black pen.

**INSTRUCTIONS:**

- You must write your name, candidate number, centre name and centre number on the answer sheets in the designated spaces.
- Objective section consists of 25 questions, and it is essential that you attempt all of them.
- Each question has four options labelled A, B, C, and D. Select the option that you think is correct. Mark it on the multiple choice answer sheet using a soft pencil.
- Attempt all the questions from subjective section using a dark blue or black pen.
- It is important to follow the instructions provided on the answer sheets.
- Do not use correction fluid.
- Avoid writing on any bar codes.
- You are allowed to use a calculator if needed.

**INFORMATION:**

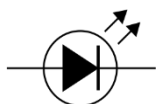
- This paper has a total of 100 marks.
- In objective section there are 25 questions, each carries one mark. There is no negative marking for incorrect responses.
- Subjective section comprises of 75 marks
- The number of marks assigned for every question or its parts is indicated within brackets [ ].
- Rough work must be completed on this question paper.

**OBJECTIVE SECTION:**

**[Total 25 marks]**

1 – [1]

Which electrical component is denoted by this symbol?



- A) Lamp
- B) LED
- C) Diode
- D) LDR

2 – [1]

An electromagnet is constructed by wrapping a current carrying wire around a core. What material could the core of the electromagnet be made from?

- A) Carbon
- B) Steel
- C) Iron
- D) Plastic

3 – [1]

Which of the following surfaces has the highest rate of heat loss?

- A) Black and Shiny
- B) White and Shiny
- C) Black and Matt
- D) White and Matt

4 – [1]

An 'Isotope' of carbon has:

	Electrons	Neutrons	Protons
A	Different	Same	Different
B	Same	Different	Same
C	Same	Different	Different
D	Different	Different	Same

- A)
- B)
- C)
- D)

5 – [1]

A potential difference of 12 mV is placed across a 3 k $\Omega$  resistor. What current flows through the resistor?

- A) 4 A
- B) 4 mA
- C) 4  $\mu$ A
- D) 4 nA

6 – [1]

Which method of heat transfer is due to high energy particles leaving the system?

- A) Convection
- B) Radiation
- C) Conduction
- D) Evaporation

7 – [1]

What is the domestic electricity supply in the UK?

- A) A.C. at 60 Hz, equivalent to 120V D.C.
- B) A.C. at 60 Hz, equivalent to 230V D.C.
- C) A.C. at 50 Hz, equivalent to 120V D.C.
- D) A.C. at 50 Hz, equivalent to 230V D.C.

8 – [1]

What effect does a Step-Down Transformer have on the input potential difference and current?

- A) Reduces the current and increases the current
- B) Reduces the p.d. and increases the current
- C) Reduces the current and the p.d. stays the same
- D) Reduces the p.d. and the current stays the same

9 – [1]

A metal cylinder has a length of 0.65 m and a diameter of 0.03 m has a mass of 4.1 kg. What is the density of the metal?

- A) 8900 kg/m<sup>3</sup>
- B) 6300 kg/m<sup>3</sup>
- C) 2200 kg/m<sup>3</sup>
- D) 1500 kg/m<sup>3</sup>

10 – Nuclear, Hard [1]

A machine determines the thickness of a sheet of metal using a radioactive source and a detector. What properties should the source have?

- A) Alpha source with a short half-life.
- B) Beta source with a long half-life.
- C) Gamma source with a long half-life.
- D) Beta source with a short half-life.

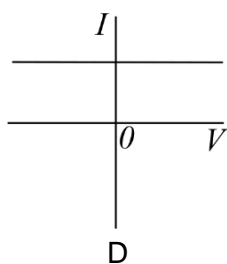
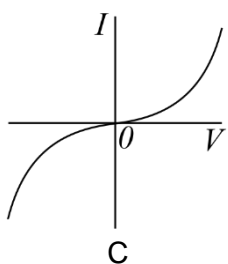
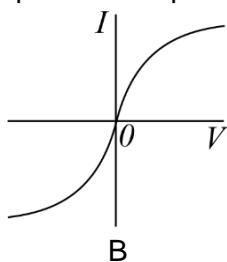
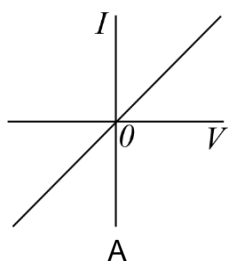
11 – [1]

The gradient of a graph is:

- A) the point the line crosses the  $x$ -axis.
- B) the point the line crosses the  $y$ -axis.
- C) the change in  $x$  divided by the change in  $y$ .
- D) the change in  $y$  divided by the change in  $x$ .

12– Electricity, Medium, [1]

Which of these is the I-V graph for a lamp?



- A)
- B)
- C)
- D)

13– [1]

Which of the following changes will **not** increase the magnetic field strength of a solenoid?

- A) Adding an iron core
- B) Increasing the diameter of the wire
- C) Increasing the resistance of the wire
- D) Increasing the number of turns

14 – [1]

A radioactive source has an activity of 252 Bq at the start of an experiment. After 20 minutes the activity has dropped to 63 Bq.  
What is the half-life of the source?

- A) 5 minutes
- B) 10 minutes
- C) 8 minutes
- D) 12 minutes

15 – [1]

A transformer is a device for changing the voltage of an alternating current. The following statements describe how it works:

- 1) Which induces an alternating magnetic field inside the coil
- 2) Causing an alternating magnetic field inside the secondary coil
- 3) The iron core magnetises and demagnetises quickly
- 4) Which induces an alternating current in the secondary coil
- 5) An alternating current flows through the primary coil
- 6) The ratio of the primary and secondary potential differences is the same as the ratio of the number of turns on the primary and secondary coils

What is the correct order of the statements?

- A)  $5 \rightarrow 1 \rightarrow 4 \rightarrow 2 \rightarrow 3 \rightarrow 6$
- B)  $5 \rightarrow 1 \rightarrow 3 \rightarrow 2 \rightarrow 4 \rightarrow 6$
- C)  $5 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 6$
- D)  $5 \rightarrow 2 \rightarrow 3 \rightarrow 1 \rightarrow 4 \rightarrow 6$

16 – [1]

The nucleus of an atom contains:

- A) protons and neutrons.
- B) protons, neutrons, and electrons.
- C) protons only.
- D) neutrons only.

17 – [1]

When measuring the temperature of a thermistor placed in a water bath, which of the following should you **not** do?

- A) Place the thermometer close to the thermistor.
- B) Stir the water.
- C) Take temperature readings immediately.
- D) Read the thermometer with the meniscus at eye level.

18 – [1]

Which of the following are **not** physical changes?

- A) Water evaporating
- B) Wood burning
- C) Oxygen condensing
- D) Salt dissolving in water

19 – [1]

A circuit requires a total resistance of  $1\text{ k}\Omega$ . The circuit contains two resistors in parallel, one of which has a resistance of  $3\text{ k}\Omega$ . What is the resistance of the other resistor?

- A)  $3000\Omega$
- B)  $1500\Omega$
- C)  $1000\Omega$
- D)  $750\Omega$

20 – [1]

A magnet is dropped north pole first vertically down a copper tube. The magnet does not touch the sides. The moving magnet creates currents in the copper. What happens to the magnet as it falls, compared to the same magnet falling outside the tube?

- A) It falls at the same rate.
- B) It falls slower until it reaches the middle of the tube, then it falls faster.
- C) It falls faster all the way through.
- D) It falls slower all the way through.

21 – [1]

Following an experiment, a radioactive source is placed in a lead-lined box and removed to a safe storage location. The detector continues to detect radiation at a low level.

Why is the detector detecting radiation after the source is removed?

- A) The detector is faulty.
- B) The source irradiated the room with the detector in it.
- C) The source can still be detected from a large distance while inside its box.
- D) It's detecting background radiation.

22 – [1]

A thermistor is calibrated by finding its resistance at specific temperatures and then plotting a calibration curve (graph of R against T).

When conducting the measurements for a specific thermistor, what are the dependent, independent and control variables?

	Dependent	Independent	Control
A	Resistance	Temperature	p.d. across thermistor
B	Temperature	Resistance	p.d. across thermistor
C	Resistance	p.d. across thermistor	Temperature
D	p.d. across thermistor	Temperature	Resistance

- A)
- B)
- C)
- D)

23 – [1]

A transformer with 400 turns in its primary coil and 1200 turns in its secondary coil, has an alternating potential difference of 30 volts applied across its primary coil.

What is the potential difference across the secondary coil?

- A) 90 V
- B) 10 V
- C) 120 V
- D) 0 V



24– [1]

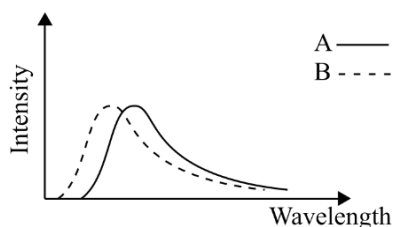
When light shines on an LDR the LDR's resistance decreases, because:

- A) the number of charge carriers increases.
- B) a potential difference is created across the LDR.
- C) the LDR gets hotter.
- D) the LDR gets shorter.

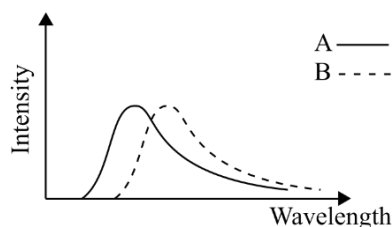
25– Thermal, Hard, [1]

In the graphs below, curve A is the blackbody radiation curve for an object at room temperature. The object is heated, and its temperature rises.

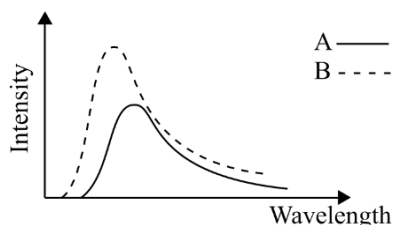
Which of the curves labelled B shows the blackbody radiation curve for the object now that it is hotter?



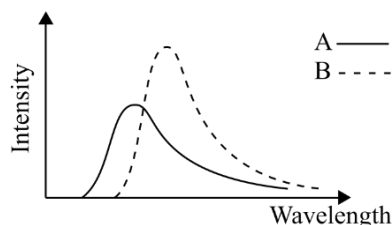
A



B



C

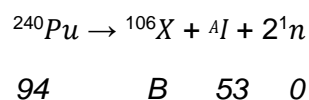


D

- A)
- B)
- C)
- D)

26 – [2][3][4]

A plutonium-240 nucleus undergoes fission in to two daughter nuclei and two neutrons. The nuclear equation for the fission reaction is:



a) What is the atomic mass,  $A$ , of the Iodine nucleus, and the atomic number,  $B$ , of the nucleus  $X$ ?

[2]

b) Explain how the fission of this plutonium nucleus could lead to a chain reaction in the presence of other plutonium nuclei.

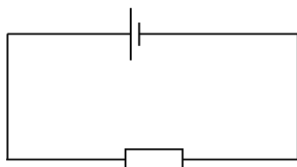
[4]

c) Describe the functions of the moderator and the control rods.

[3]

27 – [2][3][6]

A teacher gives each of their students a copy of the circuit shown below:



The students are asked to add a voltmeter and an ammeter to the circuit, and to use them to find the resistance of the resistor.

a) Show on the diagram above where the voltmeter and ammeter should be placed using the standard circuit symbols.

[2]

The student records a voltage of 1.3 V, and a current of 0.011 A.

b) What is the resistance of the resistor?

\_\_\_\_\_  $\Omega$

[3]

The teacher has also built two demonstration circuits, each with a 6 V battery and two identical resistors. In the first circuit the resistors are in series with each other and the battery, in the other they are in parallel with each other and the battery.

c) Draw diagrams of the two circuits and explain why the resistance in the series circuit is greater than in the parallel circuit.

[6]

28 – [2][3][4]

Carbon-14 is a radioactive isotope that emits beta radiation with a half-life of 5730 years.

a) State two precautions you should take when working with radioactive isotopes.

[2]

A sample of wood from the archaeological remains of a village was found to have 12  $\mu\text{g}$  of carbon-14 in it. A sample of wood from a nearby living tree has 32  $\mu\text{g}$  of carbon-14 in it.

b) How old is the village?

\_\_\_\_\_ thousand years

[4]

c) Explain why carbon dating cannot be used to find the age of objects over 50,000 years.

[2]

29 – [2][3][4][6]

<div style="text-align: center;"> <div style="display: inline-block; border: 1px solid black; padding: 5px; margin: 0 10px;">N</div> <div style="display: inline-block; border: 1px solid black; padding: 5px; margin: 0 10px;">S</div> </div> <p>The magnets are 2.5 cm wide and 4 cm apart.</p> <p>a i) Describe how a plotting compass is used to plot the field lines between the two magnets. [3]</p> <p>a ii) Sketch the field lines on the diagram above. [2]</p> <p>A wire is placed inbetween the magnets and a potential difference of <math>V</math> volts is put across it as shown below.</p> <div style="text-align: center;"> <div style="display: inline-block; border: 1px solid black; padding: 5px; margin: 0 10px;">N</div> <div style="display: inline-block; vertical-align: middle;"> <div style="border-left: 1px solid black; height: 50px; position: relative;"> <span style="position: absolute; top: -10px; left: 50%; transform: translateX(-50%);">+V</span> <span style="position: absolute; bottom: -10px; left: 50%; transform: translateX(-50%);">+0</span> </div> </div> <div style="display: inline-block; border: 1px solid black; padding: 5px; margin: 0 10px;">S</div> </div> <p>b i) Explain what happens to the wire and why? [6]</p> <p>b ii) The apparatus is placed on a balance and the wire is clamped so that it can't move. When a current of 6 A is passed through the wire, a force of 3 mN is calculated to be acting on the magnets. What is the magnetic field strength between the two magnets? _____ T [4]</p>	
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30 – [2][3][3][2]

<p>a) A cylinder with a volume of 45ml is full of nitrogen gas at 25°C. The pressure on the internal walls of the cylinder is 101 kPa. A plunger is pushed slowly into the cylinder, decreasing the volume of the gas to half the original volume. What is the pressure on the internal walls of the cylinder after the volume change is complete? _____ kPa [3]</p>
<p>b) The plunger is moved slowly in order to do as little work on the gas as possible. Explain how doing work on the gas would increase its temperature. [3]</p>
<p>c) If work is done on the gas, state whether the pressure will greater than, equal to, or less than the value obtained in part a). [2]</p>
<p>d) When the plunger is released it moves back out of the cylinder. Explain why this happens. [2]</p>

31 – [2][3][5]

A capacitor is made by connecting two parallel plates to a battery. The battery provides the energy necessary to move electrons off one plate and onto the other. When the capacitor is disconnected from the battery and connected to a circuit, the electrons flow back to the other plate until neither plate is charged.

The capacitor has a charge of 6.0 C on its positive plate when it is connected with a resistor. The capacitor discharges completely through the resistor in a time of 3.6 seconds.

a) If the average potential difference across the resistor is 4.2 V, how much energy is transferred from the capacitor to the resistor?

[5]

A plastic rod becomes charged when it is rubbed with a cloth.

b) Explain why small pieces of paper can be picked up by the charged rod.

[3]

An electrical appliance with a metal case develops a fault so that the live wire comes in contact with the case. The live wire rapidly charges and discharges the case. If someone touches the case then the charge will flow through them instead, causing them to be electrocuted.

c) What safety feature should the device be fitted with, and how would it stop the person being electrocuted.

[2]

32 – [2][3][6]

A new thermal liquid is being tested for use storage heaters.

a) Describe an experiment to determine the specific heat capacity of the liquid.

[6]

The specific heat capacity of the thermal liquid is found to be 2400 J/kg/K and the specific latent heat of vaporisation is found to be 3.6 MJ/kg.

b i) A 40 kg mass of the liquid is used in a storage heater.

How much energy is stored in the heater when its temperature is raised from 15°C to 35°C?  
\_\_\_\_\_ J

[3]

b ii) During the rise in temperature to 35°C, 0.032 kg of the liquid is vaporised.

Ignoring the energy required to raise the temperature of the vaporised liquid, calculate the energy required to vaporise that liquid.

\_\_\_\_\_ MJ

[2]