Merit Minds
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Exam Preparation and Free Resources
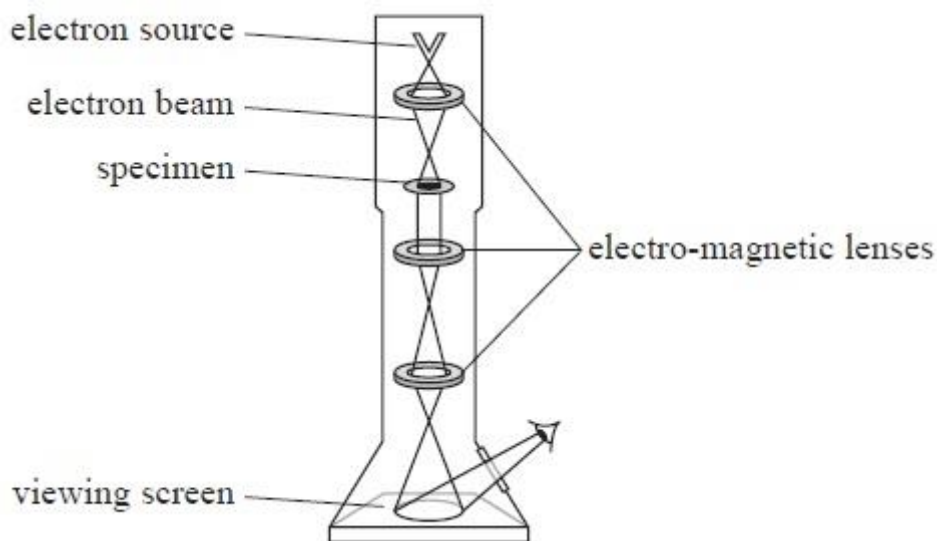
Name of the Student:_____

Max. **Marks : 20 Marks**   **Time : 20 Minutes**

Q1.
A transmission electron microscope passes a beam of electrons through a tiny specimen to form an image on a viewing screen.

Due to the wave nature of electrons, diffraction occurs which can blur the image. To reduce this effect when viewing a smaller object the beam must contain

☒ **A** more electrons per second.

☒ **B** fewer electrons per second.

☒ **C** faster moving electrons.

☒ **D** slower moving electrons.

(Total for Question = 1 mark)

Q2.

In everyday life the effect of diffraction is more significant for sound than for light.

This is because

☐ **A**   light has a much shorter wavelength than sound.

☐ **B**   light is a transverse wave but sound is a longitudinal wave.

☐ **C**   light is an electromagnetic wave but sound is a mechanical wave.

☐ **D**   the speed of light in air is much higher than the speed of sound.

Q3.

Answer the question with a cross in the box you think is correct ⊠. If you change your mind about an answer, put a line through the box ⊠ and then mark your new answer with a cross ⊠.

Sound waves can diffract around obstacles as shown in the diagram.
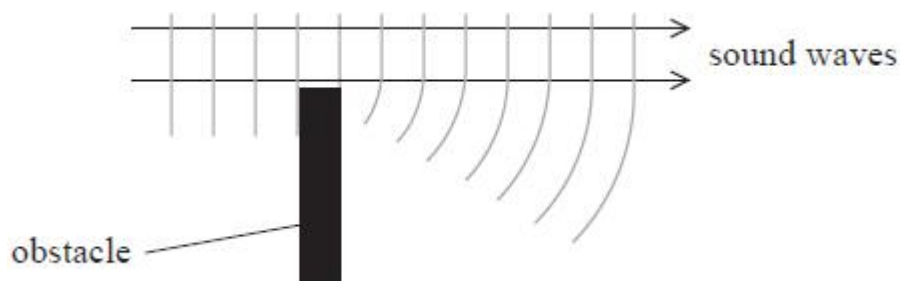
The diffraction effect is

⊠ **A**   greater for large amplitude sound waves.

⊠ **B**   greater for low frequency sound waves.

⊠ **C**   independent of the frequency of the sound waves.

⊠ **D**   independent of the speed of the sound waves.

(Total for question = 1 mark)

Q4.

Answer the question with a cross in the box you think is correct (⊠). If you change your mind about an answer, put a line through the box (⊠) and then mark your new answer with a cross (⊠).

The image shows a diffraction pattern formed when a beam of electrons passes through thin metal foil.

Which of the following would cause the diameter of the rings to increase?

⊠ **A**   Decreasing the number of electrons in the beam.

⊠ **B**   Decreasing the speed of electrons in the beam.

⊠ **C**   Increasing the number of electrons in the beam.

⊠ **D**   Increasing the speed of electrons in the beam.

Q5.

Answer the question with a cross in the box you think is correct ⊠. If you change your mind about an answer, put a line through the box ⊠ and then mark your new answer with a cross ⊠.

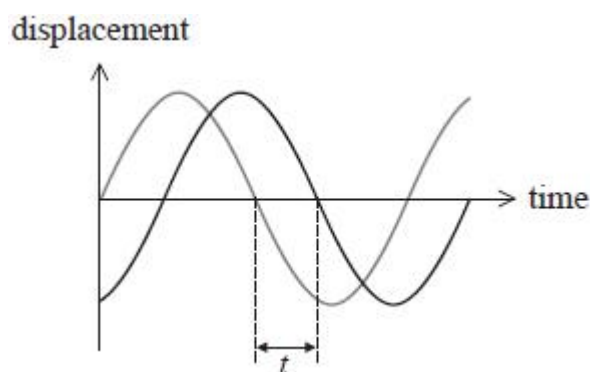A displacement-time graph is shown for a particle in a transverse wave.
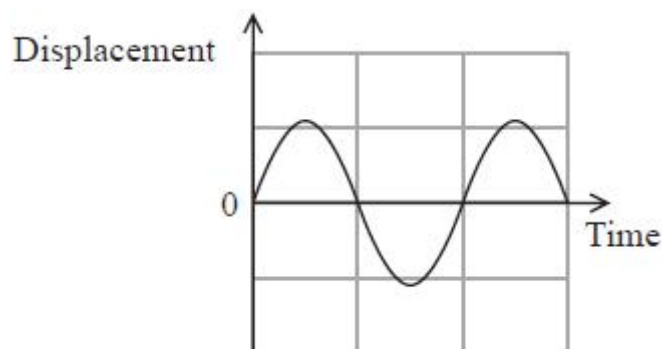
Which property of the wave can **not** be determined directly from the displacement-time graph?

⊠ **A**   amplitude

⊠ **B**   frequency

⊠ **C**   time period

⊠ **D**   wavelength

(Total for question = 1 mark)

Q6.

Displacement-time graphs are shown for two waves, each of frequency *f* and period *T*.

The phase difference in radians between the two waves is given by
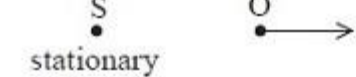
(1)

☒ A $\dfrac{2\pi t}{T}$

☒ B $\dfrac{\pi t}{T}$

☒ C $\dfrac{2\pi t}{f}$

☒ D $\dfrac{\pi t}{f}$

(Total for question = 1 mark)

Q7.
The diagrams show the motions of a source of sound, S, and an observer, O.

Which line of the table correctly shows the effect this relative motion has on the frequency of the sound heard by the observer.

	Motions of S and O	Frequency
☒ A	←— S• O• stationary	increased
☒ B	S• —→ ←— •O	decreased
☒ C	←— S• O• —→	decreased
☒ D	S• stationary O• —→	increased

(Total for Question = 1 mark)

Q8.

When a sound wave passes from water into air it slows down. As the wave crosses the boundary from water to air its

☒ **A**   frequency decreases.

☒ **B**   frequency increases.

☒ **C**   wavelength decreases.

☒ **D**   wavelength increases.

(Total for question = 1 mark)

Q9.

Light passes between medium X and medium Y.

Speed of light in X = 2.00×10^8 m s^{-1}

Speed of light in Y = 2.25×10^8 m s^{-1}

Which line of the table correctly shows what happens to the frequency and wavelength of the light as it passes from medium X to medium Y?

	Frequency	Wavelength
☒ **A**	decreases	increases
☒ **B**	increases	decreases
☒ **C**	unchanged	increases
☒ **D**	unchanged	decreases

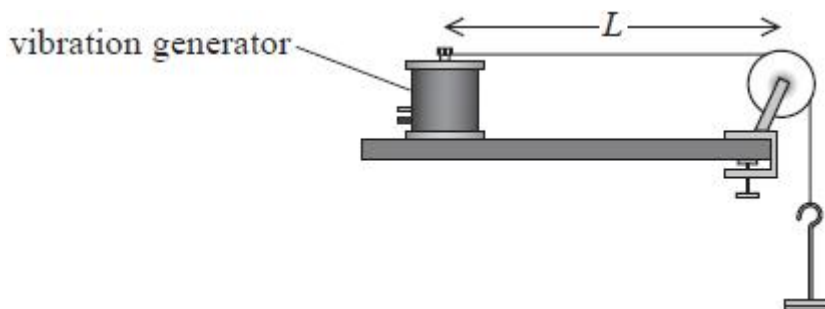**(Total for question = 1 mark)**

Q10.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The speed v of a transverse wave on a string is given by

$$v = \sqrt{\frac{T}{\mu}}$$

where μ is the mass per unit length of the string and T is the tension in the string.

A fixed length L of string is connected to a vibration generator and held under tension T as shown. The frequency of the vibration generator is varied until, at a frequency f, a standing wave with one antinode is observed. T is increased and the procedure is repeated.

Which of the following describes the variation in f as T increases?

☒ **A**   decreases linearly

☒ **B**   decreases non-linearly

☒ **C**   increases linearly

☒ **D**   increases non-linearly

(Total for question = 1 mark)

Q11.

Einstein's photoelectric equation states

$$hf = \phi + \frac{1}{2}mv^2_{max}$$

The quantity denoted by ϕ is the minimum

☒ **A**   amount of energy of a photon needed to release an electron.

☒ **B**   amount of energy of an electron needed to release a photon.

☒ **C**   frequency of a photon needed to release an electron.

☒ **D**   frequency of an electron needed to release a photon.

(Total for question = 1 mark)

Q12.
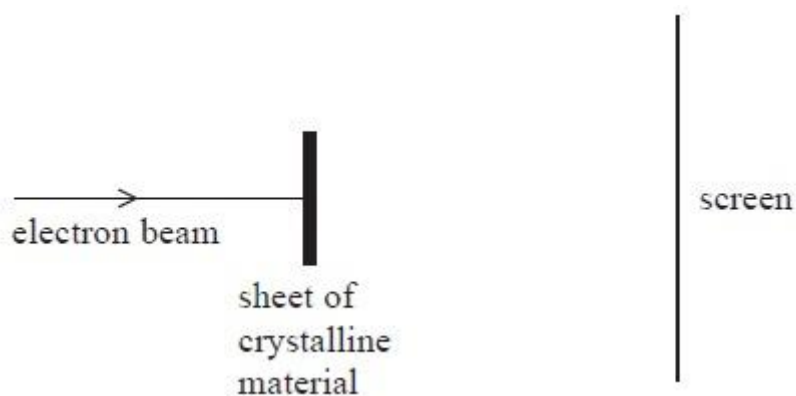Which type of electromagnetic radiation is used for communicating with satellites?

☒ **A**   infrared

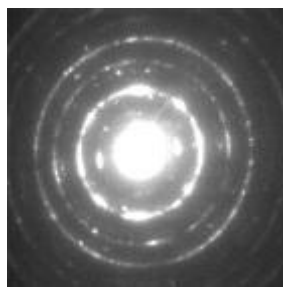☒ **B**   microwave

☒ **C**   ultraviolet

(Total for Question = 1 mark)

Q13.

A beam of electrons is directed towards a section of crystalline material.

The following pattern is produced by the electrons on the screen.
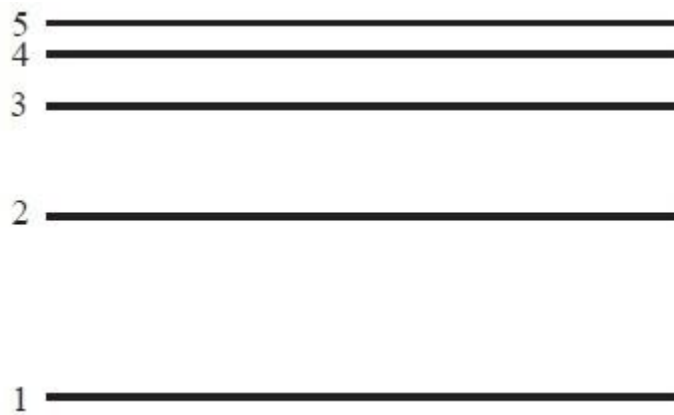

This pattern demonstrates

☒ **A**   diffraction.

☒ **B**   polarisation.

☒ **C**   reflection.

☒ **D**   refraction.

(Total for Question = 1 mark)

Q14.

The diagram shows five energy levels in an atom.
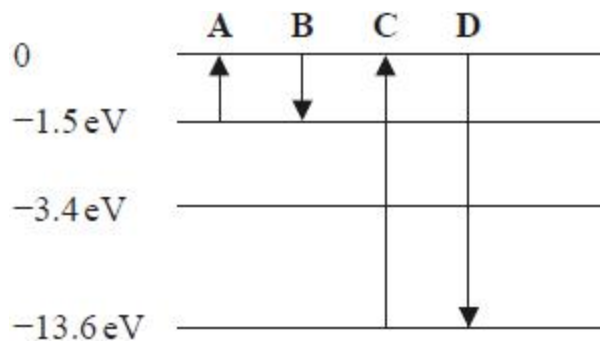
Electromagnetic radiation is incident on the atom.

Which transition would be caused by the absorption of the lowest frequency of radiation?

☒ **A** 1 to 5

☒ **B** 1 to 2

☒ **C** 4 to 5

☒ **D** 5 to 4

(Total for Question = 1 mark)

Q15.

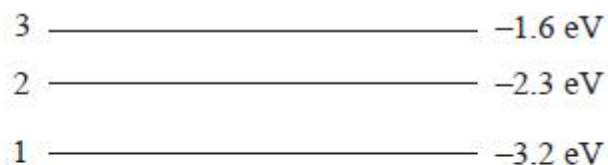Some of the energy levels of an atom of a gas are shown.

During which transition, A, B, C or D, is electromagnetic radiation with the shortest wavelength emitted?

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

Q16.

The diagram shows the lowest energy levels for a certain atom.

$$3 \quad\text{———————} \quad -1.6\ \text{eV}$$
$$2 \quad\text{———————} \quad -2.3\ \text{eV}$$
$$1 \quad\text{———————} \quad -3.2\ \text{eV}$$

$$\text{ground state} \quad\text{———————} \quad -5.5\ \text{eV}$$

A photon with energy 3.2 eV is absorbed.

An electron could move from

(1)

☒ **A**   ground state to level 1.

☒ **B**   ground state to level 2.

☒ **C**   level 1 to ground state.

☒ **D**   level 2 to ground state.

(Total for question = 1 mark)

Q17.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The energy level diagram shows four possible energy transitions for an electron in an atom.
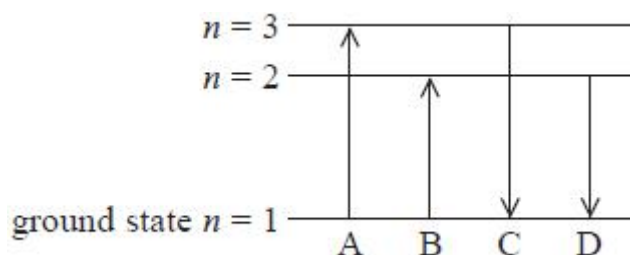
Which arrow shows the transition made by the electron when the atom emits radiation with the longest wavelength?

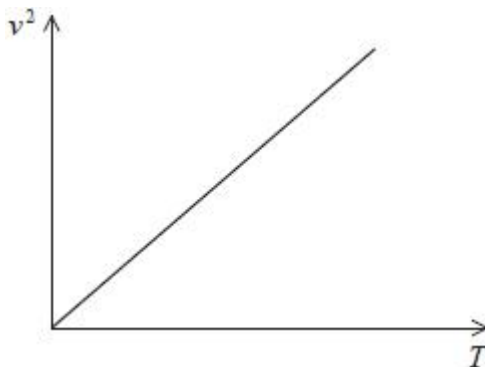☒ **A**

☒ **B**

☒ **C**

☒ **D**

(Total for question = 1 mark)

Q18.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

This question refers to an experiment to investigate stationary waves on a string.

Corresponding values of v^2 against T are plotted. A straight line graph is obtained, as shown.

Which of the following expressions for the mass per unit length μ of the string is correct?

☒ **A** $\mu = \text{gradient}$

☒ **B** $\mu = \sqrt{\text{gradient}}$

☒ **C** $\mu = \dfrac{1}{\text{gradient}}$

☒ **D** $\mu = \dfrac{1}{\sqrt{\text{gradient}}}$

(Total for question = 1 mark)

Q19.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

An electron travels at a velocity v.

Which of the following is the correct expression for the de Broglie wavelength λ of the electron?

☒ A $\lambda = \dfrac{3.00 \times 10^8}{9.11 \times 10^{-31} \times v}$

☒ B $\lambda = \dfrac{9.11 \times 10^{-31} \times v}{3.00 \times 10^8}$

☒ C $\lambda = \dfrac{6.63 \times 10^{-34}}{9.11 \times 10^{-31} \times v}$

☒ D $\lambda = \dfrac{9.11 \times 10^{-31} \times v}{6.63 \times 10^{-34}}$

(Total for question = 1 mark)

Q20.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

An electron in an atom absorbs energy E and is excited from one energy level to the next. When the electron returns to its original energy level a photon is emitted.

Which of the following is an expression for the wavelength of the emitted photon?

☒ A $\dfrac{hc}{E}$

☒ B $\dfrac{E}{hc}$

☒ C $\dfrac{Eh}{c}$

☒ D $\dfrac{c}{Eh}$

(Total for question = 1 mark)