A ray of light is travelling in medium A, as shown in the diagram. Medium A is surrounded by medium B. Medium B has a lower refractive index than medium A.

The ray of light would be most likely to continue in which direction?

(A) 

(B) 

(C) 

(D)
2 A fundamental difference between mechanical waves and electromagnetic waves is that:

(A) mechanical waves cannot be refracted.
(B) mechanical waves do not require a medium.
(C) electromagnetic waves cannot travel through a medium.
(D) electromagnetic waves do not require a medium.

3 A source of electromagnetic radiation produces all of the wavebands in the electromagnetic spectrum. This radiation is then passed through the Earth’s atmosphere and analysed. It is found to contain wavebands predominantly of the types:

(A) radio and light
(B) radio and gamma rays
(C) light and alpha
(D) light and UV

4 The number of electrons which flow past a point in a wire carrying a current of 2.5 A in a 5.0s time interval is:

(A) 12.5
(B) 20
(C) 7.8 x 10^{19}
(D) 2.0 x 10^{-19}
Which of the following diagrams best shows the appropriate arrangement of field lines around a pair of bar magnets? The arrows have been omitted intentionally.

(A)

(B)

(C)

(D)
In an investigation to measure the power of a model 12V heating coil, an ammeter and voltmeter were used to measure the current and voltage.

The apparatus was arranged exactly as shown in a student’s diagram below.

![Diagram of apparatus](image)

The experiment was performed and repeated for a total of five times following exactly the same method each time. Each of the five results was very similar. This experiment could be described as being:

(A) not valid and not reliable.
(B) valid but not reliable.
(C) not reliable but accurate.
(D) reliable but not accurate.

In the home, circuit breakers have not replaced earthing as a safety measure, but both are used. Double insulation and fuses are other safety measures. If a double-insulated 240V hair dryer (with a two-pronged plug) that is turned on is dropped into a full bath, the safety feature that would be most effective in protecting the person in the bath is:

(A) earthing.
(B) double insulation.
(C) the circuit breaker.
(D) the earth leakage detector.
The path of a bee is tracked over several minutes and is shown below:

![Path of a bee](image)

The instantaneous speed of the bee was recorded at a number of places during its journey. It is possible that the instantaneous speeds recorded, compared with the average speed of the bee, are:

(A) always higher than the average speed.
(B) always lower than the average speed.
(C) always equal to the average speed.
(D) higher, lower or equal to the average speed.

An aeroplane is flying in a straight line, climbing steadily at a rate of 6.0 metres per second through still air. The net force acting on a passenger of mass $M$ in the aeroplane is:

(A) $6Mg$
(B) $Mg$
(C) zero
(D) $6M$

The reason airbags are a successful addition to the safety features of cars is:

(A) airbags increase the deceleration time of the occupants in a crash.
(B) airbags reduce the impulse on the occupants in a crash.
(C) seatbelts are no longer necessary with airbags.
(D) airbags reduce the momentum during a crash.
11 The colour of a star is useful in determining the star’s:

(A) composition and surface temperature.
(B) size and age.
(C) surface temperature and dominant wavelength of radiation.
(D) chemical composition and age.

12 In an experiment to determine the effect of a variable “P” on the value of a quantity “Q”, it was found that Q increased proportional to the inverse square of P. When plotted on a set of axes, the curve most likely to resemble the result is:

(A) ![Graph A]
(B) ![Graph B]
(C) ![Graph C]
(D) ![Graph D]

13 Sunspots appear on the surface of the Sun as dark regions. Their dark appearance is due to:

(A) the shadows cast by the sunspots.
(B) the dust clouds thrown up by sunspots.
(C) sunspots having a lower temperature than the surroundings.
(D) sunspots being deep craters on the Sun’s surface.
14 Which of the following Hertzsprung-Russell diagrams (with identical axes) correctly plots a star’s position movements on the diagram when it evolves from its original form as a yellow main sequence star into a red giant star?

(A)  
(B)  
(C)  
(D)  

15 The aim of a certain experiment was: “To measure the effect of the force on a trolley”. Which of the following combinations of independent variable, dependent variable and controlled variable is most appropriate for this experiment?

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Dependent variable</th>
<th>Controlled variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) force on trolley</td>
<td>acceleration of trolley</td>
<td>type of trolley</td>
</tr>
<tr>
<td>(B) acceleration of trolley</td>
<td>force on trolley</td>
<td>types of masses used</td>
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<tr>
<td>(C) types of masses used</td>
<td>force on trolley</td>
<td>acceleration of trolley</td>
</tr>
<tr>
<td>(D) acceleration of trolley</td>
<td>mass of trolley</td>
<td>force on trolley</td>
</tr>
</tbody>
</table>
Question 16 (5 marks)

During the year, you performed a first-hand investigation to identify the relationship between the frequency and the wavelength of a sound wave travelling at a constant velocity.

(a) Use a labelled diagram to describe the apparatus used. 

(b) Outline what measurements/variables were recorded (actual results are not required).

(c) Recall the relationship that was found between the wavelength and the frequency of the sound wave.

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Marks

2

2

1
Question 17 (3 marks)

Modulation is the method by which information is carried by radio waves.

(a) Outline how a radio wave is modulated.

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(b) Describe how the shape of the wave is changed when frequency modulation is used.

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Question 18 (2 marks)

A light ray enters a transparent prism from air as shown in the diagram.

![Diagram of light ray entering prism]

Calculate the velocity of light within the prism.

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Question 19 (4 marks)

Modern communication technologies utilise a number of different parts of the electromagnetic spectrum.

(a) Identify one type of communication technology and then clearly identify which part of the electromagnetic spectrum it uses.

(b) Only a limited range of the electromagnetic spectrum is available for use by communication technologies.

Discuss the problems that this causes for our communications industries.

Question 20 (4 marks)

Australia has many remote communities which cannot obtain electricity from the national electricity distribution system.

Choose one method by which electricity is generated for remote communities, and for it, list two advantages and one disadvantage of the technology.
**Question 21** (3 marks)

A household switches off four appliances which are in stand-by mode all day, every day. Each of the appliances consumes 10W in stand-by mode.

Calculate the reduction in electrical consumption in kilowatt-hours each year when these appliances are switched off, assuming that they are never used in the year.

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**Question 22** (2 marks)

Compare the generation of a magnetic field by a solenoid and a bar magnet.

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**Question 23** (6 marks)

Early experimenters with electricity had difficulty in understanding its nature and its source. Two of these experimenters were Galvani and Volta.

(a) Outline the differing views held by Galvani and Volta as to the nature of electricity.

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Question 23 continues on page 14
Question 23 (continued)

(b) Discuss whether their views have contributed to our increased understanding of electricity.

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Question 24 (3 marks)

Over recent decades, a number of technologies have been developed which assist drivers to avoid collisions.

Identify one such technological development, and describe the physics principles upon which it relies.

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Question 25 (5 marks)

The motion of a motorbike was recorded and graphed, as shown on the axes below:

(a) Describe the motion of the motorbike between the times \( t = 5.0s \) and \( t = 12.0s \).

(b) Calculate the distance travelled by the motorbike in the first three seconds shown on the graph.

(c) On the original axes above, draw a graph of the motion of a car which starts from rest at \( t = 0s \) and has an acceleration of \(-2.0\text{ms}^{-2}\).
**Question 26** (4 marks)

Friction plays an important role in everyday life.

(a) Describe one example of how friction is beneficial, including a method by which it is purposefully or intentionally increased.

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(b) Describe one further example where friction is undesirable, and the way in which it is minimised.

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**Question 27** (2 marks)

A star viewed from Earth has a brightness of 64 units. Measurements show that this star is 100 light years away.

Calculate the brightness of the same star when it is viewed from a distance of 40 light years.

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Marks

2

2
Question 28 (4 marks)

In a special three-way tug-of-war competition, three teams pull on ropes attached to a central mass of 1000kg, resting on a frictionless surface, as shown from above in the diagram.

(a) Find the net force (with direction) acting on the 1000kg mass.

(b) Hence find the acceleration of the 1000kg mass.
Question 29 (3 marks)

Over recent decades, studies into the nature of the solar wind have revealed detailed information as to its nature and behaviour.

(a) Outline the nature of the solar wind.

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(b) Outline some of the impacts of the solar wind on Earth and on our society.

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Question 30 (3 marks)

Early models of the Universe were developed with very limited or no assistance from technology.

Describe how TWO (2) limitations caused by a lack of technology prevented the further development of the models of the Universe. 3

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Question 31 (5 marks)

In a first-hand investigation you performed this year, the penetrating power of nuclear radiation was investigated.

(a) Using the observations you made, explain why the use of alpha-particle sources in smoke detectors used in all homes is not a major health concern.

(b) With the aid of a diagram, describe how the paths of alpha particles differ from the paths taken by beta particles when they move through an electric field which is perpendicular to their velocity.
Question 31 (continued)

(c) State how the path taken by gamma rays is different again to both alpha and beta particles when moving through the perpendicular electric field.

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Question 32 (2 marks)

The AIM of an experiment was given as “To observe the effect of varying the voltage on the current through a globe”.

Write a suitable HYPOTHESIS for this experiment.

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END OF EXAMINATION