



**2016 specification**  
first exams in 2018

# **Multiple-Choice Practice Questions**

for GCSE (9–1) AQA Physics  
Topics 5–8 (Paper 2)

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# Contents

<b>Thank You for Choosing ZigZag Education .....</b>	<b>ii</b>
<b>Teacher Feedback Opportunity .....</b>	<b>iii</b>
<b>Terms and Conditions of Use .....</b>	<b>iv</b>
<b>Teacher’s Introduction .....</b>	<b>1</b>
<b>Student’s Introduction .....</b>	<b>2</b>
<b>Multiple-choice Question Bank A .....</b>	<b>3</b>
Topic 5: Forces – Bank A .....	3
Topic 6: Waves – Bank A .....	9
Topic 7: Magnetism and electromagnetism– Bank A .....	15
Topic 8: Space physics (physics only) – Bank A .....	20
<b>Answers to Multiple-Choice Question Bank A .....</b>	<b>22</b>
Topic 5: Forces .....	23
Topic 6: Waves .....	29
Topic 7: Magnetism and electromagnetism .....	34
Topic 8: Space physics .....	38
<b>Multiple-choice Question Bank B .....</b>	<b>40</b>
Topic 5: Forces .....	40
Topic 6: Waves .....	46
Topic 7: Magnetism and electromagnetism .....	51
Topic 8: Space physics (physics only) .....	55
<b>Answers to Multiple-Choice Question Bank B .....</b>	<b>57</b>

# Teacher's Introduction

## The return of multiple-choice questions!

The GCSE reformation has seen the return of multiple-choice questions on all GCSE Science specifications. Multiple-choice questions now feature on both Paper 1 and Paper 2 of the AQA Physics GCSE. Where previously multiple-choice questions may have been viewed as easier questions to answer, the reformed GCSE has led to the cognitive demand on students dramatically increasing. As a result, it is vital that students have a chance to practise answering more multiple-choice questions.

### Remember!

Always check the exam board website for new information, including changes to the specification and sample assessment material.

## Save on marking!

Multiple-choice questions have been included in the new linear GCSE exams as they allow exam boards to assess a greater breadth of content across their exams. This also makes them excellent tools for teachers! Multiple-choice questions are an excellent formative assessment for students and teachers alike. Setting pupils questions with a high demand allows teachers to identify misconceptions in students' understanding through less-onerous marking. Through setting carefully designed questions to truly assess learning, such as within this resource, you can gauge students' progress in a shorter amount of time than by setting open questions.

## A resource carefully designed to be useful to both pupils and teachers

This resource closely links to the AQA GCSE Physics specification for Paper 2, assessing areas of the course in which there are common misconceptions. The questions have been designed to test students at a higher level of demand to 'unpick' learning. There are also questions on most of the required practical activities for topics 5–8 and opportunities to assess Working Scientifically and mathematical skills.

This resource is split into two parts: Bank A and Bank B. Each part contains approximately 100 multiple-choice questions. Bank A includes fully explained answers, describing either the correct method or, for incorrect answers, where the student has gone wrong for incorrect choices. Bank B provides an opportunity to repeat the same skills to test the student's understanding after completing the first set of questions.

Alongside the questions there is a mark scheme for Bank A which acts as a commentary for common 'pitfalls'. This can be used by you as part of formative assessment, or be provided to the students when completing the questions as a way to reflect on areas for development.

## A versatile and formative resource

This resource would be best used when students have already covered and revised the content, so that they can fully focus on practising the skills needed to get the multiple-choice questions right. They could be provided with the full set of questions from Bank A and the solutions with the commentary. The students should be encouraged to make notes from those questions they got wrong so that they can review and reflect on particular skills or areas of content, ready to try similar questions in Bank B. Encouraging students to reflect between sections can help them to develop their growth mindset and, therefore, improve their likelihood of making progress.

Alternatively, some of the questions could be used throughout teaching as part of formative assessment, or within tests as part of summative assessments. You could review any common areas of weakness in class, using the commentary to help you, and then give the students the resource at the end of the course as an opportunity to practise the skills again. Then provide them with Bank B as further practice.

H Sproul, February 2019

### Free Updates!

Register your email address to receive any future free updates\* made to this resource or other Science resources your school has purchased, and details of any promotions for your subject.

\* resulting from minor specification changes, suggestions from teachers and peer reviews, or occasional errors reported by customers

Go to [zzed.uk/freeupdates](http://zzed.uk/freeupdates)

# Student's Introduction

The new GCSEs has seen the return of multiple-choice questions on all GCSE Science specifications. Multiple-choice questions now feature on both Paper 1 and Paper 2 of the AQA Physics GCSE.

You might view multiple-choice questions as easier questions on the paper, and, in some cases, they might be. However, multiple-choice questions are being used by the exam board to assess a broad range of content, so they can be tricky! Many of the multiple-choice questions link lots of different topics together and assess maths skills; therefore, it is vital that you have a chance to practise answering more multiple-choice questions.

## How to use this resource

This resource has been written to closely match the specification you are studying and give you lots of opportunity to practise answering questions relating to some of the more demanding skills and content of the course.

- If you are completing the foundation tier paper, ignore questions which start with '(HT only)'
- If you are completing the combined science course, ignore questions which start with '(Physics only)'

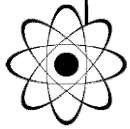
We recommend you use this resource when you have already covered and revised the content. You can then use this resource as a way of practising skills and identifying any areas for development.

Bank A comes with a mark scheme with a full commentary on it. If you get an answer incorrect, read the commentary carefully to look at how you should have approached the question. Make notes as you are doing this and spend time reviewing content if lack of knowledge is a problem. If you get the answer correct, still read the commentary as it will still act as part of your revision!

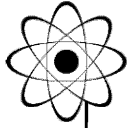
Once you have completed Bank A and reviewed any necessary content or skills, complete Bank B and mark it. Then, review any content or skills you need to develop further.

When you have finished Bank B, complete both sections again until you get 100%! There is no such thing as too much practice!

*Good Luck*

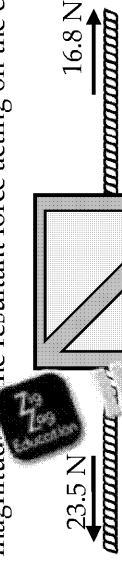


## Topic 5: Forces



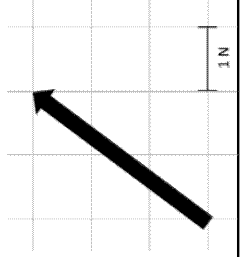
- Which of the following is the correct description of a vector?
  - A Has magnitude only
  - B Has magnitude and direction
  - C Has direction only
  - D Has two magnitudes
- How are vectors represented in diagrams?
  - A Using dashed lines
  - B Using circles
  - C Using arrows
  - D Using gridlines
- What is meant by a non-contact force?
  - A A force that doesn't communicate between the objects it acts upon
  - B A force that acts between two objects that aren't touching
  - C A force that varies when two objects are kept a fixed distance apart
  - D A force that acts between two objects that are in contact
- Which of the following is an example of a contact force?
  - A Magnetic force
  - B Gravitational force
  - C Frictional force
  - D Electrostatic force
- What is the definition of weight?
  - A The force acting on an object due to gravity
  - B The number of atoms in an object
  - C The mass of a substance when on Earth

7. What is the magnitude of the resultant force acting on the crate below?



- A 23.5 N
- B 6.70 N
- C 16.8 N
- D 40.3 N

8. (HT only) What are the two components of the force represented by the black arrow if it is resolved?



- A 2 N left, 3 N up
- B 3 N right, 3 N up
- C 2 N right, 2 N up
- D 2 N right, 3 N up

9. A gardener pushes their wheelbarrow with a constant force of 6.0 N. If the gardener does 75 J of work on the wheelbarrow when pushing it, how far does the wheelbarrow travel?



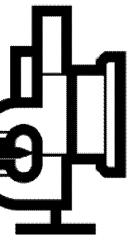
- A 450 cm
- B 13 cm
- C 13 m
- D 450 m

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11. A nail is clamped into a vice so that it does not move, and is pushed from one side. What type of deformation does this force cause on the nail?



- A Compression  
 B Bending  
 C Stretching  
 D No deformation

12. A spring is extended by 17 cm when a 45 N force is exerted on it. What is the spring constant of the spring?

- A 260 N/m  
 B 7.7 N/m  
 C 260 N m  
 D 7.7 N m

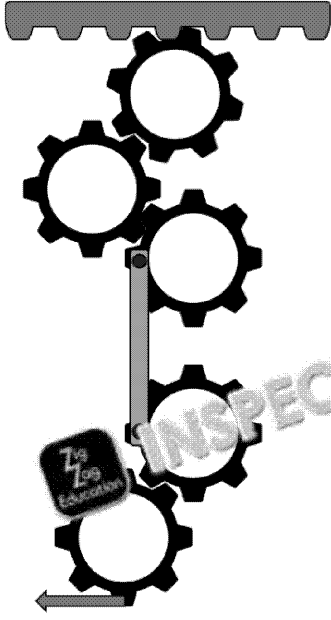
13. A spring is compressed by 5.7 cm from its equilibrium position. If the spring has a spring constant of 23 N/m, how much energy is stored elastically in the spring?

- A 74 mJ  
 B 37 mJ  
 C 0.66 J  
 D 15 J

14. In an experiment investigating the relationship between the force and extension of a spring, which of the following is a control variable?

- A Extension of spring

16. (Physics only) A force acts on the gear below causing it to turn. In which direction will the final straight piece move?

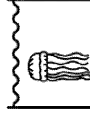


- A Upwards  C It won't move   
 B Downwards  D It will oscillate

17. (Physics only) The average surface area of a human body is 2.7 m<sup>2</sup>. Assuming atmospheric pressure,  $1.0 \times 10^5$  Pa, acts equally over the surface area, what is the force exerted by the atmosphere on the human body?

- A 37 kN   
 B 270 kN   
 C 370 kN   
 D 729 kN

18. (Physics and HT only) A cylindrical fish tank standing 7.0 m tall is to be installed in the lobby of a new five-star hotel. What is the difference in water pressure between



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19. (Physics and HT only) Which of the following explains why air pressure decreases with altitude?

- A Space sucks air away from Earth
- B The higher the altitude, the less air above that altitude, so the less weight pushing down, creating pressure at that altitude
- C The rotation of Earth causes air to be flung out towards space, reducing the pressure at high altitudes
- D The higher the altitude, the lower the temperature, and, therefore, the lower the pressure

20. What name is given to the quantity that measures the distance an object moves in a straight line from start to finish, and gives the direction of this movement?

- A Displacement
- B Distance
- C Longitude
- D Latitude

21. Which of the following is a typical value for the speed of sound in air?

- A 35 m/s
- B 330 m/s
- C 30 km/s
- D 3.3 m/s

22. A train travels 658 m in 3.75 minutes. What is the average speed of the train when it travels this distance?



A 2.92 m/s

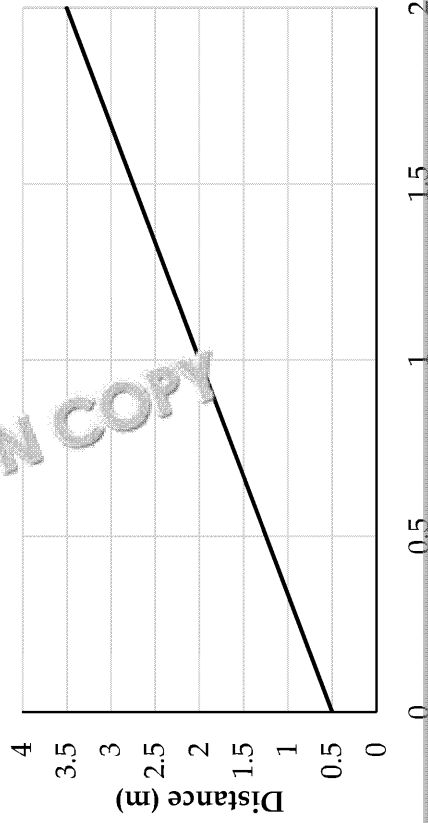
23. (HT only) Which description of the velocity of the Moon as it orbits Earth is correct? (Assume the radius of orbit is constant.)

- A The velocity is constant
- B The velocity is always decreasing
- C The velocity is always changing
- D The velocity is always increasing

24. A car accelerates on the motorway from 12 m/s to 16.5 m/s in 25 s. What is the acceleration of the car?

- A 0.66 m/s<sup>2</sup>
- B 0.48 m/s<sup>2</sup>
- C 0.18 m/s<sup>2</sup>
- D 1.1 m/s<sup>2</sup>

25. What is the velocity described by the distance–time graph below?

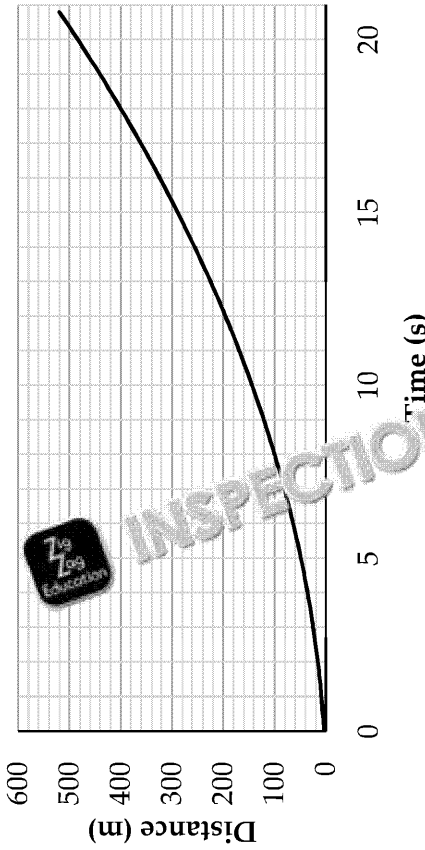


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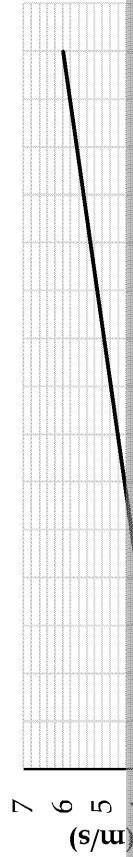
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26. (HT only) The distance–time graph below describes the motion of a hypercar as it pulls away from the starting line. What is its velocity at  $t = 15$  s?

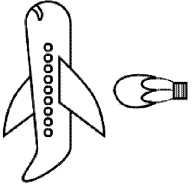


- A  30 m/s  
 B  34 m/s  
 C  46 m/s  
 D  15 m/s

27. What is the acceleration of an object whose motion is described by the velocity–time graph below?

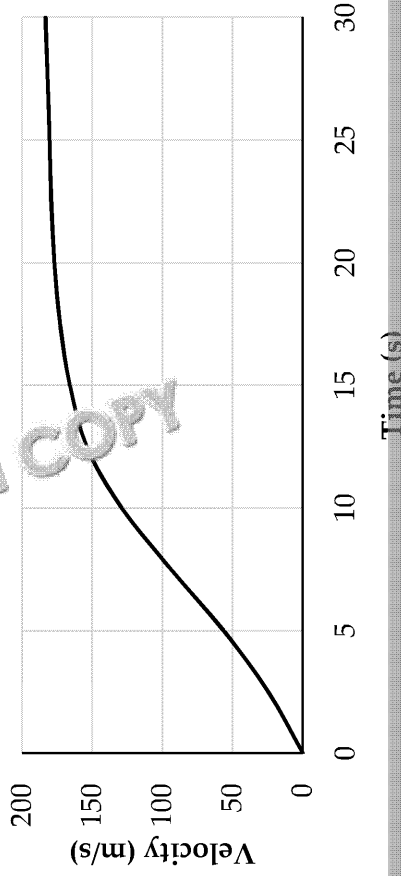
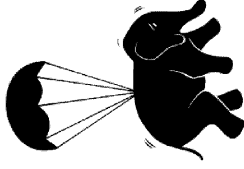


28. A cargo plane delivering humanitarian aid drops a care package 10.0 km above its target area. After falling 100 m, the care package is travelling at 44.3 m/s. Assuming no air resistance, how fast is it travelling when it reaches the target area after falling another 1500 m?



- A  177 m/s  
 B  171 m/s  
 C  183 m/s  
 D  166 m/s

29. (Physics only) An elephant is dropped out the back of an airplane – don't worry, it's on a parachute! Before the parachute opens, however, the velocity of the elephant increases up to a point. Below is a graph describing the velocity of the elephant. What is the constant velocity of the elephant after 20 seconds of free-fall?



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30. A car travels along the motorway at a constant speed of 19 m/s. Its engine is running and is providing power to the wheels. What does Newton's first law tell us about the forces acting on the car?
- A The force exerted by the engine is more than the resistive forces
- B The weight of the car is less than the normal contact force exerted by the road
- C The force exerted by the engine is equal to the resistive forces
- D The weight of the car is double the size of the resistive forces

31. A trolley with a mass of 450 g is pushed against a spring. It is then released, causing the spring to exert a constant force of 1.5 N on the trolley. Calculate the acceleration of the trolley.

- A  $0.68 \text{ m/s}^2$
- B  $0.30 \text{ m/s}^2$
- C  $3.3 \text{ m/s}^2$
- D  $0.33 \text{ m/s}^2$

32. Which of the following correctly describes the relationship between the acceleration and the mass of an object?

- A  $m \propto \frac{1}{a}$
- B  $m = \frac{1}{a}$
- C  $m \propto a$
- D  $m = a$

33. (HT only) A 240 N force accelerates an object from 11 m/s to 34 m/s in 5.0 s. What is the mass of the object?

- A 35 kg
- B 52 kg
- C 7.8 kg
- D 21 kg

35. A student is investigating the acceleration of a toy car when dragged by the weight of a weight stack. The student increases the mass on the weight stack in regular increments and records the time it takes the car to move between equally spaced lines. What is the independent variable in this investigation?

- A The time it takes the car to travel between each line
- B The distance between each horizontal line the car moves between
- C The weight on the weight stack
- D The mass of the toy car

36. Which of the following is the correct calculation for stopping distance?

- A stopping distance = braking distance – thinking distance
- B stopping distance = thinking distance – braking distance
- C stopping distance = thinking distance + braking distance
- D stopping distance = braking distance  $\times$  thinking distance

37. (Physics only) The stopping distance of a lorry is measured by a safety regulations company. The company tests the stopping distance of the lorry when it is travelling at 5 m/s, 10 m/s, 15 m/s and 20 m/s. Which of the following measured stopping distances correctly corresponds to the stated speeds?

- A 20 m, 45 m, 15 m, 95 m
- B 20 m, 45 m, 75 m, 120 m
- C 120 m, 75 m, 45 m, 20 m
- D 20 m, 40 m, 50 m, 55 m

38. The thinking distance of a vehicle is affected by the reaction time of the driver. Which of the following is **not** a factor that can affect the reaction time

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39. Which of the following statements is **false**?

- A Old, well-used brakes are more effective at braking.
- B Icy road conditions cause stopping distances to increase.
- C Younger tyres in good condition result in shorter braking distances.
- D The heavier a vehicle is, the greater its stopping distance.

40. **(HT only)** A 1.35 kg mass is travelling at 3.5 m/s. What is its momentum to two significant figures?

- A 4.73 kg m/s
- B 2.6 kg m/s
- C 2.59 kg m/s
- D 4.7 kg m/s

41. **(HT only)** An event occurs in a closed system. Which of the following statements is true about the momentum in the system?

- A The momentum before the event and the momentum after the event are equal.
- B The momentum before the event is double the momentum after the event.
- C The momentum before the event is less than the momentum after the event.
- D The momentum after the event is random.

42. **(Physics and HT only)** If the two objects below collide and move away together, at what speed do they move away to two significant figures?



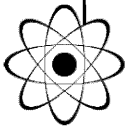
43. **(Physics and HT only)** Which two equations combine to give the equation

$$F = \frac{m\Delta v}{\Delta t}$$

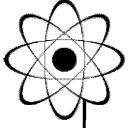
- A  $F = ma$  and  $E_k = \frac{1}{2}mv^2$
- B  $W = Fs$  and  $s = at^2$
- C  $F = ma$  and  $a = \frac{v-u}{t}$
- D  $W = mg$  and  $p = mv$

44. **(Physics and HT only)** A driver is involved in a crash, causing the driver's airbag to detonate. The driver is initially travelling at 23 m/s before the airbag slows them down. The mass of the head and body of the driver is 35 kg. The airbag slows the driver to a stop in 0.80 s. What is the average force exerted on the driver by the airbag?

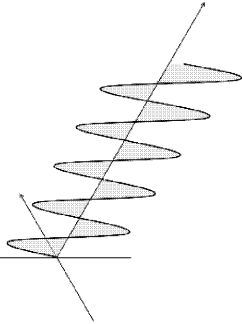
- A 1.0 kN
- B 640 N
- C 1300 N
- D 1010 N



## Topic 6: Waves



45. To the right is a snapshot of particles moving as a wave, shown as one cycle. What type of wave is shown?

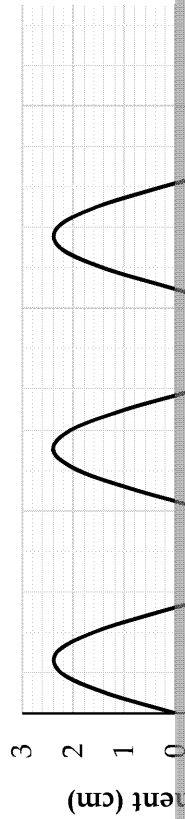


- A A longitudinal wave
- B A transverse wave
- C A sound wave
- D A seismic P-wave

46. Which of the following statements about waves is true?

- A A wave is the propagation of energy and not matter.
- B As a wave travels through a medium, the particles of the medium travel with the wave.
- C Both energy and matter are transferred by a wave travelling through a medium.
- D Only transverse waves transfer energy and not matter.

47. What is the frequency of the wave below.



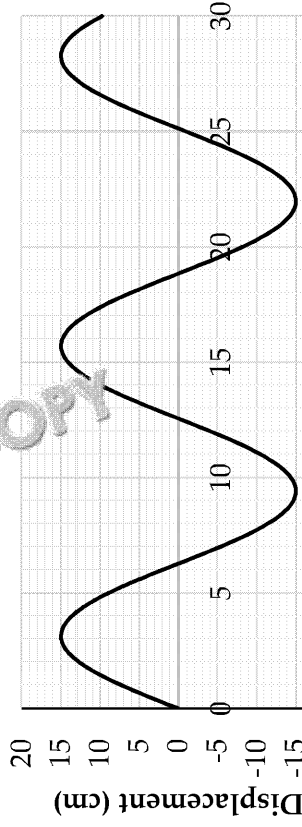
48. What is the amplitude of a wave?

- A The maximum displacement of a wave from its equilibrium position
- B The speed at which a wave oscillates
- C The distance between two peaks of a wave
- D The average displacement of a wave from its equilibrium position

49. A wave travels at  $25 \text{ m s}^{-1}$  and has a frequency of  $38 \text{ Hz}$ . What is the wavelength of the wave?

- A 1.1 mm
- B 0.43 m
- C 0.66 m
- D 1.5 m

50. (HT only) The following wave is shown to have a wavelength of 4.1 cm. What is its wave speed?



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51. A ripple tank is used to investigate the wave speed of water waves. An electric motor drives a wooden rod that creates the waves, and the wavelength of the waves is measured using a ruler. The wave speed can be calculated as the gradient from a plot of wavelength against  $1/\text{frequency}$ . What is the independent variable in this investigation?

- A The frequency of the water waves
- B The amplitude of the water waves
- C The temperature of the water
- D The wavelength of the water waves

52. (Physics only) A student is investigating the refraction of light by different transparent materials. The student aims a light ray at each block of material on a piece of paper. They then trace the light ray on the paper, either side of the block, move the block and connect the rays. From this, the angle of refraction at each surface can be calculated. This is repeated for a range of angles of light. The student then replaces the block and repeats the process. What is the independent variable in this investigation?

- A The angle of incidence
- B The angle of reflection
- C The angle of refraction
- D The intensity of light

53. (Physics only) Which of the following correctly shows the reflection of the light ray shown to the right?

A  B  C  D

54. (Physics only) When a wave interacts with a boundary, any of three things can happen. One of them is the reflection of the wave by the boundary. What are the other two?

- A Absorption and reflection
- B Vibration and transmission
- C Transmission and superposition

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56. (Physics and HT only) How are sound waves detected by the human ear?

- A Sound waves excite electrons in the inner ear, causing an alternating current that the brain can interpret.
- B Sound waves are reflected by the eardrum which causes the inner drum to vibrate and this produces electrical signals that the brain can detect.
- C Sound waves are transverse waves that vibrate the inner ear. This causes the neurons in the brain to vibrate, hence the brain can interpret the sound.
- D Sound waves are absorbed by the ear which vibrates the skull. The entire brain therefore vibrates and can interpret the sound.

57. (Physics and HT only) Ultrasound uses high-frequency sound waves to build an image of the inside of a body. Which of the following descriptions correctly describes how this works?

- A Sound waves excite different atoms by different amounts → atoms fall to lower energy state → atoms emit photons specific to fall in energy → an image can be built from these different photons
- B Sound waves refract as they propagate through different materials → they refract enough to turn 180° back to the detector → the time it takes to reach the detector is used to build an image.
- C Sound waves slow down or speed up in different materials → sound waves are reflected off the table after passing through the body → sound waves pass back through the body to be detected → time is used to build an image

58. (HT only) Waves are refracted when they transmit across a boundary between two materials with different refractive indices. How does the difference in refractive indices cause a wave to refract?

- A The refractive index changes the frequency of the wave, which results in the refraction of the wave.
- B The speed of propagation of a wave depends on the refractive index. This change in speed causes the wave to refract.
- C The higher the refractive index, the more energy the medium absorbs from the wave, the slower the wave travels.
- D The lower a refractive index, the more energy the wave loses to the medium, so the slower the wave travels.

59. Which of the following statements about electromagnetic waves is false?

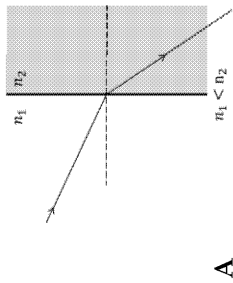
- A They don't have a wavelength.
- B They are transverse waves
- C They all travel at the same speed in a vacuum
- D They form a continuous spectrum

60. Which of the following is not a type of electromagnetic wave?

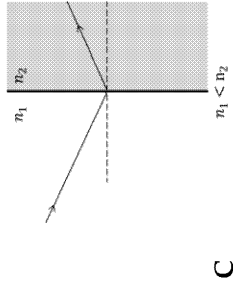
- A Radio wave
- B Infrared
- C Gamma wave
- D Ultrasound

61. Which of the following types of electromagnetic radiation has the longest

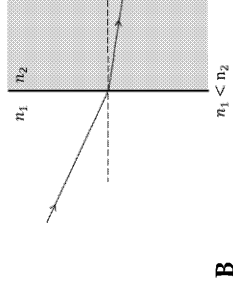
62. Which of the following diagrams correctly shows the refraction of the light ray shown to the right?



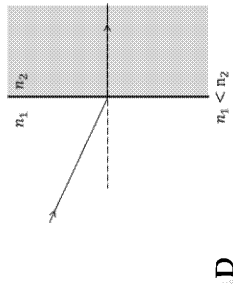
A



B



C



D

63. (HT only) What type of electromagnetic radiation can induce AC currents in a conducting wire?

- A X-rays
- B Gamma rays
- C Radio waves
- D Microwaves

65. Which of the following is caused by long exposure to UV radiation?

- A Increased risk of mutations in bone cells
- B Decreased risk of skin cancer
- C Increased risk of mutations in cells becoming radioactive
- D Premature ageing of skin

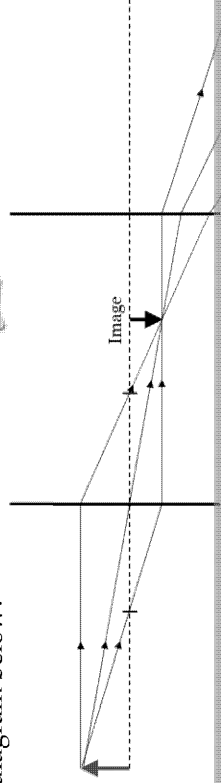
66. What is the best type of electromagnetic radiation for wireless communication, and why?

- A Visible light – humans can see the communication channels
- B Gamma rays – carry the most energy
- C Ultraviolet light – passes through the atmosphere
- D Radio waves – longest wavelength which reflects well

67. What type of electromagnetic radiation is emitted by electrical heaters?

- A Microwaves
- B X-rays
- C Infrared
- D Ultraviolet

68. (Physics only) From left to right, what are the two types of lens in the ray diagram below?



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69. (Physics only) What is meant by a virtual image?

- A A point where the light from an object appears to come from for certain lenses
- B An image created by a lens
- C An image that does not exist in reality, but only exists to make ray diagrams work
- D An image that exists for a very short amount of time, too short to be observed by humans

70. (Physics only) Which of the following is the correct definition for diffuse reflection?

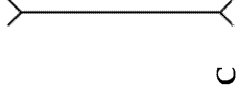
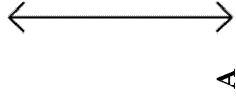
- A The reflection of light from a smooth surface
- B The scattering of light after being reflected from a rough surface
- C The reflection of a specific range of wavelengths of light from a surface
- D The reflection of a specific range of incident angles of light from a surface

71. (Physics only) The eye of a needle has a diameter of 0.67 mm. It is viewed through a convex lens and is seen to have a diameter of 5.4 mm. What is the magnification of the convex lens?

- A 44
- B 12
- C 3.6
- D 8.1



72. (Physics only) Which of the following symbols is the symbol for a concave lens?



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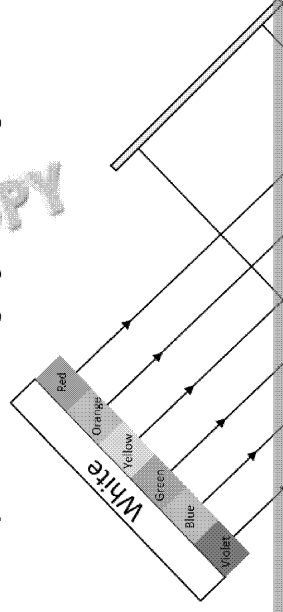
A

C

B

D

73. (Physics only) What colour light passes through the following filter?



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74. (Physics only) A green tennis ball is viewed through a blue filter. What colour does the tennis ball appear to be?

- A Green  C Blue  
 B Red  D Black

75. (Physics only) Which of the following statements about a perfect black body is false?

- A A perfect black body does not emit all incident radiation.  
 B A perfect black body does not reflect any incident radiation.  
 C A perfect black body would be the best possible emitter of radiation.  
 D A perfect black body absorbs all incident radiation.

76. (Physics and HT only) A bucket of water is left out in the sun causing the temperature of the water to increase. Which of the following is true about the radiation on the object?

- A The water emits more radiation than it absorbs.  
 B The water absorbs radiation at a higher rate than it emits radiation.  
 C The water absorbs radiation but emits no radiation.  
 D The rates of absorption and emission of radiation by the water are equal.

77. (Physics only) What does the intensity of emitted radiation from a body depend on?

- A The object's colour

78. (Physics and HT only) Which of the following is the correct reason why greenhouse gases are causing an increase in the average temperature of Earth's atmosphere?

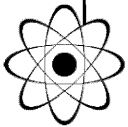
- A Greenhouse gases emit less radiation to be emitted into space, causing the rate of absorption to be higher than the rate of emission, resulting in an increase in temperature.  
 B Greenhouse gases result in more radiation from the Sun being reflected into space, causing the rate of absorption to be lower than the rate of emission, resulting in an increase in temperature.  
 C Greenhouse gases absorb all wavelengths of radiation from space, but only emit wavelengths of radiation that heat Earth's atmosphere, thereby increasing its temperature.  
 D Greenhouse gases are perfect absorbers and emitters for all wavelengths of light except for green light. They therefore emit infrared radiation that heats Earth's atmosphere.

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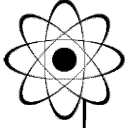


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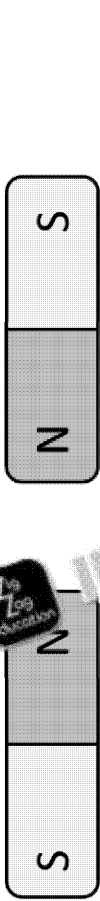




# Topic 7: Magnetism and electromagnetism



79. What will happen to the bar magnets below?



- A They will attract each other.
- B They will repel each other.
- C They will rotate so their like poles are touching.
- D Nothing will happen.

80. What is the correct definition of an induced magnet?

- A A magnet that produces its own magnetic field.
- B A magnet that uses its own magnetic field to magnetise another material.
- C A material that becomes magnetic in the presence of a magnetic field.
- D A material that stays magnetic after leaving a magnetic field.

81. Which field diagram correctly represents the magnetic field around a bar magnet?



82. Which of the following materials is magnetic?

- A Aluminium
- B Nickel
- C Copper
- D Nitrogen

83. A bar magnet is brought near an iron nail. Which of the following describes the force between the magnet and the nail?

- A There is no force.
- B The force is a contact force.
- C The force is repulsive.
- D The force is attractive.

84. Which point around the bar magnet below experiences the strongest magnetic field?



A X

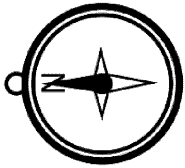
B X

C X

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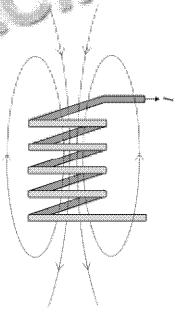
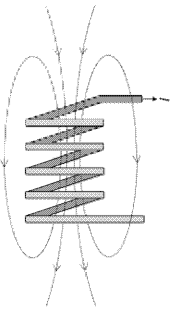
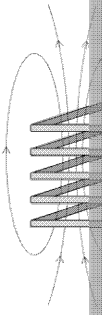


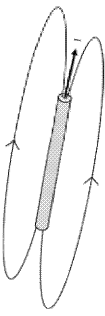
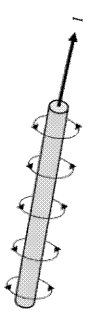

85. Why does a compass point north?
- A The needle of a compass is magnetic → force aligns needle with Earth's magnetic field → needle points north
  - B Earth's magnetic field causes the compass to become an induced magnet → it experiences an attractive force → aligns with Earth's magnetic field
  - C Gravity is weaker near Earth's poles → the needle is heavier on one side so falls and moves to point towards Earth's equator → the other end points north/south depending on which hemisphere the compass is in
  - D The needle reacts to the position of the sun in the sky → it rotates depending on the Sun → it always points north → this is why compasses only work during the day



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87. What is the name given to a current-carrying wire that is coiled up so the magnetic field strength is increased?
- A A capacitor
  - B A solenoid
  - C A bar magnet
  - D A transformer

88. Which of the following shows the correct magnetic field lines for the current-carrying solenoid?
- A 
  - B 
  - C 

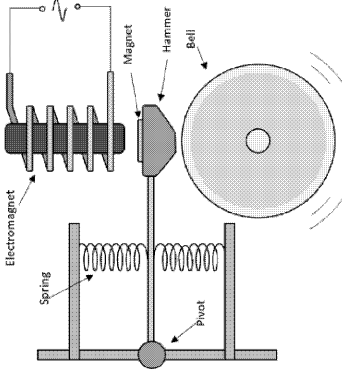
86. A conducting wire carries a large current. Which of the following diagrams correctly shows the magnetic field created by the current-carrying wire?
- A 
  - B 
  - C 

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89. (Physics only) An electromagnet is used to ring a bell. To the right is a diagram of an electric bell. The electromagnet is supplied with an alternating current with a frequency of 5 Hz. Which of the following correctly explains how the electric bell works?

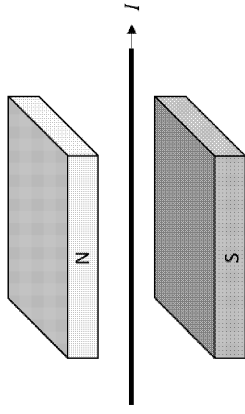


- A The electromagnet turns on and off every 0.2 s. This causes the hammer to become an induced magnet and so it is attracted to the electromagnet. When the electromagnet turns off, the hammer falls back down and strikes the bell. The springs ensure the hammer returns to its equilibrium position.
- B The electromagnet turns on for 0.2 s and then off again. This attracts the magnet on the back of the hammer. When the electromagnet turns off, the hammer falls down and strikes the bell. The springs cause the hammer to oscillate back and forth, striking the bell several times.
- C The alternating current causes the direction of the magnetic field of the electromagnet to change every 0.2 s. This attracts and repels the hammer every 0.2 s which hits the bell every 0.2 s.
- D The electromagnet attracts the bell which is free to move a little about its fixed centre. The bell pushes on the hammer and falls back down when the electromagnet changes polarity. The hammer doesn't fall back down with the bell due to resistance from the springs; therefore, the hammer and the bell lose contact. The bell

90. (HT only) What is the motor effect?

- A The turning of a shaft connected to a combustion engine
- B A current-carrying conductor and a magnet will exert a force on one another when the conductor is placed in the magnetic field of the magnet
- C The force exerted on a conductor connected to an open circuit when placed in a magnetic field
- D The current or potential difference induced in a conductor when the conductor moves through a magnetic field

91. (HT only) In which direction will the current-carrying wire to the right experience a force?



- A Out of the page
- B Downwards
- C Upwards
- D Into the page

92. (HT only) A copper wire carrying  $0.15 \text{ A}$  is placed in a  $75 \text{ mT}$  magnetic field. If  $35 \text{ cm}$  of the wire is in the magnetic field, what is the magnitude of the force exerted on the wire? You will need  $F = BIl$ .

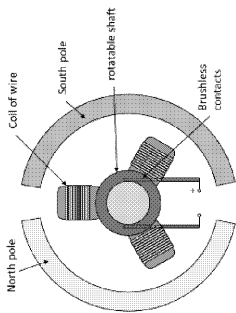
- A  $0.70 \text{ N}$
- B  $400 \text{ N}$
- C  $175 \text{ mN}$
- D  $3.9 \text{ mN}$

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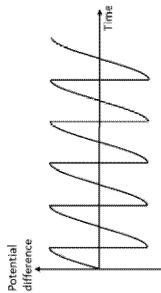


94. (HT only) The coils of wire shown in the diagram to the right are supplied with a direct current.

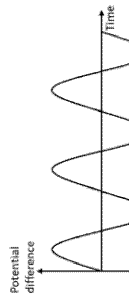
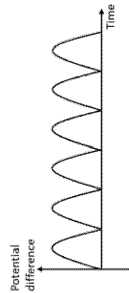
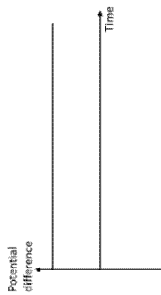


- What happens in this situation?
- A The coils will rotate in one continuous direction within the magnetic field.
  - B The coils will rotate back and forth, but won't actually complete one revolution.
  - C The magnetic field generates an additional current in the coils, so the DC current in the circuit increases.
  - D Nothing happens.

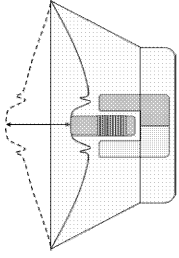
95. (Physics and HT only) Which of the following graphs shows the generated potential difference from an alternator?



A



96. (Physics and HT only) To the right is a diagram of a loudspeaker.



Which of the following statements correctly describes how the loudspeaker works?

- A A direct current supplied to the coil causes the coil to move in the presence of the permanent magnets. The movement of the coil and paper cone produces sound waves.
- B Variations in current in the coil cause a changing magnetic field. This interacts with the field of the permanent magnets, causing a varying force. This force moves the coil and connected paper cone up and down, creating pressure waves, i.e. sound.
- C The polarity of the permanent magnets varies which causes a varying force to be exerted on the coil and paper cone. This results in pressure waves in the air that propagate as sound.
- D The field of the permanent magnets induces a current in the coil, causing an attractive force between the magnets and the coil. The permanent magnets are then vibrated up and down, causing the coil and paper cone to vibrate with them. From this, sound waves are produced.

97. (Physics and HT only) A student connects a brushed DC motor to an ammeter. The student then connects a fan to the motor and takes the motor and ammeter outside. The wind outside starts to turn the fan at a constant speed. Which of

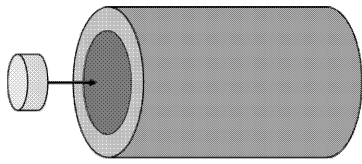


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98. (Physics and HT only) A magnet is dropped into a copper tube, as shown in the diagram to the right. The magnet induces a current in the copper which creates its own magnetic field. The interaction of the two fields results in a force acting on the magnet. In which direction does the force act?



- A To the right.
- B Downwards.
- C Upwards.
- D To the left.

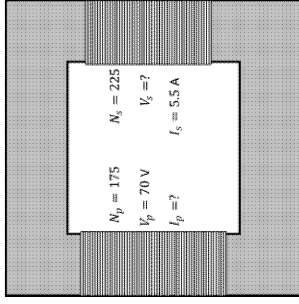
99. (Physics and HT only) What effect does a microphone use to create an electrical signal?

- A The motor effect
- B The generator effect
- C The turning effect
- D The electromagnetic effect

100. (Physics and HT only) A transformer has 50 turns on its primary coil and 300 turns on its secondary coil. The potential difference at the primary coil is 60 V. What is the potential difference at the secondary coil? ( $V_p = \frac{N_p}{N_s} V_s$ )

- A 150 V
- B 3800 V
- C 24 V
- D 60 V

102. (Physics and HT only) A transformer has 175 turns on its primary coil and 225 turns on its secondary coil. The potential difference in the primary coil is 70 V. The current in the secondary coil is 5.5 A. The transformer is 100 % efficient. What is the current in the primary coil?



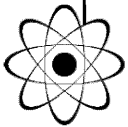
- A 7.1 A
- B 4.3 A
- C 9.1 A
- D 5.5 A

101. (Physics and HT only) What is meant by a step-up transformer?

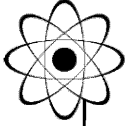
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## Topic 8: Space physics (Physics only)



103. How many planets are there in the solar system?
- A 4  C 9
- B 8  D 12
104. What is the name of the galaxy where our solar system is found?
- A Andromeda  C Sunflower
- B Black eye  D Milky Way
105. How does a star form?
- A Dust and gas in a nebula come together due to gravity, creating immense heat and pressure until fusion occurs.
- B A nebula starts rotating under its own gravity, until conditions are right for fusion to occur, so the nebula becomes a star.
- C A nebula transitions into a supergiant when its mass is large enough. Left behind after a supernova is a protostar.
- D Fusion occurs due to change in a nebula which causes a chain reaction for more fusion processes. Gravity brings these fusion processes together to form a star.
106. What stellar object does the core of a red giant become after the red giant runs out of hydrogen to fuse?
- A A white dwarf  C A supernova
108. Which of the following do not orbit planets?
- A Gas giants  C Galaxies
- B Moons  D Red giants
109. Which of the following processes creates and distributes elements heavier than iron out into the universe?
- A Gravitational collapse  C Supernovae
- B Fusion  D Fission
110. (HT only) A planet has a stable orbit around its star. The distance between the planet and its star changes as the planet orbits around the star. Which of the following is true about the planet's orbit?
- A The planet speeds up when it is furthest from the star.
- B The planet's velocity is constant throughout its orbit.
- C The planet gains gravitational potential energy when it moves closer to the star.
- D The planet speeds up as it moves closer to the star.
111. How is a black hole formed?
- A A black dwarf cools over time into a black hole



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112. What does the red shift of distant galaxies tell us about the history of the universe?

- A The galaxies used are a lot more blue than they are today
- B Galaxies began at one hot, dense point, rapidly receding away from each other
- C All electromagnetic radiation used to have the same, very short wavelength before red shift effects began
- D The galaxies are slowing down as they recede from us

113. What is observed in the light from the most distant galaxies?

- A The frequency is higher than expected
- B The wavelength is longer than expected
- C The speed of light measured is higher than expected
- D The range of observed frequencies is larger than expected

114. There is conclusive evidence that the universe began as a hot, dense region before rapidly expanding. A scientist says that our knowledge of all celestial objects in the universe is now complete. Which of the following objects contradicts this scientist's claim?

- A Main sequence stars
- B Neutron stars
- C Moons
- D Dark energy



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# Answers to Multiple-choice Question Bank A

1. B  
2. C  
3. B  
4. C  
5. A  
6. C  
7. C  
8. A  
9. C  
10. D  
11. B  
12. A  
13. B  
14. D  
15. C  
16. A  
17. B  
18. D  
19. B  
20. A  
21. B  
22. A  
23. C  
24. C  
25. B
31. C  
32. A  
33. B  
34. D  
35. C  
36. C  
37. B  
38. B  
39. A  
40. D  
41. A  
42. C  
43. C  
44. A  
45. B  
46. A  
47. D  
48. A  
49. C  
50. B  
51. A  
52. A  
53. B  
54. D  
55. C
61. B  
62. B  
63. C  
64. D  
65. D  
66. D  
67. C  
68. A  
69. A  
70. B  
71. D  
72. C  
73. A  
74. D  
75. A  
76. B  
77. C  
78. A  
79. B  
80. C  
81. C  
82. B  
83. D  
84. B  
85. A
91. D  
92. D  
93. C  
94. A  
95. D  
96. B  
97. A  
98. C  
99. B  
100. C  
101. D  
102. A  
103. B  
104. D  
105. A  
106. A  
107. C  
108. B  
109. C  
110. D  
111. D  
112. B  
113. B  
114. D

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## Topic 5: Forces

Q1	A	X	
	B	✓	The correct answer. A vector has magnitude and a direction in v
	C	X	
	D	X	
Q2	A	X	
	B	X	
	C	✓	The correct answer. A vector has a magnitude and direction; the the vector and its length is proportional to the magnitude of the
	D	X	
Q3	A	X	
	B	✓	The correct answer. A non-contact force is any force that acts be touching. Examples include gravitational or electrostatic forces.
	C	X	
	D	X	
Q4	A	X	
	B	X	
	C	✓	The correct answer. Frictional forces occur when two objects ru are in contact so friction is a contact force.
	D	X	
Q5	A	✓	The correct answer. The weight of an object is the force exerted in a gravitational field. It depends on the mass of the object and at the point where the object is located.
	B	X	
	C	X	
	D	X	
Q6	A	X	You have only used the mass of the empty plane – you have forg passengers.
	B	X	You have forgotten to include the mass of the passengers and ca
	C	X	You have accidentally used $g = 8.9 \text{ N kg}$ instead of $g = 9.8 \text{ N/kg}$
	D	✓	The correct answer. The total mass of the plane before take-off i $20\,000 + 79\,000 = 99\,000 \text{ kg}$ ; therefore, its weight is $W = mg = 990\,000 \text{ N}$
Q7	A	X	You haven't taken into account the force acting to the right.
	B	✓	The correct answer. The forces act in opposite directions; theref force between the two.
	C	X	You haven't taken into account the force acting to the left.
	D	X	You have added the forces which you should only do if the force they act in opposing directions and so you must subtract the sm
Q8	A	X	
	B	X	
	C	X	
	D	✓	The correct answer. The vector for the force is equivalent to a 2 3 N force acting upwards.

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Q9	A	X	You have used $s = W \times F$ and used the wrong unit - cm instead
	B	X	You have used the correct equation, $s = \frac{W}{F}$ , but used the wrong
	C	✓	The correct answer. $s = \frac{W}{F} = \frac{75}{6.0} = 13 \text{ m}$
	D	X	You have used $s = W \times F$
Q10	A	X	This can happen (on hot days, for example), but it isn't the most
	B	X	The body heat of the runner will heat the insides of the shoes, but
	C	X	Running slowly involves less kinetic energy which isn't likely to
	D	✓	The correct answer. The soles grip the pavement due to friction,
Q11	A	X	For compression, the forces will need to act towards each other
	B	✓	The correct answer. The vice exerts the necessary force on the nail
	C	X	For stretching, two forces will need to act away from each other
	D	X	More than one force is being applied to the nail and the object is
Q12	A	✓	The correct answer. $k = \frac{F}{e} = \frac{45}{0.17} = 260 \text{ N/m}$
	B	X	You have used the equation $k = Fe$
	C	X	You have given the wrong units for spring constant.
	D	X	You have used the equation $k = Fe$ and given the wrong units.
Q13	A	X	You have used $E_e = ke^2$
	B	✓	The correct answer. $E_e = \frac{1}{2}ke^2 = \frac{1}{2} \times 23 \times 0.057^2 = 37 \text{ mJ}$
	C	X	You have used $E_e = \frac{1}{2}ke$
	D	X	You have used $E_e = \frac{1}{2}k^2e$
Q14	A	X	This is the dependent variable in the experiment.
	B	X	The position of the counterweight doesn't affect the results of the
	C	X	This is the independent variable in the experiment.
	D	✓	The correct answer. The position of the ruler needs to be kept constant
Q15	A	X	You have mistaken the force for the moment.
	B	X	You have mistaken the perpendicular distance for the moment.
	C	✓	The correct answer. $M = Fd = 85 \times 0.27 = 23 \text{ N}$
	D	X	You have used the equation $M = \frac{F}{d}$
Q16	A	✓	The correct answer. The initial gear starts clockwise so the final
	B	X	The straight piece moves up due to the rotational effects of the gear
	C	X	The gears and pieces are free to move so will move due to the in
	D	X	The gears only rotate in one direction so the final piece will only

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Q17	A	X	You have used $F = \frac{p}{A}$
	B	✓	The correct answer. $F = pA = (1 \times 10^5) \times 2.7 = 270 \text{ kN}$
	C	X	You have used $F = p + A$ and used $A = 2.7 \times 10^5 \text{ m}^2$
	D	X	You have used $F = pA^2$
Q18	A	X	This is atmospheric pressure, not the difference in water pressure.
	B	X	The answer is to the wrong magnitude.
	C	X	This answer is to the wrong number of significant figures.
	D	✓	The correct answer. $p = \rho gh = 1000 \times 9.8 \times 7 = 6.9 \times 10^4 \text{ Pa}$
Q19	A	X	Although there is a pressure gradient between Earth and space, atmospheric pressure is still present.
	B	✓	The correct answer. The weight of air above a point decreases with height, so the pressure therefore also decreases.
	C	X	As before, Earth's gravity is strong enough to counteract the centrifugal force and hold the atmosphere.
	D	X	The decrease in temperature is not the cause of the decrease in air pressure that creates the decrease in temperature.
Q20	A	✓	The correct answer. Displacement is a measure of distance and direction.
	B	X	Distance is a scalar quantity with no direction.
	C	X	Longitude is the measure of where a point is around the equator.
	D	X	Latitude is the measure of how far from the equator a place is.
Q21	A	X	
	B	✓	The correct answer. The speed of sound in air is 330 m/s.
	C	X	
	D	X	
Q22	A	✓	The correct answer. $v = \frac{s}{t} = \frac{658}{3.75 \times 60} = 2.92 \text{ m/s}$
	B	X	You haven't converted the time from minutes to seconds.
	C	X	You have multiplied by the time rather than dividing it, and converted the time incorrectly: $v = 658 \times \frac{3.75}{60}$
	D	X	You have used $v = \frac{s}{t} = \frac{658}{30}$
Q23	A	X	The Moon experiences a centripetal acceleration; therefore, its velocity is changing.
	B	X	A decrease in velocity suggests the magnitude is changing, which is not the case. Velocity is the component that is changing.
	C	✓	The correct answer. The Moon has a circular orbit around Earth, so it has a centripetal acceleration that changes its velocity. Remember, velocity is a vector quantity. If the magnitude is constant, the direction and, therefore, the velocity is changing.
	D	X	An increase in velocity suggests the magnitude is changing, which is not the case. Velocity is the component that is changing.

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Q24	A	X	You have used $\Delta v = 16.5 \text{ m/s}$
	B	X	You have used $\Delta v = 12 \text{ m/s}$
	C	✓	The correct answer. $a = \frac{\Delta v}{t} = \frac{16.5 - 12}{25} = 0.18 \text{ m/s}^2$
	D	X	You have used $\Delta v = 16.5 + 12 = 28.5 \text{ m/s}$
Q25	A	X	
	B	✓	The correct answer. $\frac{\Delta y}{\Delta x} = \frac{3.5 - 0.5}{2 - 0} = 1.5 \text{ m/s}$
	C	X	
	D	X	
Q26	A	X	
	B	✓	The correct answer. $\frac{\Delta y}{\Delta x} = \frac{460 - 90}{20 - 9} = 34 \text{ m/s}$
	C	X	
	D	X	
Q27	A	X	
	B	X	
	C	X	
	D	✓	The correct answer. $a = \frac{\Delta v}{\Delta t} = \frac{6 - 3.4}{15 - 0} = 0.17 \text{ m/s}^2$
Q28	A	✓	The correct answer. $v^2 - u^2 = 2as$ , $v = \sqrt{2as + u^2} = \sqrt{2 \times 9.8 \times 100} = 44.3 \text{ m/s}$
	B	X	You have used $u = 0 \text{ m/s}$ instead of $u = 44.3 \text{ m/s}$
	C	X	You have used $s = 1500 + 100 = 1600 \text{ m}$
	D	X	You have used $s = 1500 - 100 = 1400$ and $u = 0 \text{ m/s}$
Q29	A	X	Gravity becomes stronger, not weaker, as an object falls closer to Earth.
	B	✓	The correct answer. Air resistance increases with speed. There is a point where air resistance is equal in magnitude to the weight of the elephant, but acts in the opposite direction. At this point the elephant stops accelerating.
	C	X	It's true that air resistance does work against the elephant; however, it does not do work on the elephant's kinetic energy because it's travelling at a constant speed. The lost kinetic energy is converted into thermal energy in the air.
	D	X	It's true that air resistance increases with decreasing altitude, but it's not the main reason for the air resistance experienced by the elephant. The main variable affecting air resistance is the velocity of the elephant.
Q30	A	X	The car would accelerate if this were true.
	B	X	The car would float away if this were true.
	C	✓	The correct answer. Newton's first law states that if no resultant force acts on an object, it will stay stationary or continue moving at a constant velocity. If the car is travelling at a constant velocity, it must experience resistive forces that equal the force exerted by the engine.
	D	X	This cannot be determined from the information given.

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Q31	A	X	You have used $a = F \times m$
	B	X	You have used $a = \frac{m}{F}$
	C	✓	The correct answer. $a = \frac{F}{m} = \frac{1.5}{0.45} = 3.3 \text{ m/s}^2$
	D	X	You have used $m = 4.5 \text{ kg}$
Q32	A	✓	The correct answer. From Newton's second law $m = \frac{F}{a}$ and, therefore, proportional to acceleration, $m \propto \frac{1}{a}$
	B	X	
	C	X	
	D	X	
Q33	A	X	You have used $(v - u) = 34 \text{ m/s}$
	B	✓	The correct answer. The acceleration of the objection is $a = \frac{v - u}{t}$ is, therefore, $m = \frac{F}{a} = \frac{240}{4.6} = 52 \text{ kg}$ .
	C	X	You have used $a = v \times u \times t$ and $m = \frac{a}{F}$
	D	X	You have used $a = (v - u) \times t$
Q34	A	X	
	B	X	
	C	X	
	D	✓	The correct answer. Weight and resistive forces such as friction act in opposite directions on one another and are, therefore, unrelated. Newton's third law states that the force that object A on object B creates an equal and opposite force by object B on object A. It is that it's in the opposite direction so they must be parallel.
Q35	A	X	
	B	X	
	C	✓	The correct answer. The weights are varied in the experiment and the distance is the independent variable in the experiment.
	D	X	
Q36	A	X	
	B	X	
	C	✓	The correct answer. The stopping distance is the total distance that the vehicle has made up to the point where it has stopped. This is the distance travelled while the driver reacts (the thinking distance) plus the distance travelled by the vehicle while it decelerates (the braking distance).
	D	X	
Q37	A	X	
	B	✓	The correct answer. The stopping distance increases with speed and the amount it increases by will be increasing in the respective order. The amount it increases by will be increasing because the kinetic energy of the vehicle increases with the square of the speed.
	C	X	
	D	X	

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Q38	A	X	The more tired a driver is, the longer they take to react to a hazard.
	B	✓	The correct answer. The speed of the vehicle does affect the thinking reaction time of the driver.
	C	X	Poor visibility such as fog or heavy rain means the driver cannot get closer to the vehicle, hence reducing the reaction time of the driver.
	D	X	Drugs and alcohol intoxicate the driver, increasing the reaction time.
Q39	A	✓	The correct answer. Brakes apply a frictional force against the wheels. The older they are, the more worn down they are, so the smaller the frictional force they apply, hence they are less effective.
	B	X	Icy roads decrease the friction between the tyres and the road, hence making them less effective.
	C	X	Similar to brakes, old tyres become more worn due to the friction between them and the road, therefore exert less frictional force as they get older and so become less effective at braking.
	D	X	The more kinetic energy a vehicle has, the more kinetic energy it has, so the more force is needed to stop it down. Brakes can only apply so much force; therefore, they are less effective.
Q40	A	X	You haven't converted your answer to two significant figures. Remember that the question is given to two significant figures so your answer should only be given to two significant figures.
	B	X	You have used $p = \frac{v}{m}$
	C	X	You have used $p = \frac{v}{m}$ and not converted your answer to the correct number of significant figures.
	D	✓	The correct answer. $p = m \times v = 1.35 \times 3.5 = 4.7 \text{ kg m/s}$
Q41	A	✓	The correct answer. In a closed system the momentum before and after a collision is the same, hence its name, the conservation of momentum.
	B	X	This contradicts the conservation of momentum.
	C	X	This contradicts the conservation of momentum.
	D	X	Momentum is related to energy - for a closed system, the total energy is conserved.
Q42	A	X	You have calculated your answer to too many significant figures.
	B	X	You have used $p_{\text{before}} = m_2v_1 + m_1v_2$
	C	✓	The correct answer. $p_{\text{before}} = m_1v_1 + m_2v_2 = 0.45 \times 0.75 + 0.82 \times 0.35 = 0.3375 \text{ kg m/s}$ . After the collision, $p_{\text{after}} = (m_1 + m_2)v_{12}$ , $v_{12} = \frac{p_{\text{after}}}{m_1 + m_2} = \frac{0.3375}{0.45 + 0.82} = 0.28 \text{ m/s}$
	D	X	You have used $v_{12} = p_{\text{before}}$ . Momentum and velocity are different quantities.
Q43	A	X	
	B	X	
	C	✓	The correct answer. $F = ma = m \times \frac{v-u}{t} = m \times \frac{\Delta v}{t} = \frac{m\Delta v}{\Delta t}$
	D	X	
Q44	A	✓	The correct answer. $F = m \times \frac{\Delta v}{\Delta t} = 35 \times \frac{23-0}{0.8} = 1000 \text{ N} = 1.0 \text{ kN}$
	B	X	You have used $F = m \times \Delta v \times \Delta t$
	C	X	You have used $F = m \times \frac{\Delta v}{\Delta t^2}$
	D	X	You have calculated your answer to too many significant figures.

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## Topic 6: Waves

Q45	A	X	A longitudinal wave oscillates in the direction of propagation. T
	B	✓	The correct answer. A transverse wave oscillates perpendicular
	C	X	This is a type of longitudinal wave.
	D	X	This is a type of longitudinal wave.
Q46	A	✓	The correct answer. A wave only transfers energy through a me medium move back and forth as the wave passes, but don't mov
	B	X	
	C	X	
	D	X	
Q47	A	X	You have used $f = \frac{T}{2}$
	B	X	You have used $f = A$
	C	X	You have used $f = T$
	D	✓	The correct answer. $f = \frac{1}{T} = \frac{1}{2.1} = 0.48 \text{ Hz}$
Q48	A	✓	The correct answer. The amplitude is the displacement from the point on the wave.
	B	X	This is the frequency of a wave.
	C	X	This is the wavelength of a wave.
	D	X	This is simply the average displacement of the wave. (For those equal to $\frac{\text{amplitude}}{\sqrt{2}}$ )
Q49	A	X	You have used $\lambda = \frac{1}{v \times f}$
	B	X	You have used $\lambda = \frac{v^2}{f^2}$
	C	✓	The correct answer. $\lambda = \frac{v}{f} = \frac{25}{38} = 0.66 \text{ m}$
	D	X	You have used $\lambda = \frac{f}{v}$
Q50	A	X	You have used $v = f$
	B	✓	The correct answer. $v = f\lambda = \left(\frac{1}{12.6}\right) \times 0.041 = 3.3 \text{ mm/s}$
	C	X	You have used $v = A \times f$
	D	X	You have used $v = T\lambda$
Q51	A	✓	The correct answer. The frequency is set by the frequency of the is the independent variable in the investigation.
	B	X	Amplitude is not related to the speed of the wave.
	C	X	Temperature of the water is a control variable.
	D	X	The wavelength of the generated waves is the dependent variab
Q52	A	✓	The correct answer. The angle of incidence is chosen by moving of material, hence it's the independent variable.
	B	X	This is not important in the experiment.
	C	X	This is the dependent variable.
	D	X	This is a control variable.

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Q53	A	X	
	B	✓	The correct answer. The angle between the incident ray and the normal is equal to the angle between the normal and the reflected ray.
	C	X	
	D	X	
Q54	A	X	Reflection has already been mentioned in the question. The question asks for the other two ways.
	B	X	The boundary doesn't vibrate for electromagnetic waves, only for mechanical waves).
	C	X	Superposition is the mixing of two waves; this can occur at a boundary between two media, not at a wave interacting with a boundary.
	D	✓	The correct answer. Waves can be reflected, absorbed or transmitted at a boundary.
Q55	A	X	
	B	X	
	C	✓	The correct answer. Humans can only hear in the frequency range of 20 Hz to 20 kHz. The inner parts of the ear are not sensitive to vibrations outside this range.
	D	X	
Q56	A	X	
	B	✓	The correct answer. The eardrum absorbs the sound, vibrating in response. These vibrations are transmitted to the brain.
	C	X	
	D	X	
Q57	A	X	Sound waves cannot excite individual atoms enough for their own energy level.
	B	X	Waves are not refracted as they pass through a material, only at boundaries between different materials.
	C	X	It's true that waves travel at different speeds in different materials, but it's not at boundaries between different materials. It's this reflection that allows us to see objects underwater.
	D	✓	The correct answer. Ultrasound waves are reflected at boundaries. The time it takes the wave to return tells us the depth of the boundary.
Q58	A	X	
	B	✓	The correct answer. The speed of a wave in a material is given by $v = \frac{c}{n}$ , where $c$ is the speed of light in a vacuum and $n$ is the refractive index, the lower the speed. This change in speed causes refraction (if the wave was incident on the boundary at an angle).
	C	X	
	D	X	
Q59	A	✓	All waves, including electromagnetic waves, have wavelengths.
	B	X	It's true that electromagnetic waves are transverse.
	C	X	It's true that electromagnetic waves propagate at the same speed in a vacuum.
	D	X	electromagnetic waves can have a range of wavelengths/frequencies across the electromagnetic spectrum.
Q60	A	X	
	B	X	
	C	X	
	D	✓	The correct answer. This is a high-frequency sound wave.

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Q61	A	X	
	B	✓	The correct answer. Microwaves are second to radio waves for frequency.
	C	X	
	D	X	
Q62	A	X	
	B	✓	The correct answer. The wave refracts towards the normal when it enters a high refractive index material to a low refractive index material.
	C	X	
	D	X	
Q63	A	X	
	B	X	
	C	✓	The correct answer. Radio waves have a low frequency, so oscillating electric fields induce currents in conducting materials at these low frequencies, resulting in an A
	D	X	
Q64	A	X	
	B	X	
	C	X	
	D	✓	The correct answer. The material used on each face of the cube is different and is what varies, hence it is the independent variable.
Q65	A	X	Ultraviolet light can't penetrate deep enough into the body to reach DNA and cause mutations.
	B	X	The opposite happens; the risk of skin cancer developing increases with UV exposure.
	C	X	Atoms don't become radioactive when subjected to electromagnetic radiation.
	D	✓	The correct answer. Skin cells die more quickly due to atoms being damaged by UV radiation, so skin to age more quickly.
Q66	A	X	This would be blinding with the present amount of communication.
	B	X	This amount of energy isn't necessary for communication.
	C	X	Ultraviolet light interacts with the atmosphere more than visible light.
	D	✓	The correct answer. The reflection of radio waves means they can be used for communication and can travel around Earth.
Q67	A	X	
	B	X	
	C	✓	The correct answer. Electrical heaters have a high temperature and emit infrared radiation.
	D	X	
Q68	A	✓	The correct answer. The rays first converge to make an image, then diverge to make a second image, hence the lenses are converging and diverging lenses.
	B	X	
	C	X	
	D	X	

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Q69.	A	✓	The correct answer. The image appears to come from somewhere that can't be located. A common example is the image of an object seen in a plane mirror. The image seems to be on the other side of the mirror, when in fact it's in front of the mirror.
	B	X	
	C	X	
	D	X	
Q70.	A	X	This is the definition for specular reflection.
	B	✓	The correct answer. Light reflected from a rough surface will hit your eye from many different angles so will be scattered by different angles. The result is the diffuse reflection. Images become blurry.
	C	X	This defines the colour of a surface rather than the type of reflection.
	D	X	The angle of incidence is equal to the angle of reflection assuming all incident light is parallel light.
Q71.	A	✓	You have used $magnification = \frac{(image\ height)^2}{object\ height}$
	B	X	You have used $magnification = \frac{image\ height}{(object\ height)^2}$
	C	X	You have used $magnification = image\ height \times object\ height$
	D	✓	The correct answer. $magnification = \frac{image\ height}{object\ height} = \frac{5.4}{0.67} = 8.1$
Q72.	A	X	This is the symbol for a convex lens (one which curves outwards).
	B	X	This isn't a ray diagram symbol for a lens.
	C	✓	The correct answer. A concave lens (one which curves inwards pointing towards its centre).
	D	X	This isn't a ray diagram symbol for a lens.
Q73.	A	✓	The correct answer. The red filter only allows red light to pass through. An object illuminated with white light will look red through a red filter.
	B	X	Blue light is blocked by the red filter.
	C	X	All other colours except blue and red are absorbed by the purple object. (A mix of all colours) does not reach the filter.
	D	X	Violet light is absorbed by the purple object.
Q74.	A	X	
	B	X	
	C	X	
	D	✓	The correct answer. The white light from the Sun is absorbed by the tennis ball. The green light, which is reflected, cannot pass through the filter so the tennis ball appears black.
Q75.	A	✓	The correct answer. A perfect black body will absorb all incident radiation. It is not reflected or transmitted.
	B	X	
	C	X	
	D	X	

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Q76	A	X	If the amount of radiation absorbed by the water was lower than the rate of emission, the water would cool down.
	B	✓	The correct answer. The rate of absorption of radiation from the sun is constant, therefore, energy is absorbed in a given time, so the temperature of the water increases.
	C	X	All objects absorb and emit radiation.
	D	X	The rate of absorption and the rate of emission must be different for the temperature to occur.
Q77	A	X	The colour of an object doesn't affect the emitted radiation, only the intensity.
	B	X	The mass of an object doesn't affect the intensity of emitted radiation.
	C	✓	The correct answer. The hotter an object is, the higher the intensity of emitted radiation. The wavelength of the emitted radiation also decreases with temperature.
	D	X	The shape of an object doesn't affect the intensity of emitted radiation.
Q78	A	✓	The correct answer. The temperature of an object such as Earth increases when the rate of absorption of radiation is higher than the rate of emission. This allows less radiation to escape the atmosphere, therefore decreasing the rate of emission, causing an increase in temperature.
	B	X	While greenhouse gases do reflect some incident radiation from the Earth, the rate of absorption is still higher than the rate of emission.
	C	X	If greenhouse gases absorb all wavelengths of incident radiation from the Earth, they will also emit all wavelengths of radiation. As such, there is no net gain or loss of energy.
	D	X	The 'green' in greenhouse gas refers to the effect as seen in a greenhouse, where more radiation is absorbed than emitted, causing an increase in temperature.

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## Topic 7: Magnetism and electromagnetism

Q79	A	X	Only opposite poles will attract.
	B	✓	The correct answer. Two like poles (both are north) will repel each other.
	C	X	South poles are like poles so would repel, not attract.
	D	X	Both are permanent magnets so the interaction of their magnetic fields will be repulsive.
Q80	A	X	This is a permanent magnet.
	B	X	This is an inducing magnet, the type that creates the field to magnetise other materials.
	C	✓	The correct answer. An induced magnet is a material that is susceptible to an external magnetic field. An inducing field causes the material to become magnetic.
	D	X	This half describes a permanent magnet; however, when the inducing magnet is removed the induced magnet is quickly lost.
Q81	A	X	
	B	X	
	C	✓	The correct answer. All field lines flow from the north pole to the south pole.
	D	X	
Q82	A	X	Aluminium isn't magnetic – only certain metals are.
	B	✓	The correct answer. Nickel is a magnetic material.
	C	X	Copper isn't magnetic.
	D	X	Nitrogen isn't magnetic.
Q83	A	X	Iron is magnetic so will have a field induced when near the bar magnet. An attractive force will happen.
	B	X	A magnetic force is a non-contact force.
	C	X	The induced field in the nail (or any other magnetic material) will be in the same direction as the magnet's field. This will cause an attractive force.
	D	✓	The correct answer. The magnet will induce a field in the nail that is in the same direction as the magnet's field, causing an attractive force between them.
Q84	A	X	Too far away from the magnet.
	B	✓	The correct answer. The magnetic field is strongest where the field lines are most dense, which is close to the magnet as possible at either one of its poles.
	C	X	Too far away from the magnet.
	D	X	The magnetic field strength is strongest where the field lines are most dense, which is close to the magnet as possible at either one of its poles.
Q85	A	✓	The correct answer. Both Earth and the compass needle are magnets. They will experience an attractive force when in each other's field (Earth is much larger than the needle). The needle is free to rotate so it points north.
	B	X	The induced field would be too weak to cause a large enough rotation of the needle with the field. Therefore, the needle is a permanent magnet.
	C	X	Gravitational field strength on Earth's surface is the same no matter where you are. It is measured in $\text{N kg}^{-1}$ .
	D	X	The Sun can be used to determine where north is, although it's not the best method. Earth's magnetic field to find north.

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Q86	A	X	
	B	✓	The correct answer. The magnetic field forms a loop around the wire.
	C	X	
	D	X	
Q87	A	X	A capacitor is a circuit component consisting of two parallel conductive plates. An electric field is created between the plates when they are charged.
	B	✓	The correct answer. A solenoid is a coil of current-carrying wire.
	C	X	A bar magnet doesn't carry a current – it is a permanent magnet.
	D	X	Transformers do include solenoids but a solenoid is not the name of a transformer.
Q88	A	✓	The correct answer. The field of a solenoid is like a bar magnet with one pole to the left and one to the right. The south pole of a solenoid is the side from which the current enters the solenoid.
	B	X	
	C	X	
	D	X	
Q89	A	X	It is a permanent magnet on top of the hammer and this is what makes it an electromagnet. The hammer may be magnetically induced but it is not an electromagnet.
	B	X	The magnet turns on and off every 0.2 s, not every 5 s. Also, the current changes direction every 0.2 s, not that it turns on and off every 0.2 s.
	C	✓	The correct answer. The permanent magnet on top of the hammer is repelled by the electromagnet, depending on the polarity of the current. The hammer vibrates up and down in time with the alternating current, hitting the bell.
	D	X	The bell is further away so the magnetic field strength and the force on the bell is smaller.
Q90	A	X	This is an effect of a motor, not the motor effect.
	B	✓	The correct answer. This is called the motor effect because the current-carrying conductor is placed in a magnetic field, as applied in electric motors.
	C	X	The conductor needs to be carrying a current for a force to be exerted on it.
	D	X	This is an example of the generator effect, the opposite of the motor effect.
Q91	A	X	
	B	X	
	C	X	
	D	✓	The correct answer. Using Fleming's right-hand rule, the force will be upwards.
Q92	A	X	You have used $F = \frac{Il}{r}$
	B	X	You have not converted the magnetic field strength and length into the correct units. Your answer is incorrect.
	C	X	You have used $F = \frac{Bl}{I}$
	D	✓	The correct answer. $F = BIl = 0.075 \times 0.15 \times 0.35 = 3.9 \times 10^{-3}$ N
Q93	A	X	You have not converted the quantities into the correct units, and you have used the wrong formula.
	B	X	You have not multiplied the mass by $g = 9.8$ N / kg
	C	✓	The correct answer. The weight of the cylinder is $W = mg = 0.14 \times 9.8 = 1.372$ N. The required magnetic field strength is $B = \frac{F}{Il} = \frac{1.372}{22 \times 0.14} = 0.57$ T
	D	X	You have used $B = \frac{Il}{F}$

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Q94	A	✓	The correct answer. The coils will experience a force due to the magnetic field. They rotate slightly before coming near the opposite brushless contacts then switch the direction of the current, ensuring they are always in the same direction.
	B	X	The brushless contacts ensure the coils keep rotating in the same direction.
	C	X	For a current to be induced in the coils, the coils would first need to be in a magnetic field. This isn't the initial case of the device.
	D	X	A current is flowing in a magnetic field so a force will be exerted on the coils.
Q95	A	X	The wave form of the potential difference will be sinusoidal.
	B	X	The current and, therefore, the potential difference generated will be alternating, positive and negative.
	C	X	An alternator produces an alternating current.
	D	✓	The correct answer. An alternator generates an alternating current. The wave form will be smooth due to the commutator, hence it looks sinusoidal.
Q96	A	X	The current must be alternating/varying for a varying magnetic field to be produced.
	B	✓	The correct answer. The coil is supplied with an alternating current. The two fields interact and attract/repel depending on the current direction, causing the paper cone to move. The resulting sound waves have the same frequency as the supplied current.
	C	X	The polarity of the permanent magnets will never vary.
	D	X	The permanent magnets in a loudspeaker are fixed in position.
Q97	A	✓	The correct answer. The moving coil in the presence of the magnetic field has a current to be induced in the coil. This current is direct current and is constant because the rotational speed of the fan is constant.
	B	X	The brushed contacts cause the current to keep its polarity constant. The rotational speed keeps the magnitude constant, hence the current is constant.
	C	X	Turning the motor to generate a current is known as the generator effect.
	D	X	A conductor is moving in the presence of a magnetic field so a current will be induced. An observation other than those described will be made.
Q98	A	X	
	B	X	
	C	✓	The correct answer. The magnetic field generated always opposes the motion of the magnet, hence the force opposes the motion of the magnet and it slows down.
	D	X	
Q99	A	X	The motor effect uses an electric current to create some movement. This happens in a microphone. A loudspeaker uses the motor effect.
	B	✓	The correct answer. A microphone absorbs sound waves in the diaphragm which in turn moves a magnet within a coil. This generates a current in the coil. The amplitude and frequency of the sound wave. This is known as the generator effect.
	C	X	The turning effect relates to moments and not to electromagnetic induction.
	D	X	The electromagnetic effect isn't a specific effect like the generator effect.
Q100	A	X	You have used $V_s = V_p \times \frac{N_p}{N_s}$
	B	X	You have used $V_s = \frac{(N_s \times N_p)}{V_p}$
	C	✓	The correct answer. $V_s = V_p \times \frac{N_s}{N_p} = 60 \times \frac{300}{750} = 24 \text{ V}$
	D	X	You have used $V_s = V_p$ ; however, the potential difference will be different as the number of coils is different.

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Q101	A	X	Power is the rate of energy transfer so cannot suddenly increase. Conservation of energy.
	B	X	The number of turns increases, not decreases, for a step-up transformer.
	C	X	The magnetic field strength increases with current, not potential difference.
	D	✓	The correct answer. A step-up transformer increases the potential difference and decreases the current.
Q102	A	✓	The correct answer. $V_s = V_p \times \frac{N_s}{N_p} = 70 \times \frac{225}{175} = 90 \text{ V}$ . Then $I_p = \frac{P}{V_p} = \frac{150}{70} = 2.14 \text{ A}$ .
	B	X	You have used $I_p = \frac{V_p I_s}{V_s}$ or $V_s = V_p \times \frac{N_p}{N_s}$ .
	C	X	You have used $V_s = V_p \times \frac{N_p}{N_s}$ and $I_p = \frac{V_p I_s}{V_s}$ .
	D	X	The current must change because the number of turns and potential difference are different between the primary and secondary coils.



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## Topic 8: Space physics

Q103	A	X	
	B	✓	The correct answer. There are eight planets orbiting our Sun: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.
	C	X	
	D	X	
Q104	A	X	
	B	X	
	C	X	
	D	✓	The correct answer. Our galaxy is called the Milky Way.
Q105	A	✓	The correct answer. Matter is brought together under gravity, and pressure until the conditions are right for fusion, hence a star is born.
	B	X	
	C	X	
	D	X	
Q106	A	✓	The correct answer. The core of a red supergiant becomes a white dwarf to become a black dwarf.
	B	X	This is the remnant of a core after a red supergiant becomes a black dwarf.
	C	X	This is the name of the process when a red supergiant 'explodes' and ejects its outer layers to fuse.
	D	X	This is a star early into its life, yet to reach an equilibrium state as a main sequence star.
Q107	A	X	These are known as clusters of galaxies.
	B	X	Neutron stars are left after red supergiants become supernovae and are found within nebulae.
	C	✓	The correct answer. The gas and dust clump together due to gravity, forming objects that fuse elements, releasing energy; hence, a star is born.
	D	X	This is known as a rotating black hole.
Q108	A	X	This is a type of planet.
	B	✓	The correct answer. Moons are natural satellites that orbit planets.
	C	X	Galaxies are much, much larger than planets so, therefore, don't orbit them.
	D	X	A red giant is a type of star after a main sequence star runs out of hydrogen and helium fuel. It is much larger than planets so, therefore, don't orbit them.
Q109	A	X	
	B	X	
	C	✓	The correct answer. Supernovae are explosions of stars, and occur at the end of their life cycle when they form during them.
	D	X	

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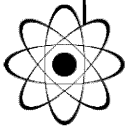


Q110	A	X	The opposite happens; its kinetic energy is transferred to gravity and the planet moves away from the star, hence it slows down.
	B	X	Velocity is a vector and the direction in which the planet moves along its orbit is circular/elliptical, hence its velocity is always changing.
	C	X	The opposite happens; its gravitational potential energy transfers to kinetic energy as the planet moves closer to the star.
	D	✓	The correct answer. As the planet moves closer to the star, its gravitational potential energy transfers to kinetic energy, hence it speeds up.
Q111	A	X	Black dwarfs stay as black dwarfs as they cool.
	B	X	Stars don't split on their own.
	C	X	The collection of matter in a nebula that doesn't become a star eventually disperses; this object starts to orbit a star and then becomes a planet.
	D	✓	The correct answer. Black holes are the densest object in the universe, not a really massive object such as a red supergiant.
Q112	A	X	Red shift is the light shifted when compared to the same light emitted from the same galaxy in the past.
	B	✓	The correct answer. All matter in the universe began in a small, dense state and rapidly started to expand. This is known as the Big Bang theory.
	C	X	Red shift is only a relative effect between two moving objects. The expansion of the universe has stretched the electromagnetic radiation leftover from the Big Bang, measure as the CMBR – but this isn't due to red shift.
	D	X	The opposite is true; distant galaxies are receding from us faster as the universe is expanding.
Q113	A	X	
	B	✓	The correct answer. This effect is known as red shift as the light is shifted towards the red end of the electromagnetic spectrum.
	C	X	
	D	X	
Q114	A	X	Main sequence stars are arguably the most known celestial objects, not planets because our own star, the Sun, has been studied for millions of years.
	B	X	Neutron stars, although interesting and newly discovered celestial objects, are mostly neutrons after protons and electrons are forced together in a supergiant core.
	C	X	Moons are natural satellites which orbit planets, hence we know about them.
	D	✓	The correct answer. We are yet to directly detect dark energy, hence we have no knowledge of what it is.

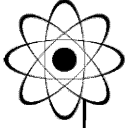
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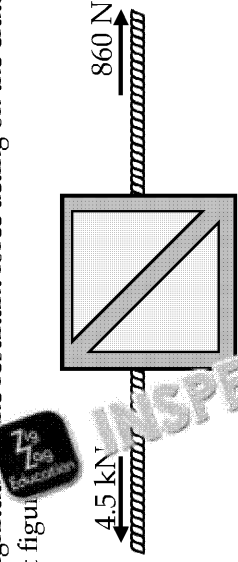


# Topic 5: Forces



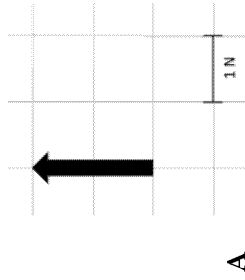
- Which of the following is the correct description of a scalar?
  - A Has magnitude only
  - B Has magnitude and direction
  - C Has direction only
  - D Has two magnitudes
- What part of a vector arrow represents the magnitude of the vector?
  - A The colour of the arrow
  - B The length of the arrow
  - C The width of the arrow
  - D The direction of the arrow
- What is meant by a contact force?
  - A A force that doesn't have a direction
  - B A force that acts between two objects that aren't touching
  - C A force that varies when two objects are kept a fixed distance apart
  - D A force that acts between two objects that are in contact
- Which of the following is **not** an example of a contact force?
  - A Tension
  - B Gravitational force
  - C Normal force
  - D Friction
- What does weight of an object depend on?
  - A The volume of the object
  - B The gravitational field strength where the object is located

7. What is the magnitude of the resultant force acting on the crate below to two significant figures?



- A 5400 N
- B 3.6 kN
- C 856 N
- D 3640 N

8. (HT only) Which of the following vectors can be resolved into a 2 N vector acting to the right and a 2 N vector acting downwards?



- A
- C

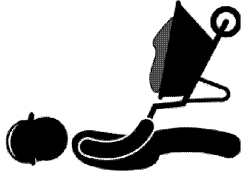
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9. A builder pushes their wheelbarrow with a constant force of 12.5 N. The builder pushes the wheelbarrow 26.8 m. How much work does the builder do on the wheelbarrow to three significant figures?

- A 470 J  C 466 J   
 B 340 J  D 335 J

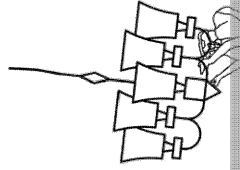


10. A metal worker uses a hacksaw to cut through a sheet of metal. After cutting the metal, the worker notices the blade of the hacksaw is very hot to touch. What has caused this?

- A The friction between the blade and metal sheet caused work to be done on the blade, raising its temperature   
 B The friction between the blade and the air has caused the temperature of the blade to increase   
 C The hacksaw must have been left on a radiator before being used   
 D It's an illusion. Metal has a high thermal conductivity which makes the blade seem hot when someone touches it.

11. A disobedient child swings from the chandelier in his grandmother's house. The extra weight causes the metal cable connecting the chandelier to the ceiling to deform. What type of deformation is occurring here?

- A Compressing   
 B Bending



13. A spring is compressed by 1.45 m from its equilibrium position. If the spring has a spring constant of 368 N/m, how much energy is stored elastically in the spring to three significant figures?

- A 368 J  C 267 J   
 B 386.9 J  D 387 J

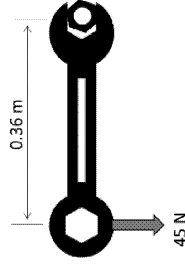


14. In an experiment investigating the relationship between the force and extension of a spring, which of the following is the dependent variable?

- A Position of ruler placed parallel against the spring   
 B Position of counterweight on the base of the clamp stand   
 C Weights attached to the end of the spring   
 D Extension of the spring

15. (Physics only) Calculate the moment on the nut shown in the diagram to the right.

- A 130 N m   
 B 16 N m   
 C 45 N m   
 D 80 N m



16. (Physics only) A force acts on the gear below causing it to turn. In which direction will the final grey gear turn?



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17. **(Physics only)** The average surface area of a frog is  $150 \text{ cm}^2$ . Assuming atmospheric pressure,  $1.0 \times 10^5 \text{ Pa}$ , acts equally over the surface area, what is the force exerted by the atmosphere on the frog?
- A 6.6 kN      C 15 kN  
 B 670 kN      D 1.5 kN

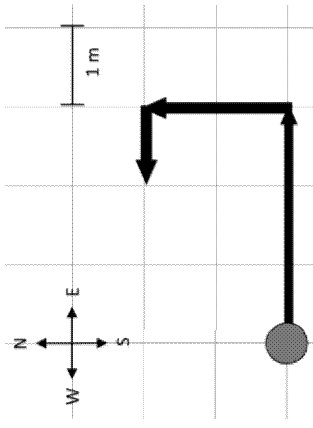


18. **(Physics and HT only)** A cylindrical fish tank standing  $12.5 \text{ m}$  tall is to be installed in the lobby of a new five-star hotel. What is the difference in water pressure between the top of the tank and a point  $3.0 \text{ m}$  from the bottom of the tank?
- A  $1.0 \times 10^5 \text{ Pa}$         
 B  $9.3 \times 10^4 \text{ Pa}$         
 C  $1.2 \times 10^5 \text{ Pa}$         
 D  $1.2 \times 10^4 \text{ Pa}$



20. What is the displacement of the grey circle if it moves along the direction of the arrows?

- A 1 m north, 2 m east        
 B 2 m north, 2 m east        
 C 1 m north, 3 m east        
 D 2 m north, 1 m east



21. The typical speed of someone walking is  $1.5 \text{ m/s}$ . Estimate the speed of a typical cyclist.
- A  $1.5 \text{ m/s}$             C  $3.0 \text{ km/s}$         
 B  $12 \text{ m/s}$             D  $6.0 \text{ m/s}$
22. A cruise ship travels  $15 \text{ km}$  in  $130$  minutes. What is the average speed of the cruise ship when it travels this distance?

- A  $6.9 \text{ m/s}$         
 B  $15 \text{ m/s}$         
 C  $1.9 \text{ m/s}$         
 D  $0.69 \text{ m/s}$



23. **(HT only)** A T-shirt sticks to the drum of a washing machine. It completes one revolution (one full rotation) every second. Which of the following is true about the speed of the T-shirt?



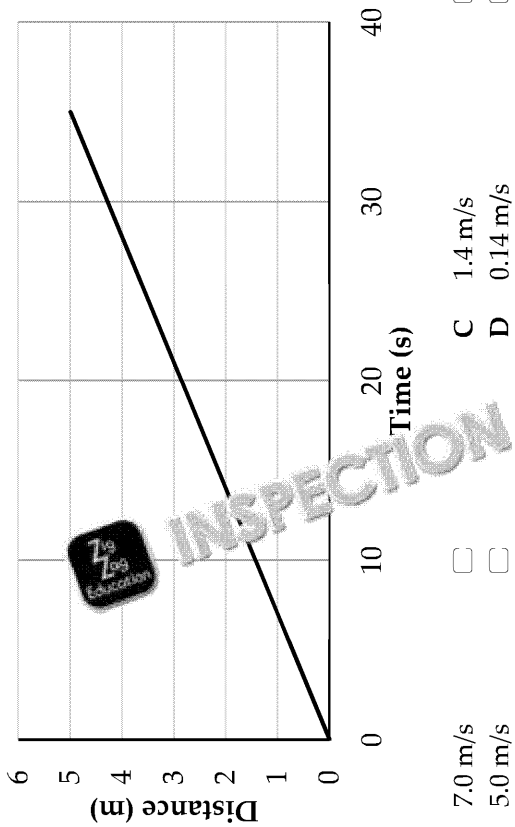
19. **(Physics and HT only)** Which of the following statements correctly describes how our atmosphere exerts a pressure on an object?
- A The air molecules collide with the object's surface, exerting a force over the object's surface area, i.e. a pressure.        
 B The higher the temperature of the atmosphere, the denser the air, so the larger the pressure exerted on the object in that air.        
 C The air molecules have a larger mass than the object's atoms so a resultant force is exerted on the object.

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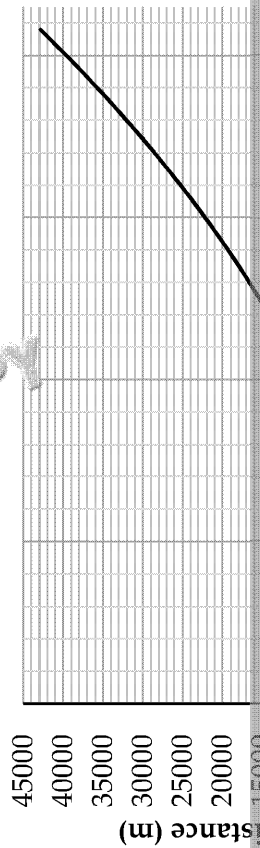
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25. What is the velocity described by the distance–time graph below?

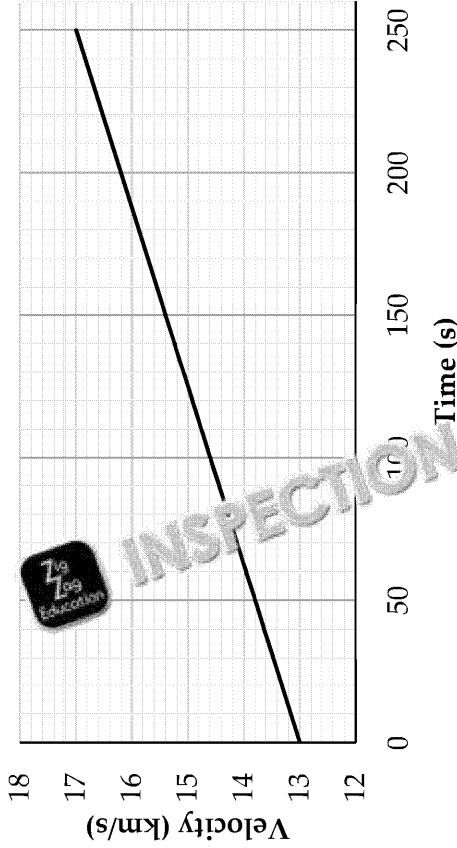


- A 7.0 m/s  C 1.4 m/s   
 B 5.0 m/s  D 0.14 m/s

26. (HT only) The distance–time graph below describes the motion of a rocket in space relative to Earth. What is its velocity at  $t = 130$  s?

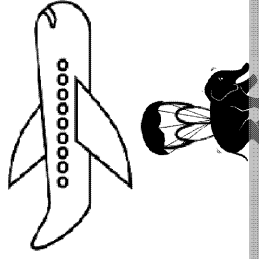


27. What is the acceleration of an object whose motion is described by the velocity–time graph below?



- A 0.016 m/s<sup>2</sup>  C 0.068 m/s<sup>2</sup>   
 B 63 m/s<sup>2</sup>  D 16 m/s<sup>2</sup>

28. A cargo plane delivering an elephant to a target area drops the elephant 12.0 km above its target area. A parachute opens as the elephant is dropped, slowing her down. How fast would she be travelling without her parachute after falling 627 m to three significant figures (assuming there is no air resistance)?



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29. A book sits on a bookshelf. Its weight is constantly acting downwards on the bookshelf, with a normal contact force acting upwards. What does Newton's first law tell us about these forces?

- A The normal contact force acts perpendicular to the weight of the book
- B The weight of the book and the normal contact force are equal in magnitude because no resultant force acts on the book
- C The normal contact force is smaller than the weight of the book, so friction between the book and the bookshelf keeps the book in place
- D The normal contact force acts in the same direction as the weight of the book

30. (Physics only) What causes a falling object to reach terminal velocity?

- A The object loses kinetic energy while falling
- B The weight of the object balances the drag force acting on the object
- C The frictional forces increase the temperature of the object until its state changes, allowing it to reach terminal velocity
- D The object starts spinning during free fall until its velocity is changing so much the object rips apart

31. A trolley with a mass of 380 g is pushed against a spring. It is then released, causing the spring to exert a constant force of 4.8 N on the trolley. Calculate the acceleration of the trolley.

- A 13 m/s<sup>2</sup>
- B 1.8 m/s<sup>2</sup>
- C 1.8 m/s<sup>2</sup>

33. (HT only) A 170 N force accelerates an object from 6.1 m/s to 9.4 m/s in 30 s. What is the mass of the object?

- A 1500 kg
- B 540 kg
- C 560 kg
- D 1600 kg

34. A child sits on a swing. The child and the swing are not moving. What can be said about the forces acting on the child?

- A The weight of the child is the only force that acts
- B The weight of the child acts against friction, but is larger in magnitude
- C The weight of the child acts in the opposite direction to a normal contact force between the child and the swing, but is greater in magnitude
- D The weight of the child is balanced by the normal contact force between the child and the seat of the swing

35. A student is investigating the acceleration of a toy car when dragged by the weight of a weight stack. The student increases the mass on the weight stack in regular increments and records the time it takes the car to move between equally spaced lines. What is the dependent variable in this investigation?

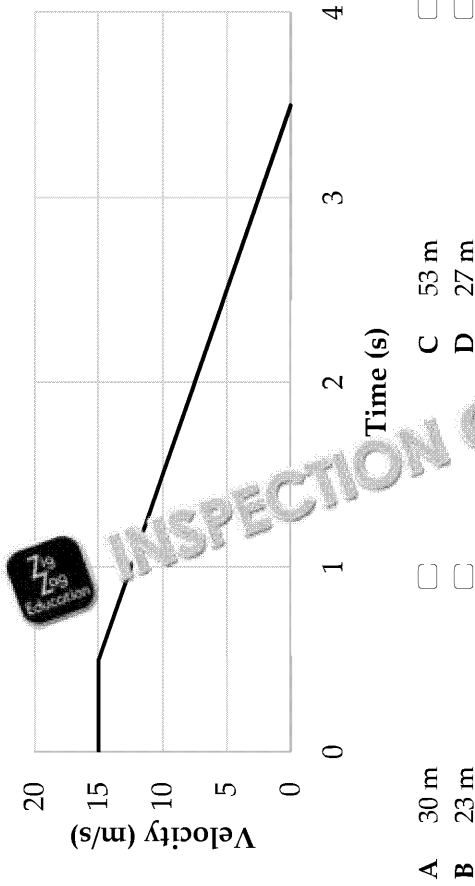
- A The time it takes the car to travel between each line
- B The distance between each horizontal line the car moves between
- C The weight on the weight stack
- D The mass of the toy car



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37. (Physics only) Below is a graph showing the stopping distance of a car as the driver performs an emergency stop. Calculate the stopping distance of the car.



38. The thinking distance of a vehicle is affected by the reaction time of the driver. Which of the following is a factor that can affect the reaction time of a driver?

- A Poor tyre conditions
- B Speed of vehicle
- C Icy roads
- D Distractions

41. (HT only) An asteroid collides with another asteroid in outer space. Both asteroids stay intact after the collision. Which law of physics can be used to determine the speed of each asteroid after the collision if the initial speeds and masses of the asteroids are known?
- A The conservation of momentum
- B The conservation of mass
- C Newton's third law
- D Newton's law of gravitation

42. (Physics and HT only) If the two objects below collide and move away together, at what speed do they move away?



- A 10 m/s  C 2.2 m/s
- B 1.9 m/s  D 2.4 m/s

43. (Physics and HT only) A tennis racket hits a tennis ball. The change in momentum of the tennis ball is 1.5 kg m/s. The force the racket exerts on the tennis ball is 60 N. How long are the tennis racket and tennis ball touching for?

- A 17 ms  C 25 ms
- B 38 ms  D 11 ms

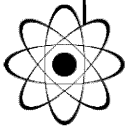
44. Which of the following statements is true?

The floors of playgrounds are made from a rubbery material that flexes when

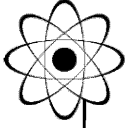
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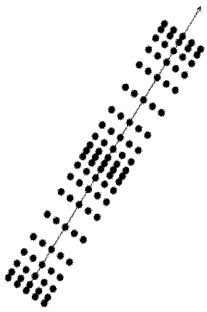


## Topic 6: Waves



45. What type of wave is shown to the right?

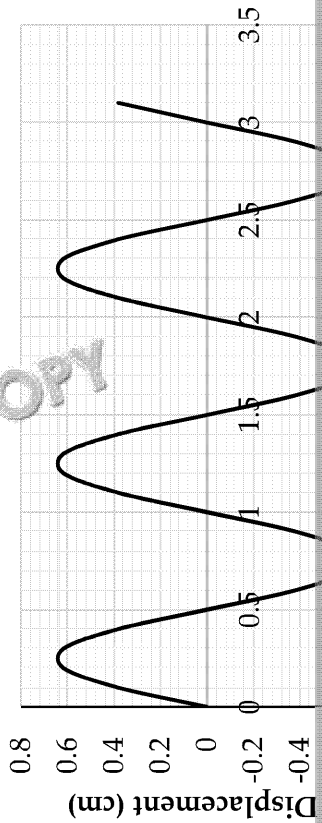
- A An electromagnetic wave
- B A transverse wave
- C A water wave
- D A longitudinal wave



46. Which of the following statements about waves is **false**?

- A A wave is the propagation of energy and not matter.
- B A wave can be either longitudinal or transverse.
- C Transverse waves show areas of compression and rarefaction.
- D A sound wave is an example of a longitudinal wave.

47. What is the frequency of the wave below?



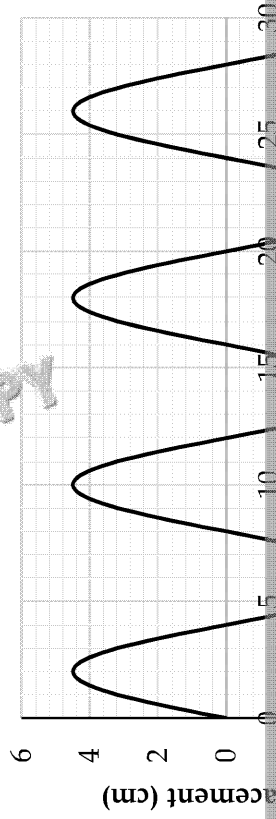
48. What is the frequency of a wave?

- A The average displacement of a wave from its equilibrium position
- B The number of cycles of a wave that occur in a single second
- C The maximum displacement of a wave from its equilibrium position
- D The distance between adjacent points on a wave with equal displacement

49. A wave travels at  $77 \text{ cm s}^{-1}$  and has a frequency of  $91 \text{ Hz}$ . What is the wavelength of the wave?

- A  $8.5 \text{ mm}$
- B  $70 \text{ mm}$
- C  $70 \text{ cm}$
- D  $120 \text{ mm}$

50. The following wave is known to have a wave speed of  $13 \text{ m/s}$ . What is its frequency?



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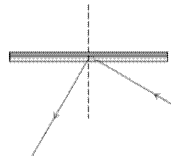
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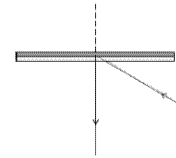
51. A ripple tank is used to investigate the wave speed of water waves. An electric motor drives a wooden rod that creates the waves, and the wavelength of the waves is measured using a ruler. The wave speed can be calculated as the gradient from a plot of wavelength against  $1/\text{frequency}$ . What is the dependent variable in this investigation?

- A The frequency of the water waves
- B The amplitude of the water waves
- C The temperature of the water
- D The wavelength of the water waves

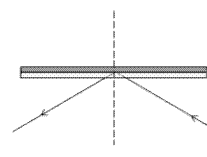
52. (Physics only) Which of the following correctly shows the reflection of the light ray shown to the right?



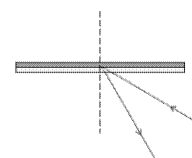
A



B



C

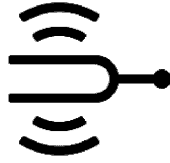


D

54. (Physics only) When a wave interacts with a boundary, any of three things can happen. One of them is the absorption of the wave by the boundary. What are the other two?

- A Absorption and reflection
- B Vibration and reflection
- C Transmission and reflection
- D Absorption and transmission

55. (Physics and HT only) When a tuning fork is struck, the prongs of the fork vibrate back and forth. Which of the following statements correctly explains how this produces sound?



- A The movement of the prongs causes areas of high and low pressure in the surrounding air that propagate away from the fork as sound waves.
- B The movement of the prongs with friction against the air causes the air to become charged. This alternating electric field generates sound waves.
- C The prongs bounce off one another, creating sounds that occur at a high frequency.
- D The movement of the prongs creates small cracks in each prong. Each time a crack appears, a sound wave is emitted. Many of these sounds occur each second, creating the sound wave associated with tuning forks.

53. (Physics only) A student is investigating the refraction of light by different

56. (Physics and HT only) Human hearing only works within a specific range of frequencies. Which of the following correctly evaluates this?

57. (Physics and HT only) Seismic waves can be categorised into two types: P-waves and S-waves. Which of the following statements about seismic waves is **false**?

- A P-waves are longitudinal waves.
- B S-waves cannot travel through a liquid.
- C S-waves travel through solids and liquids at different speeds.
- D P-waves travel at different speeds through solids and liquids.

58. A laser shines red light at a whiteboard. Which of the following is **true** about the laser light?

- A The light doesn't have a wavelength.
- B The frequency of the light varies with distance between the laser and the whiteboard.
- C The speed of the laser light is the same, no matter what medium it travels through.
- D The light is a transverse wave.

59. Below is a diagram representing the electromagnetic spectrum. Which three types of electromagnetic radiation are missing from the diagram?



- A X-ray, UV, infrared
- B Gamma rays, X-rays, infrared
- C UV, infrared, ultrasound

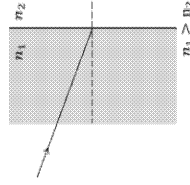
61. A student is investigating the emission of infrared radiation from different types of surface. The student covers each face of a Leslie cube with a different material and fills up the cube with hot water. The student then measures the intensity of infrared radiation emitted from each face. Which of the following are variables in this experiment?

- A The initial temperature of the water and the time interval between measurements
- B The final temperature of the water and the volume of the Leslie cube
- C The intensity of the infrared radiation and the mass of water used
- D The initial and final temperatures of the water

62. When an electromagnetic wave interacts with a substance, the wave can be absorbed, reflected or refracted. In what way in which this happens depends on what property of the wave?

- A Its amplitude
- B Its speed
- C Its wavelength
- D Its intensity

63. Which of the following diagrams correctly shows the refraction of the light ray shown to the right?



$n_1 > n_2$

$n_1 > n_2$

$n_1 > n_2$

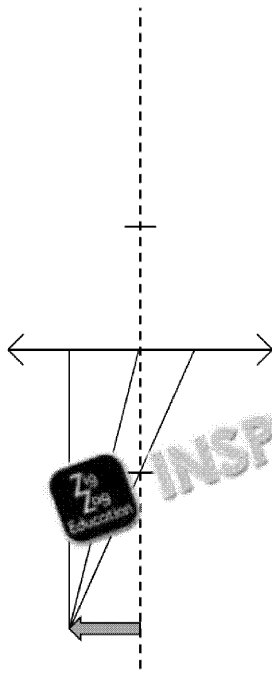
$n_1 > n_2$

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64. Which of the following is the correct completed ray diagram for the partial diagram shown below?



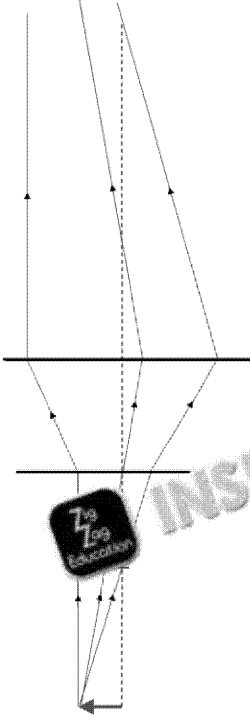
- A  B  C  D
- A  B  C  D

65. Where in the atom do gamma rays originate from?

- A From the innermost electron
- B From the nucleus
- C From the outermost electron
- D From an electron that falls to its ground state

66. What is the best type of electromagnetic radiation for sterilising food, and why?

68. (Physics only) What are the two types of lens, from left to right, in the ray diagram below?



- A Converging and diverging  C Diverging and diverging
- B Converging and converging  D Diverging and converging

69. (Physics only) A water strider can walk across the surface of water. A sample water strider is observed to have a length of 35 mm when seen through a convex lens of  $\times 15$  magnification. What is the actual length of the water strider?



- A 53 cm  C 2.3 mm
- B 2.3 cm  D 5.3 mm

70. (Physics only) What are the units for magnification?

- A  $\text{cm}^2$   C W/m
- B mm  D It has no units

71. (Physics only) Which of the following is the correct definition for specular

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72. (Physics only) Which of the following statements about colour filters is false?

- A A red filter will only allow red light to pass through
- B A filter allows all frequencies of light to pass through
- C A filter absorbs certain wavelengths of light
- D A filter will transmit a certain colour of light

73. (Physics only) An orange is viewed through a red filter. What colour does the orange appear to be?

- A White
- B Red
- C Orange
- D Black

74. (Physics only) Which of the following objects emits the most infrared radiation?

- A An ice cube
- B A dog
- C A star
- D Earth's atmosphere

75. (Physics only) A body is known to be a good absorber of radiation. Which of the following is also true about the body?

- A It's a good emitter of radiation
- B It reflects any incident radiation
- C It's a poor emitter of radiation

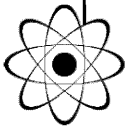
77. (Physics and HT only) From where, and when, would you expect Earth to emit the most radiation?

- A The poles during the night
- B The poles during the day
- C The equator during the night
- D The equator during the day

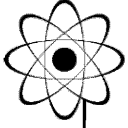


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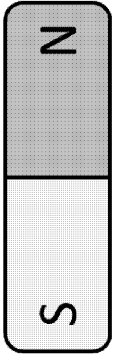
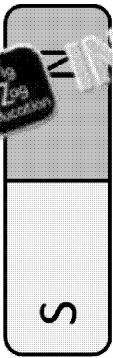
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# Topic 7: Magnetism and electromagnetism



78. What will happen to the bar magnets below?



- A They will rotate so their like poles are touching
- B They will repel each other
- C Nothing will happen
- D They will attract each other

79. What is the correct definition of a permanent magnet?

- A A magnet that produces its own magnetic field
- B A magnet that gets its magnetic field from an electrical current
- C A material that loses its magnetism after leaving a magnetic field
- D A material that becomes magnetic in the presence of a magnetic field

80. In which direction do the field lines of a magnet point?

- A They all point north
- B They point radially outwards from the magnet
- C They point from north to south
- D They point from south to north

82. What is a magnetic field?

- A The area near the ends of a magnet
- B The space between two magnets
- C The volume of space a magnet takes up
- D The area around a magnet where another magnetic material will experience a force

83. Where on Earth's surface will the magnetic field strength be weakest?

- A At the equator
- B At the North Pole
- C At the South Pole
- D At either the North Pole or the South Pole

84. A compass is placed next to a bar magnet. In which direction does the compass point?

- A Towards Earth's North Pole
- B In the direction of the magnetic field of the magnet
- C Towards the centre of the magnet
- D Towards the magnet's North Pole

85. A current carrying wire will generate its own magnetic field. What does the strength of the magnetic field depend on?

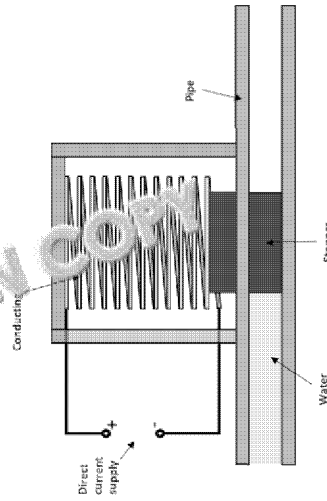
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87. A solenoid produces a magnetic field. An iron core is placed within a solenoid. What does the iron core do?
- A The iron core blocks the magnetic field from the opposite side of the coil, preventing it from interfering with and cancelling out the existing magnetic field.
  - B The iron core is induced so creates its own magnetic field, amplifying the overall magnetic field of the device.
  - C The iron core turns the magnetic field on and off more quickly when the current is turned on and off.
  - D The iron absorbs some of the generated magnetic field, allowing the coil to stay cool and operate more efficiently.

88. (Physics only) An electromagnetic valve uses a solenoid fixed to a stopper that holds back water in a pipe. Which of the following describes how the valve works?



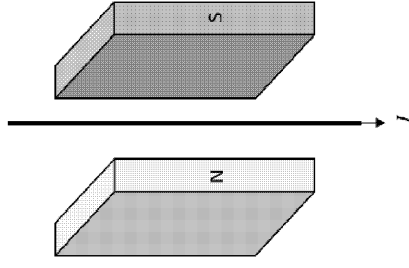
- A The magnetic field generated by the coil attracts the stopper, raising it out of the pipe.

89. (HT only) What is the motor effect?

- A The movement of charges within a conducting material.
- B The rotation of a turbine due to a fluid passing through it.
- C The force experienced by a current carrying wire and a magnet when in close proximity to each other.
- D The conversion of chemical energy into kinetic energy using a combustion engine.

90. (HT only) In which direction will the current-carrying wire to the right experience a force?

- A Out of the page
- B Upwards
- C Downwards
- D To the right



91. (HT only) A copper wire carrying 85 mA is placed in a  $2.7 \times 10^{-4}$  T magnetic field. If 12 mm of the wire is in the magnetic field, what is the magnitude of the force exerted on the wire? You will need  $F = BIl$ .

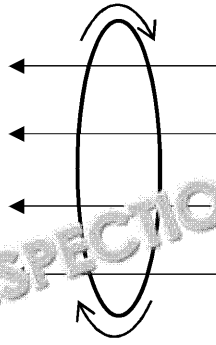
- A  $3.0 \times 10^{-4}$  N
- B  $2.8 \times 10^{-7}$  N
- C 38 mN
- D 0.38 N

93. (HT only) What is the name given to a device that uses a direct current in the presence of a magnet to turn a shaft?

- A A motor
- B A dynamo
- C An alternator
- D A solenoid

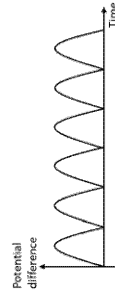
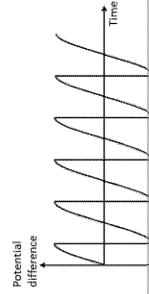


94. A loop of wire is turned in a magnetic field, as seen below. Describe what happens to the loop of wire as it turns.



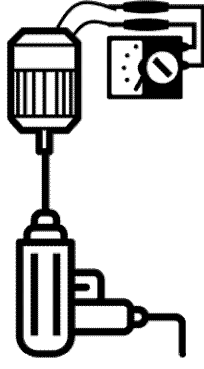
- A The loop moves downwards
- B The loop moves upwards
- C A current flows in the loop in the opposite direction as it turns
- D A current flows in the loop in the same direction as it turns

95. (Physics and HT only) Which of the following graphs shows the generated potential difference from a dynamo?



96. (Physics and HT only) What effect does a loudspeaker use to create pressure waves?

- A The Leidenfrost effect
- B The generator effect
- C The motor effect
- D The refractive effect



97. (Physics and HT only) A student connects a brushless electric motor to an ammeter. The student then connects a drill to the motor and turns on the drill. Which of the following observations is seen by the student?

- A The reading on the ammeter is constant
- B The reading on the ammeter varies between a constant positive and a constant negative value
- C The reading on the ammeter is zero
- D The reading on the ammeter is zero

98. Which of the following reasons correctly explains why transformers are used in national power transmission?

- A To decrease the current and heat loss, increasing the efficiency of power transmission
- B The reduction of current during power transmission makes the cables safer if accidentally touched

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99. (Physics and HT only) What does a microphone do?

- A It converts electrical signals into pressure waves
- B It converts pressure waves into electrical signals
- C It converts electrical signals into magnetic fields
- D It converts electrical signals into magnetic fields

100. (Physics and HT only) A transformer has 150 turns on its primary coil and 400 turns on its secondary coil. The potential difference at the primary coil is 4.5 V. What is the potential difference at the secondary coil? ( $\frac{V_p}{N_p} = \frac{V_s}{N_s}$ )

- A 1.7 V
- B 12 V
- C 27 V
- D 13 V

101. What is used to decrease the potential difference of electricity in power cables for use in homes and businesses?

- A National grid
- B Solenoid
- C Step-up transformer
- D Step-down transformer



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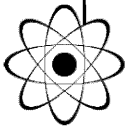
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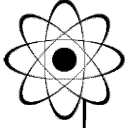


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## Topic 8: Space physics (Physics only)



102. What do the eight planets in our solar system orbit around?
- A The Milky Way  C The Sun   
 B Earth  D A natural satellite
103. How does a main sequence star stay stable during its lifetime?
- A The gravitational collapse of the star is balanced by the outward pressure from fusion reactions in the core.   
 B The rotation of the star causes a centrifugal force that balances with the gravitational force.   
 C The outward pressure from fusion reactions within the core balances gravity.   
 D The gravitational attraction from orbiting planets balances the gravitational collapse of the star.
104. What causes a star to form in a nebula?
- A The electrostatic attraction between the gravity and the dust   
 B The gravity between the dust and the gas   
 C The random fusion reactions in the nebula   
 D Aliens within the nebula put the necessary steps in place for a star to form
105. Stars are born in nebulae. What is the name given to a star before a star reaches the main sequence stage?
- A A black hole cools over time into a black dwarf   
 B The core of a red giant collapses into a white dwarf that
107. Which of the following objects is least massive?
- A Neutron star  C Planet   
 B White dwarf  D Protostar
108. Where do elements heavier than iron form?
- A Black holes  C Main sequence stars   
 B Protostars  D Supernovae
109. (HT only) A planet has a stable, circular orbit around its star. Which of the following statements is true?
- A The velocity of the planet is constant but its speed is constantly changing.   
 B The velocity of the planet is constantly changing but its speed is constant.   
 C The displacement of the planet is constant but the radius of its orbit is constantly changing.   
 D Both the displacement and radius of the planet's orbit are constantly changing.
110. How is a black dwarf formed?



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111. What was discovered in 1998 about the recession of distant galaxies?
- A The more distant a galaxy, the faster it was rotating
  - B The recession of galaxies, and hence the expansion of the universe, is slowing down
  - C The more distant a galaxy, the slower it was rotating
  - D The more distant the galaxy, the faster it was receding
- 
112. What is meant by red shift?
- A The increase in wavelength of light because it is emitted from a body moving away from the observer
  - B The increase in energy of light because it is emitted from a body that is moving towards the observer
  - C The increase in frequency of light because it is emitted from a body moving away from the observer
  - D The decrease in speed of light because it is emitted from a body moving towards the observer
- 
113. The red shift of light from distant galaxies suggests that the universe began from a hot, dense region. What is the name of this theory?
- A The Big Crunch theory
  - B The Big Bang theory
  - C The universal expansion theory
  - D The theory of relativity

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# Answers to Multiple-choice Question Bank B

1. A  
2. B  
3. D  
4. B  
5. B  
6. A  
7. B  
8. D  
9. D  
10. A  
11. C  
12. A  
13. D  
14. D  
15. B  
16. B  
17. D  
18. B  
19. A  
20. B  
21. D  
22. C  
23. B  
24. B  
25. D
26. D  
27. C  
28. B  
29. C  
30. A  
31. A  
32. C  
33. A  
34. D  
35. A  
36. B  
37. A  
38. D  
39. D  
40. B  
41. A  
42. B  
43. C  
44. D  
45. D  
46. C  
47. B  
48. B  
49. A  
50. D  
51. D  
52. C  
53. C  
54. C  
55. A
56. D  
57. C  
58. A  
59. C  
60. D  
61. A  
62. C  
63. D  
64. A  
65. B  
66. B  
67. D  
68. D  
69. C  
70. D  
71. C  
72. B  
73. B  
74. C  
75. A  
76. C  
77. D  
78. D  
79. A  
80. C  
81. C  
82. D  
83. A  
84. B  
85. C
86. A  
87. C  
88. D  
89. B  
90. C  
91. B  
92. D  
93. A  
94. C  
95. D  
96. C  
97. B  
98. A  
99. B  
100. B  
101. D  
102. C  
103. A  
104. B  
105. D  
106. A  
107. C  
108. D  
109. B  
110. B  
111. D  
112. A  
113. B



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