

Constants you will need:

$$k = 9.00 \times 10^9 \text{ Nm}^2\text{C}^{-2}$$

$$\text{speed of light} = 3.00 \times 10^8 \text{ ms}^{-1}$$

$$\text{refractive index of air} = 1.00$$

$$\text{refractive index of glass} = 1.55$$

$$\text{refractive index of water} = 1.33$$

1. An elephant is pulling a truck in one direction with 8600N of force and the mud the truck is stuck in is pulling with 8200N of force in the opposite direction.

- Calculate the net force
- Calculate the acceleration of the truck if it weighs 21000N

2.

- If there is no friction, is it harder to stop an object than it is to start it moving?
- What difference does friction make?

3. Describe the difference between mass and weight

4. How much force of friction acts on a 60kg skydiver at terminal speed?

5. Explain briefly, using Newton's third law, how either a row boat or motor boat accelerates.

6.

- Draw a diagram of a mini colliding with a truck. Show the horizontal forces acting on them.
- List all the action-reaction pairs.
- Which vehicle feels more force?
- Which feels more acceleration?

7. A stick figure representation of a man pushes a stick representation of a large ball. Use a diagram showing the horizontal forces to explain how each will accelerate.

8. Explain the following concepts

- electric fields and lines
- electrostatic charging
- electric fields inside conductors
- electric fields at sharp points
- Coulomb's Law
- proportionality and inverse squared proportionality
- polarisation

9.

- calculate the force between two charges +0.011 C and -0.030 C if they are 14 cm apart
- calculate the electric field strength at the point halfway between the two charges in part a

10. Draw the following

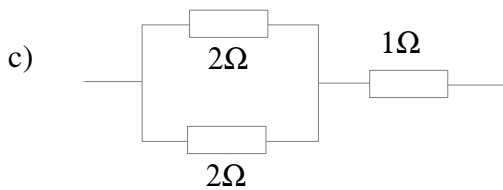
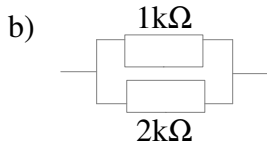
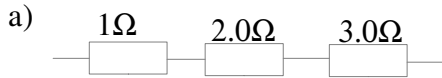
- electric field lines around a single positive charge
- electric field lines between two positive points
- electric field lines between two negative points
- electric field lines between a positive point and a negative point
- electric field lines on a positively charge conductor with a pointy end
- electric field lines between two parallel plates where one is negative and the other positive

11. Draw a diagram comparing the directions of conventional current and electron flow in a circuit

12.

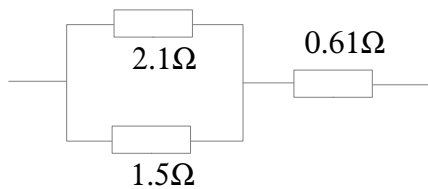
- a) What does the direction of a magnetic field line show?
- b) What does the distance between the lines show?

13. Calculate the total resistance

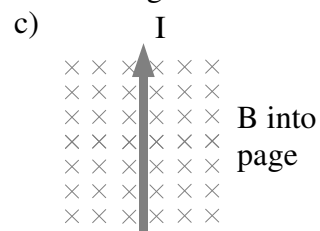
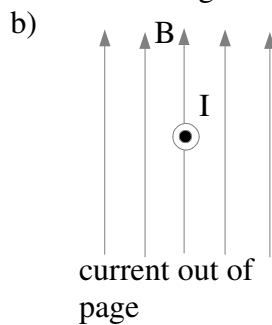
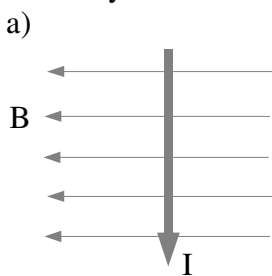


14.

- a) State Ohm's law
- b) If 1A is flowing in a circuit and there are 5V, what is the resistance?
- c) If the resistance is 3Ω and the current is 1A, what is the voltage?
- d) If the resistances are as shown below, and the current is 1.1A, what is the voltage?



15. Identify the direction of force on the following current-carrying wires in magnetic fields



16. Draw the magnetic field produced around a current-carrying wire

17.

- a) What is the magnitude of magnetic field strength for a field if a wire of length 2.0m perpendicular to the field carrying a current of 1.2A experiences a force of 0.5N?
- b) Find the magnitude of the force on a 0.50m wire placed perpendicular in a magnetic field, if the current in the wire is 6.8A and the magnetic field strength is $B = 0.40T$
- c) Find the length of wire that would need to run through a magnetic field of strength 2.2T at an angle of 36° in order to experience a force of 50N, if the current in the wire is 1.0A.

18.

- a) Draw a transverse wave. Label a wavelength, amplitude, crest and trough
- b) Draw a longitudinal wave. Label a wavelength, compression, rarefaction

19. Use the following electromagnetic waves for this question:

X-ray, green light, infrared light, radio waves, microwaves, blue light, gamma ray.

- a) List them in order of increasing frequency
- b) List them in order of increasing wavelength

20.

- a) A drummer is tapping his snare twice every second. What is the period of his tapping?
- b) He slows down so now he is tapping every 2.5 seconds. What is the frequency of tapping?

21.

- a) Find the frequency of blue light if it has a wavelength of $4.30 \times 10^{-7} \text{m}$
- b) Find the wave speed in air of the blasts given by a series of explosions, if there were 10 blasts in a second and they produced a wavelength of 34m.
- c) Hence calculate what the wavelength would be if there was a blast every 10 seconds instead.

22.

- a) What property of sound waves do we perceive as pitch?
- b) What property do we perceive as volume?

23.

- a) Draw a standing wave with 2 nodes
- b) Describe how a standing wave is produced.

24. Describe the behaviour of ripples produced by a bug bobbing up and down if it is

- a) not moving
- b) moving slower than the waves it produces
- c) moving faster than the waves it produces

25. Explain why the sound of a car engine sounds higher coming towards you and lower moving away. Make sure you mention what this effect is called.

26. Some surfaces exhibit a type of reflection which we cannot see our reflection in. Name this type of reflection and explain how it occurs.

27.

- a) Find angle of refraction for light entering water from air at an angle of 38°
- b) Calculate the angle of incidence if light leaves glass into air at an angle of 45°
- c) Find the refractive index of a medium if light enters it from air at 25° and the angle of refraction is 15°