**A-level Physics Gap Task**

City of Norwich School an Ormiston Academy

A-Level Physics



Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Maths score: \_\_\_\_\_/25

Independent Study Score: \_\_\_\_\_\_%

Physics concepts score: \_\_\_\_\_/60

# The Tasks

Ready for the first lesson back after the summer recess have this this booklet and the exercises completed to the best of your ability.

**Part 1** – Maths Questions 25 marks – you can answer directly onto the page

**Part 2** – Independent Study – you need to login and answer this section online

**Part 3** – Physics Concepts and Reasoning Skills 60 marks – please fill out the grid for the multiple choice questions

Good luck!

*The Physics Team*

Link to watch for instructions on how to complete the Gap Task - <https://youtu.be/OfpU70IAbek>

# Links for support in Gap Task

1. Mathematical support - <https://www.youtube.com/watch?v=ayjtBJ0UcqE>
2. Physics concepts support - [Introduction to A Level Physics - YouTube](https://www.youtube.com/watch?v=hYN_W8WfbGs&list=PLlDtVvefFYT9JAZspswsLLYF_ARdOzk12)

In the link for Physics concept support, there is a playlist of vidoes that we would recommend you watch. They are all the videos that have **Introduction To:** in the left hand corners

# Part 1 - Mathematical Skills

“Do not worry about your difficulties in mathematics, I assure you that mine are greater.”

Einstein

Using mathematics is a key part of understanding physics. As physics get more advance it becomes more necessary to be mathematically competent as formulae and calculations become more adept at describing phenomena.

For questions 1-5, find the size of the angle or the side marked x.

3)

1)

2)





5)

4)

(5 marks)



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6)

(4 marks)

7)

For each case please make x the subject and show all working.

(10 marks)

8)

Use the table of data below to plot an appropriate graph on the paper over leaf.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  Mass/g | Velocity 1/ms-1 | Velocity 2/ms-1 | Velocity 3/ms-1 | Mean Velocity /ms-1 |
| 0.50 | 1.61 | 1.68 | 1.69 |  |
| 0.80 | 2.35 | 2.31 | 2.32 |  |
| 1.20 | 2.54 | 2.45 | 2.56 |  |
| 1.50 | 2.81 | 2.90 | 2.81 |  |
| 1.80 | 3.10 | 3.01 | 3.08 |  |
| 2.00 | 3.12 | 3.05 | 3.17 |  |

(2 marks)

(4 marks)

# Part 2 – Independent Study

Past students have stated that the increased expectation of independent study as one of the biggest demands of studying A-level Physics. Roughly speaking, each hour of lesson should be supported by another hour of independent study. This means over a 2 week timetable, you should be doing 12 hours of independent study **on top of** any homework you are set per subject! We will help guide you in timetabling your study time if you struggle.

It can be difficult to know what exactly to do for independent study. Complete the following task as an introduction to using wider sources as an example.



1. Using the links previously suggested for support – Physics concepts to watch some of the videos.
2. Join the year 12 Physics class on Seneca using this QR code

Complete the assignments below

1. Fores, Motion and energy – <https://app.senecalearning.com/dashboard/class/fzqv9y16mx/assignments/assignment/7a9ae14b-4cfb-4e84-9706-dca806fa25b5>
2. Electromagnetic Waves and Electricity – <https://app.senecalearning.com/dashboard/class/fzqv9y16mx/assignments/assignment/eedc7c06-c77c-4a7d-975e-d825d3cdb1d7>
3. Radioactivity and the Particle Model - <https://app.senecalearning.com/dashboard/class/fzqv9y16mx/assignments/assignment/784a5bce-9a7e-4dc0-81fc-f23ea8131941>

# Part 3 - Physics concepts

One way that's kind of a fun analogy to try to get some idea of what we're doing here to try to understand nature is to imagine that the gods are playing some great game like chess. Let's say a chess game. And you don't know the rules of the game, but you're allowed to look at the board from time to time, in a little corner, perhaps. And from these observations, you try to figure out what the rules are of the game, what [are] the rules of the pieces moving.

Richard Feynman

**Throughout the A-Level Physics course you will identify new concepts and deeper understanding of the Physics and the phenomena you thought you already knew. One of the skills that is vital is being able to unpick complex questions and apply the correct law or principal. The questions on the next page are designed to do just that. For each question choose the BEST answer. Fill your answers on the answer sheet provided on the next page**! **Questions follow on next page.**

|  |
| --- |
| Answer Grid |
|  | Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Time Spent\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
|  | **1** | [A] | [B] | [C] | [D] | [E] |  | **21** | [A] | [B] | [C] | [D] | [E] |  | **41** | [A] | [B] | [C] | [D] | [E] |  |
|  | **2** | [A] | [B] | [C] | [D] | [E] |  | **22** | [A] | [B] | [C] | [D] | [E] |  | **42** | [A] | [B] | [C] | [D] | [E] |  |
|  | **3** | [A] | [B] | [C] | [D] | [E] |  | **23** | [A] | [B] | [C] | [D] | [E] |  | **43** | [A] | [B] | [C] | [D] | [E] |  |
|  | **4** | [A] | [B] | [C] | [D] | [E] |  | **24** | [A] | [B] | [C] | [D] | [E] |  | **44** | [A] | [B] | [C] | [D] | [E] |  |
|  | **5** | [A] | [B] | [C] | [D] | [E] |  | **25** | [A] | [B] | [C] | [D] | [E] |  | **45** | [A] | [B] | [C] | [D] | [E] |  |
|  | **6** | [A] | [B] | [C] | [D] | [E] |  | **26** | [A] | [B] | [C] | [D] | [E] |  | **46** | [A] | [B] | [C] | [D] | [E] |  |
|  | **7** | [A] | [B] | [C] | [D] | [E] |  | **27** | [A] | [B] | [C] | [D] | [E] |  | **47** | [A] | [B] | [C] | [D] | [E] |  |
|  | **8** | [A] | [B] | [C] | [D] | [E] |  | **28** | [A] | [B] | [C] | [D] | [E] |  | **48** | [A] | [B] | [C] | [D] | [E] |  |
|  | **9** | [A] | [B] | [C] | [D] | [E] |  | **29** | [A] | [B] | [C] | [D] | [E] |  | **49** | [A] | [B] | [C] | [D] | [E] |  |
|  | **10** | [A] | [B] | [C] | [D] | [E] |  | **30** | [A] | [B] | [C] | [D] | [E] |  | **50** | [A] | [B] | [C] | [D] | [E] |  |
|  | **11** | [A] | [B] | [C] | [D] | [E] |  | **31** | [A] | [B] | [C] | [D] | [E] |  | **51** | [A] | [B] | [C] | [D] | [E] |  |
|  | **12** | [A] | [B] | [C] | [D] | [E] |  | **32** | [A] | [B] | [C] | [D] | [E] |  | **52** | [A] | [B] | [C] | [D] | [E] |  |
|  | **13** | [A] | [B] | [C] | [D] | [E] |  | **33** | [A] | [B] | [C] | [D] | [E] |  | **53** | [A] | [B] | [C] | [D] | [E] |  |
|  | **14** | [A] | [B] | [C] | [D] | [E] |  | **34** | [A] | [B] | [C] | [D] | [E] |  | **54** | [A] | [B] | [C] | [D] | [E] |  |
|  | **15** | [A] | [B] | [C] | [D] | [E] |  | **35** | [A] | [B] | [C] | [D] | [E] |  | **55** | [A] | [B] | [C] | [D] | [E] |  |
|  | **16** | [A] | [B] | [C] | [D] | [E] |  | **36** | [A] | [B] | [C] | [D] | [E] |  | **56** | [A] | [B] | [C] | [D] | [E] |  |
|  | **17** | [A] | [B] | [C] | [D] | [E] |  | **37** | [A] | [B] | [C] | [D] | [E] |  | **57** | [A] | [B] | [C] | [D] | [E] |  |
|  | **18** | [A] | [B] | [C] | [D] | [E] |  | **38** | [A] | [B] | [C] | [D] | [E] |  | **58** | [A] | [B] | [C] | [D] | [E] |  |
|  | **19** | [A] | [B] | [C] | [D] | [E] |  | **39** | [A] | [B] | [C] | [D] | [E] |  | **59** | [A] | [B] | [C] | [D] | [E] |  |
|  | **20** | [A] | [B] | [C] | [D] | [E] |  | **40** | [A] | [B] | [C] | [D] | [E] |  | **60** | [A] | [B] | [C] | [D] | [E] |  |

1. In the absence of air resistance, a ball of mass m is tossed upward to reach a height of 20 m. At the 10-m position, half way up, the net force on the ball is
2. 2mg.
3. mg.
4. .
5. .
6. When you drop a ball it accelerates downward at 9.8 m/s2. If you instead throw it downward, then its acceleration immediately after leaving your hand, assuming no air resistance, is
7. 9.8 ms=2
8. more than 9.8 ms=2.
9. less than 9.8 ms=2.
10. Cannot say, unless the speed of throw is given.
11. A heavy rock and a light rock in free fall (zero air resistance) have the same acceleration. The reason the heavy rock doesn’t have a greater acceleration is that the
12. force due to gravity is the same on each.
13. air resistance is always zero in free fall.
14. inertia of both rocks is the same.
15. ratio of force to mass is the same.
16. None of these
17. A cannonball is fired horizontally at 10 m/s from a cliff. Its speed one second after being fired is about
	1. 10 m/s.
	2. 14 m/s.
	3. 16 m/s.
	4. 20 m/s.
18. Relative to the ground, an airplane gains speed when it encounters wind from behind, and loses speed when it encounters wind head on. When it encounters wind at a right angle to the direction it is pointing, its speed relative to the ground below
	1. increases.
	2. decreases.
	3. is the same as if there were no wind.
	4. Need more information.
19. A karate chop delivers a force of 3000 N to a board that breaks. The force that the board exerts on the hand during this event is
	1. less than 3000 N.
	2. 3000 N.
	3. greater than 3000 N.
	4. Need more information.
20. A math book and a physics book are tied together with a length of string. With the string taut, one book is pushed off the edge of a table. As it falls, the other book is dragged horizontally across the table surface. With no friction, acceleration of the books is
	1. zero.
	2. .
	3. g.
	4. a value between zero and g.
	5. a value that could be greater than g.
21. When an increase in speed doubles the momentum of a moving body, its kinetic energy
	1. increases, but less than doubles.
	2. doubles.
	3. more than doubles.
	4. depends on factors not stated.
22. When an increase in speed doubles the kinetic energy of a moving body, its momentum
	1. increases, but less than doubles.
	2. doubles.
	3. more than doubles.
	4. depends on factors not stated.
23. Big brother and little sister can balance on a seesaw because of balanced
	1. forces.
	2. torques.
	3. energies.
	4. All of these.
24. When a spinning system contracts in the absence of an external torque, its rotational speed increases and its angular momentum
	1. decreases.
	2. increases.
	3. remains unchanged.
	4. may increase or decrease.
25. Consider a ball rolling down an inclined plane. The normal force on the ball (the force perpendicular to the plane).
	1. is mg.
	2. is greater than mg, always.
	3. may be greater or less than mg.
	4. is less than mg, always.
26. Consider a ball rolling in a horizontal circular path on the inside surface of a cone. The normal force on the ball
	1. is mg.
	2. is greater than mg, always.
	3. may be greater or less than mg.
	4. is less than mg, always.
27. When a ball at rest hangs by a single vertical string, tension in the string is mg. If the ball is made to move in a horizontal circle so that the string describes a cone, string tension
	1. is mg.
	2. is greater than mg, always.
	3. is less than mg, always.
	4. may be greater or less than mg depending on the speed of the ball.
28. Imagine you're standing on the surface of a shrinking planet. If it shrinks to one-tenth its original diameter with no change in mass, on the shrunken surface you'd weigh
	1. 1/100 as much.
	2. 10 times as much.
	3. 100 times as much.
	4. 1000 times as much.
	5. None of these.
29. The fact that the Moon always shows its same face to Earth is evidence that the Moon rotates about its axis about once per
	1. day.
	2. month.
	3. year.
	4. None of these, for the moon does not rotate about an axis.
30. The Moon is most responsible for Earth’s tides. Which pulls more strongly on the Earth and its oceans?
	1. Moon.
	2. Sun.
	3. Both about equally.
31. A spacecraft on its way from Earth to the Moon is pulled equally by Earth and Moon when it is
	1. closer to the Earth’s surface.
	2. closer to the Moon’s surface.
	3. half way from Earth to Moon.
	4. At no point, since Earth always pulls more strongly.
32. Earth satellites such as the Space Shuttle orbit at altitudes that are above the Earth’s
	1. atmosphere.
	2. gravitational field.
	3. Both of these.
33. The mass of a classical atom comes mostly from its \_\_\_\_ ; and its volume from its \_\_\_\_\_\_.
	1. nucleons; nucleons.
	2. electrons; electrons.
	3. electrons; nucleons.
	4. nucleons; electrons.
34. Consider a block of wood floating on water. If you push down on the top of the block until it’s completely submerged, the buoyant force on it
	1. increases.
	2. decreases.
	3. remains the same.
	4. depends on how far beneath the water surface it is pushed.
35. An inflated balloon with a heavy rock tied to it submerges in water. As the balloon sinks deeper and deeper, the buoyant force acting on it
	1. increases.
	2. decreases.
	3. remains largely unchanged.
	4. Need more information.
36. The principal source of the Earth’s internal energy is
	1. tidal friction.
	2. gravitational pressure.
	3. radioactivity.
	4. geothermal heat.
37. The surface of Planet Earth loses energy to outer space due mostly to
	1. conduction.
	2. convection.
	3. radiation.
	4. radioactivity.
38. The "greenhouse gases" that contribute to global warming absorb
	1. more visible radiation than infrared.
	2. more infrared radiation than visible.
	3. visible and infrared about equally.
	4. very little radiation of any kind.
39. In a mixture of hydrogen, oxygen, and nitrogen gases at a given temperature, the molecules having the greatest average speed are those of
40. hydrogen.
41. oxygen.
42. nitrogen.
43. But all have the same speed on average.
44. The electrical force of attraction between an electron and a proton is greater on the
45. proton.
46. electron.
47. Neither; both are the same.
48. Immediately after two separated charged particles are released from rest, both increase in speed. The particles therefore have
	1. the same sign of charge.
	2. opposite signs of charge.
	3. either the same or opposite signs of charge.
	4. Need more information.
49. Compared with the current in the white-hot filament of a common lamp, the current in the connecting wire is
	1. less.
	2. more.
	3. the same.
	4. Need more information.
50. As more lamps are connected in a series circuit, the current in the power source
	1. increases.
	2. decreases.
	3. remains much the same.
	4. Need more information.
51. As more lamps are connected in parallel in a circuit, the current in the power source
	1. increases.
	2. decreases.
	3. remains much the same.
	4. Need more information.
52. A capacitor loses half its charge every second. If after five seconds its charge is q, what was its initial charge?
	1. 4q.
	2. 8q.
	3. 16q.
	4. 32q.
	5. None of these.
53. The magnetic force on a moving charged particle can change the particle’s
	1. speed.
	2. direction.
	3. Both of these.
	4. Neither of these.
54. A step-up transformer in an electrical circuit can step up
	1. voltage.
	2. energy.
	3. Both of these.
	4. Neither of these.
55. The mutual induction of electric and magnetic fields can produce
	1. light.
	2. energy.
	3. Both of these.
	4. Neither of these.
56. All of the following are electromagnetic waves EXCEPT
	1. radio waves.
	2. microwaves.
	3. light waves.
	4. X-rays.
	5. None is outside the family; all are electromagnetic waves.
57. You swing to and fro on a playground swing. If you stand rather than sit, the time for a to-and-fro swing is
	1. lengthened.
	2. shortened.
	3. unchanged.
58. Compared with the sound you hear from the siren of a stationary fire engine, the sound you hear when it approaches you has an increased
	1. speed.
	2. frequency.
	3. Both of these.
	4. Neither of these.
59. During the time an aircraft produces a sonic boom, the aircraft is
	1. breaking the sound barrier.
	2. pulling out of a subsonic dive.
	3. flying faster than sound.
	4. Each of these produces a sonic boom.
60. The phenomenon of interference occurs for
	1. sound waves.
	2. light waves.
	3. Both of these.
	4. Neither of these.
61. The speed of sound in air depends on
	1. frequency.
	2. wavelength.
	3. air temperature.
	4. All of these.
	5. None of these.
62. Your friend states that under all conditions, any radio wave travels faster than any sound wave. You
	1. agree with your friend.
	2. disagree with your friend.
63. The phenomenon of beats results from sound
	1. reflection.
	2. refraction.
	3. interference.
	4. All of these.
	5. None of these.
64. To view your full-face image in a steamy mirror, compared to the height of your face, the minimum height of the patch to wipe away is
	1. one-quarter.
	2. one-half.
	3. the same.
	4. dependent on your distance from the mirror.
65. Light reflecting from a smooth surface undergoes a change in
	1. frequency.
	2. speed.
	3. wavelength.
	4. All of these.
	5. None of these.
66. Which of these changes when light refracts in passing from one medium to another?
	1. Speed.
	2. Wavelength.
	3. Both of these.
	4. Neither of these.
67. When white light passes through a prism, green light is bent more than
	1. blue light.
	2. violet light.
	3. red light.
	4. Two of these choices are correct.
	5. None of these choices is correct.
68. When you look at the red petals of a rose, the colour light you're seeing is
	1. red.
	2. green.
	3. white minus red.
	4. a mixture of green and yellow.
	5. cyan.
69. When the colour yellow is seen on your TV screen, the phosphors being activated on the screen are
	1. mainly yellow.
	2. blue and red.
	3. green and yellow.
	4. red and green.
70. The red glow in the neon tube of an advertising sign is a result of
	1. fluorescence.
	2. incandescence.
	3. polarization.
	4. coherence.
	5. de-excitation.
71. Polarization is a property of
	1. transverse waves.
	2. longitudinal waves.
	3. all waves.
	4. None of these.
72. 52. Astrophysicists are able to identify the elements in the outer layers of a star by studying its
	1. Doppler effect.
	2. molecular structure.
	3. temperature.
	4. spectrum.
73. If the Sun collapsed to become a black hole, Planet Earth would
	1. continue in its present orbit.
	2. fly off in a tangent path.
	3. likely be sucked into the black hole.
	4. be pulled apart by tidal forces.
	5. Both C and D.
74. Any atom that emits an alpha particle or beta particle
	1. becomes an atom of a different element, always.
	2. may become an atom of a different element.
	3. becomes a different isotope of the same element.
	4. increases its mass.
75. Suppose the number of neutrons in a reactor that is starting up doubles each minute, reaching one billion neutrons in 10 minutes. When did the number of neutrons reach half a billion?
	1. 1 minute.
	2. 2 minutes.
	3. 5 minutes.
	4. 9 minutes.
	5. None of these.
76. When a uranium nucleus undergoes fission, the energy released is primarily in the form of
	1. gamma radiation.
	2. kinetic energy of fission fragments.
	3. kinetic energy of ejected neutrons.
	4. All of these about equally.
77. When a fusion reaction converts a pair of hydrogen isotopes to an alpha particle and a neutron, most of the energy released is in the form of
	1. gamma radiation.
	2. kinetic energy of the alpha particle.
	3. kinetic energy of the neutron.
	4. All of these about equally.
78. Because there is an upper limit on the speed of particles, there is also an upper limit on
	1. momentum.
	2. kinetic energy.
	3. temperature.
	4. All of these.
	5. None of these.
79. Relativistic equations for time dilation, length contraction, and relativistic momentum and energy hold true at
	1. speeds near that of light.
	2. everyday low speeds.
	3. all speeds.
	4. only approximately.
80. The equation E = mc2 indicates that energy
	1. equals mass moving at the speed of light squared.
	2. equals moving mass.
	3. is fundamentally different than mass.
	4. and mass are closely related.