3.12 Physics: Light, Sound and Space: 1-hour Pack

ISEB CE 13+ Science (Physics) · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Which of these is a luminous object?

- [ ] A) a mirror
- [ ] B) a planet
- [ ] C) the Sun
- [ ] D) the Moon
- [ ] E) a white wall

2 The eight planets orbit at different distances from the Sun. Name the two planets whose orbits are between the Sun and the Earth's orbit.

(1)

3 Dev sees a lightning flash and hears the thunder 10 s later. Taking the speed of sound as 340 m/s and ignoring the time light takes to arrive, calculate the distance to the lightning in m.

- [ ] A) 3400 m
- [ ] B) 34 m
- [ ] C) 1700 m
- [ ] D) 350 m
- [ ] E) 34000 m

4 During a thunderstorm, Maya hears the thunder 12 seconds after the lightning. The speed of sound is 340 m/s. State the distance in kilometres, to 1 decimal place.

(1)

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5 Nina shouts towards a cliff and hears the echo 5.4 s later. The speed of sound is 340 m/s. Calculate the distance to the cliff in m.

- ☐ A) 9180 m
- ☐ B) 459 m
- ☐ C) 1836 m
- ☐ D) 918 m
- ☐ E) 3672 m

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6 What is the name for a material that blocks all light?

- ☐ A) transparent
- ☐ B) translucent
- ☐ C) reflective
- ☐ D) luminous
- ☐ E) opaque

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7 Femi shouts towards a cliff and hears the echo 1.4 s later. The speed of sound is 340 m/s. Calculate the distance to the cliff in m.

- ☐ A) 952 m
- ☐ B) 238 m
- ☐ C) 119 m
- ☐ D) 2380 m
- ☐ E) 476 m

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8 During a thunderstorm, Jake hears the thunder 6 seconds after the lightning. The speed of sound is 340 m/s. State the distance in kilometres, to 1 decimal place.

(1)

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9 Dev shouts towards a cliff and hears the echo 0.4 s later. The speed of sound is 340 m/s. Calculate the distance to the cliff in m.

- [ ] A) 136 m
- [ ] B) 850 m
- [ ] C) 272 m
- [ ] D) 68 m
- [ ] E) 34 m

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10 A sound travels at 340 m/s through air. How long does it take to travel 340 m?

- [ ] A) 0.1 s
- [ ] B) 2 s
- [ ] C) 1 s
- [ ] D) 115600 s
- [ ] E) 10 s

---

11 A ray of light hits a plane mirror. The ray hits the mirror such that the angle between the incident ray and the mirror surface itself is 50 degrees. Calculate the angle of incidence, measured from the normal.

(1)

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12 Chloe sees a lightning flash and hears the thunder 6 s later. Taking the speed of sound as 340 m/s and ignoring the time light takes to arrive, calculate the distance to the lightning in m.

- [ ] A) 2040 m
- [ ] B) 204 m
- [ ] C) 346 m
- [ ] D) 20400 m
- [ ] E) 1020 m

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13 Fiona stands facing a tall cliff and claps. She hears the echo 2.8 seconds later. The speed of sound is 340 m/s. Calculate the distance between Fiona and the cliff.

(1)

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14 The Moon does not produce its own light. We see it because it reflects sunlight, and its appearance from Earth changes throughout the month.

(a) State where the Moon gets the light that we see it by. **(1)**

(b) Explain why we see different phases of the Moon (e.g. new moon, half moon, full moon) during the month. **(2)**

(c) State the approximate length of time it takes for the Moon to complete one full cycle of phases (e.g. from one full moon to the next). **(1)**

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15 Hana sees a lightning flash and hears the thunder 4 s later. Taking the speed of sound as 340 m/s and ignoring the time light takes to arrive, calculate the distance to the lightning in m.

- ☐ A) 680 m
- ☐ B) 1360 m
- ☐ C) 344 m
- ☐ D) 85 m
- ☐ E) 13600 m

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16 During a thunderstorm, Zara hears the thunder 15 seconds after the lightning flash. The speed of sound in air is 340 m/s. Calculate the distance between Zara and the lightning strike.

(1)

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17 Rosa is testing how different materials allow light through: a sheet of clear acrylic, rice paper, and a brick. State whether clear acrylic is transparent, translucent or opaque.

(1)

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18 Kofi shouts towards a cliff and hears the echo 4.4 s later. The speed of sound is 340 m/s. Calculate the distance to the cliff in m.

- [ ] A) 374 m
- [ ] B) 7480 m
- [ ] C) 748 m
- [ ] D) 2992 m
- [ ] E) 1496 m

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19 Marcus is testing light passage through materials: clear plastic, frosted plastic, and a wooden plank. State whether the wooden plank is transparent, translucent or opaque.

(1)

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20 Ben shouts towards a cliff and hears the echo 5.8 s later. The speed of sound is 340 m/s. Calculate the distance to the cliff in m.

- [ ] A) 9860 m
- [ ] B) 3944 m
- [ ] C) 1972 m
- [ ] D) 986 m
- [ ] E) 493 m

---

21 Humans are inhabitants of the solar system. State which planet we call home.

(1)

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22 Ben shouts towards a cliff and hears the echo 0.6 s later. The speed of sound is 340 m/s. Calculate the distance to the cliff in m.

- [ ] A) 408 m
- [ ] B) 204 m
- [ ] C) 1020 m
- [ ] D) 51 m
- [ ] E) 102 m

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23 When three coloured lights are mixed together, the three primary colours used are which three?

(1)

24 A sound travels at 340 m/s through air. How long does it take to travel 2550 m?

- ☐ A) 2210 s
- ☐ B) 7.5 s
- ☐ C) 867000 s
- ☐ D) 75 s
- ☐ E) 15 s

25 A ray of light hits a flat mirror at an angle of incidence of 20 degrees. State the angle of reflection.

(1)

26 Omar shouts towards a cliff and hears the echo 5 s later. The speed of sound is 340 m/s. Calculate the distance to the cliff in m.

- ☐ A) 850 m
- ☐ B) 425 m
- ☐ C) 68 m
- ☐ D) 1700 m
- ☐ E) 3400 m

27 A ray of light hits a plane mirror at an angle of incidence of 40 degrees. State the angle of reflection.

(1)

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28 Kofi sees a lightning flash and hears the thunder 7 s later. Taking the speed of sound as 340 m/s and ignoring the time light takes to arrive, calculate the distance to the lightning in m.

- [ ] A) 238 m
- [ ] B) 23800 m
- [ ] C) 2380 m
- [ ] D) 1190 m
- [ ] E) 347 m

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29 All colours can be made by mixing the three primary colours of light. State the names of these three colours.

(1)

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30 A sound travels at 340 m/s through air. How long does it take to travel 5100 m?

- [ ] A) 4760 s
- [ ] B) 15 s
- [ ] C) 150 s
- [ ] D) 1734000 s
- [ ] E) 30 s

---

31 Ella shouts towards a cliff and hears the echo 5.2 s later. The speed of sound is 340 m/s. Calculate the distance to the cliff in m.

- [ ] A) 884 m
- [ ] B) 8840 m
- [ ] C) 1768 m
- [ ] D) 3536 m
- [ ] E) 442 m

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32 The Earth moves in two different ways through space: spinning on its own axis and orbiting the Sun. State how long the Earth takes to spin completely on its axis.

(1)

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33 The table below shows the approximate speed of sound in three different media.

Medium: air, water, steel

Speed of sound (m/s): 340, 1500, 5000

(a) State, using the table, which of the three media sound travels fastest through. **(1)**

(b) A sound wave travels a distance of 1000 m through steel. Calculate the time this takes. **(2)**

(c) Calculate the time the same sound wave would take to travel the same 1000 m distance through air. **(2)**

(d) Explain, in terms of particles, why sound travels faster through steel (a solid) than through air (a gas). **(1)**

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34 Noah is checking light through materials: window glass, wax paper, and a metal sheet. State whether wax paper is transparent, translucent or opaque.

(1)

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35 George shouts towards a cliff and hears the echo 5.6 s later. The speed of sound is 340 m/s. Calculate the distance to the cliff in m.

- ☐ A) 9520 m
- ☐ B) 1904 m
- ☐ C) 476 m
- ☐ D) 3808 m
- ☐ E) 952 m

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36 Leah is testing light transmission through various materials: clear cellophane, tissue paper, and a stone slab. State whether clear cellophane is transparent, translucent or opaque.

(1)

37 When light hits a flat mirror at an angle of incidence of 50 degrees from the normal, state the angle of reflection.

(1)

38 A sound travels at 340 m/s through air. How long does it take to travel 680 m?

- ☐ A) 231200 s
- ☐ B) 2 s
- ☐ C) 0.5 s
- ☐ D) 4 s
- ☐ E) 340 s

39 Marcus is investigating how well light passes through different materials: a piece of clear plastic, frosted plastic, and a wooden plank. State whether clear plastic is transparent, translucent or opaque.

(1)

40 A sound travels at 340 m/s through air. How long does it take to travel 2720 m?

- ☐ A) 16 s
- ☐ B) 0.125 s
- ☐ C) 924800 s
- ☐ D) 2380 s
- ☐ E) 8 s

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41 A light ray strikes a flat mirror with an angle of incidence of 25 degrees. State the angle of reflection.

(1)

42 A sound travels at 340 m/s through air. How long does it take to travel 4250 m?

- [ ] A) 0.08 s
- [ ] B) 3910 s
- [ ] C) 12.5 s
- [ ] D) 25 s
- [ ] E) 1445000 s

43 Leah sees a lightning flash and hears the thunder 12 s later. Taking the speed of sound as 340 m/s and ignoring the time light takes to arrive, calculate the distance to the lightning in m.

- [ ] A) 4080 m
- [ ] B) 40800 m
- [ ] C) 2040 m
- [ ] D) 408 m
- [ ] E) 352 m

44 Which of the eight planets in our solar system is home to all humans and most other animals?

(1)

45 Sam sees a lightning flash and hears the thunder 3 s later. Taking the speed of sound as 340 m/s and ignoring the time light takes to arrive, calculate the distance to the lightning in m.

- [ ] A) 102 m
- [ ] B) 343 m
- [ ] C) 510 m
- [ ] D) 1020 m
- [ ] E) 10200 m

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46 Rosa is testing how light passes through materials: clear acrylic, rice paper, and a brick. State whether rice paper is transparent, translucent or opaque.

(1)

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47 Light travels through space at a speed of 300 000 km/s. The average distance from the Sun to the Earth is 150 000 000 km. The average distance from the Earth to the Moon is 384 000 km.

(a) Calculate the time it takes for light to travel from the Sun to the Earth, giving your answer in seconds. **(2)**

.....

(b) Convert your answer to part (a) into minutes and seconds. **(1)**

.....

(c) Calculate the time it takes for light to travel from the Earth to the Moon, giving your answer to 2 significant figures. **(2)**

.....

(d) State one reason why astronauts communicating by radio between the Earth and the Moon notice a short delay in their conversation, using your answer to part (c). **(1)**

.....

48 The solar system is made up of the Sun, the planets, and other objects that orbit it.

(a) State the name of the star at the centre of the solar system. **(1)**

(b) State which planet in the solar system we live on. **(1)**

(c) State what is meant by a 'moon', using the Moon that orbits the Earth as your example. **(1)**

(d) Name the two planets that orbit closer to the Sun than the Earth does. **(1)**

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Mark scheme · 3.12 Physics: Light, Sound and Space: 1-hour Pack

Question 1

C (the Sun) **B1**

Answer: C) the Sun

Question 2

Mercury and Venus (oe) **B1**

Answer: Mercury and Venus

Question 3

A (3400 m) **B1**

Answer: A) 3400 m

Question 4

4.1 km (oe) **B1**

Answer: 4.1 km

Question 5

D (918 m) **B1**

Answer: D) 918 m

Question 6

E (opaque) **B1**

Answer: E) opaque

Question 7

B (238 m) **B1**

Answer: B) 238 m

Question 8

2.0 km (oe) **B1**

Answer: 2.0 km

Question 9

D (68 m) **B1**

Answer: D) 68 m

Question 10

C (1 s) **B1**

Answer: C) 1 s

Question 11

40 degrees (oe) **B1**

Answer: 40 degrees

Question 12

A (2040 m) **B1**

Answer: A) 2040 m

Question 13

476 m (oe) **B1**

Answer: 476 m

Question 14

(a) it reflects light from the Sun; the Moon does not produce its own light, oe **B1**

(a) Answer: The Moon reflects light from the Sun.

(b) as the Moon orbits the Earth, the relative positions of the Sun, Earth and Moon change, oe **B1**

(b) so different amounts of the Moon's sunlit half are visible from Earth at different times, oe **B1**

(b) Answer: As the Moon orbits the Earth, the relative positions of the Sun, Earth and Moon change, so we see different amounts of the Moon's sunlit half at different times.

(c) about 4 weeks (about 28-30 days, roughly one month), oe **B1**

(c) Answer: About 4 weeks (roughly one month).

Question 15

B (1360 m) **B1**

Answer: B) 1360 m

Question 16

5100 m (oe) **B1**

Answer: 5100 m

Question 17

Transparent (oe) **B1**

Answer: Transparent

Question 18

C (748 m) **B1**

Answer: C) 748 m

Question 19

Opaque (oe) **B1**

Answer: Opaque

Question 20

D (986 m) **B1**

Answer: D) 986 m

Question 21

Earth (oe) **B1**

Answer: Earth

Question 22

E (102 m) **B1**

Answer: E) 102 m

Question 23

Red, green and blue (oe) **B1**

Answer: Red, green and blue

Question 24

B (7.5 s) **B1**

Answer: B) 7.5 s

Question 25

20 degrees (oe) **B1**

Answer: 20 degrees

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Question 26

A (850 m) **B1**

Answer: A) 850 m

Question 27

40 degrees (oe) **B1**

Answer: 40 degrees

Question 28

C (2380 m) **B1**

Answer: C) 2380 m

Question 29

Red, green and blue (oe) **B1**

Answer: Red, green and blue

Question 30

B (15 s) **B1**

Answer: B) 15 s

Question 31

A (884 m) **B1**

Answer: A) 884 m

Question 32

24 hours (oe) **B1**

Answer: 24 hours

Question 33

(a) steel **B1**

(a) Answer: Steel

(b) time = distance / speed = 1000 / 5000 **M1**

(b) 0.2 s, cao **A1**

(b) Answer: 0.2 s

(c) time = 1000 / 340 **M1**

(c) 2.9 s, allow awrt 2.9 **A1**

(c) Answer: 2.9 s (2 s.f.)

(d) in a solid the particles are much closer together (and more strongly bonded) than in a gas, so vibrations (energy) are passed from particle to particle more quickly, oe **B1**

(d) Answer: In a solid the particles are much closer together than in a gas, so vibrations pass from particle to particle more quickly.

Question 34

Translucent (oe) **B1**

Answer: Translucent

Question 35

E (952 m) **B1**

Answer: E) 952 m

Question 36

Transparent (oe) **B1**

Answer: Transparent

Question 37

50 degrees (oe) **B1**

Answer: 50 degrees

Question 38

B (2 s) **B1**

Answer: B) 2 s

Question 39

Transparent (oe) **B1**

Answer: Transparent

Question 40

E (8 s) **B1**

Answer: E) 8 s

Question 41

25 degrees (oe) **B1**

Answer: 25 degrees

Question 42

C (12.5 s) **B1**

Answer: C) 12.5 s

Question 43

A (4080 m) **B1**

Answer: A) 4080 m

Question 44

Earth (oe) **B1**

Answer: Earth

Question 45

D (1020 m) **B1**

Answer: D) 1020 m

Question 46

Translucent (oe) **B1**

Answer: Translucent

Question 47

(a) time = distance / speed = 150 000 000 / 300 000 **M1**

(a) 500 s, cao **A1**

(a) Answer: 500 s

(b) 8 minutes 20 seconds, ft from (a) **B1**

(b) Answer: 8 minutes 20 seconds

(c) time = 384 000 / 300 000 **M1**

(c) 1.3 s, allow awrt 1.3 **A1**

(c) Answer: 1.3 s (2 s.f.)

(d) radio waves travel at the speed of light, so there is a real delay of about 1.3 seconds for a signal to travel each way (about 2.6 seconds there and back), ft from (c) **B1**

(d) Answer: Radio signals travel at the speed of light, so each one-way message takes about 1.3 seconds to arrive, causing a noticeable delay in conversation.

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Question 48

(a) the Sun **B1**

(a) Answer: The Sun

(b) Earth **B1**

(b) Answer: Earth

(c) a moon is a natural object that orbits a planet; the Moon is Earth's only natural satellite and orbits the Earth, oe **B1**

(c) Answer: A moon is a natural object that orbits a planet; the Moon orbits the Earth.

(d) Mercury and Venus, both needed, any order **B1**

(d) Answer: Mercury and Venus

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