IGCSE (EDEXCEL) Physics : Doppler answers

Q1. wavelength or distance between wavefronts smaller;
speed of waves is constant;
reference to wave equation $v = f \lambda$;

Q2.

(a) An arrow drawn from left to right by eye;

(b) Comparative statements for side containing A:
Wavefronts closer together / EQ;
(therefore) wavelength smaller;
Same speed;
($v = f \times \lambda$) so frequency larger;

Q3. Any FIVE from:

MP1 reference to Doppler effect;

MP2 wavefronts are emitted at constant frequency by buzzer;

MP3 wavefronts arrive at student (A) further apart than when they were emitted;

MP4 distance between wavefronts is the wavelength;

MP5 speed = frequency × wavelength;

MP6 speed of waves is constant;

MP7 as speed is constant and wavelength has increased, frequency must decrease;

MP8 decrease in frequency is experienced as a decrease in pitch;

Q4. any four from:

MP1. frequency increases;

MP2. due to Doppler effect;

MP3. idea that car behaves as the source of the (reflected) waves;

MP4. (reflected) wavefronts closer together;

MP5. (reflected) wavelength decreased;

MP6. speed (of waves) stays constant;

Q5. any three from:

MP1. frequency decreases;

MP2. due to Doppler effect;

MP3. idea of increased wavelength;

MP4. idea that decrease in frequency of buzzer B is twice that of buzzer A;

Q6. (a) use/substitution of distance = average speed x time;
total distance travelled = 2 x distance to plane;
evaluation of distance to at least 2s.f.;
e.g. total distance = $1.9 \times 10^{-3} \times 3.0 \times 10^{5}$
total distance = 570 km = 2 x distance to plane
distance to plane = 570/2 = 285 (km)

(b) substitution into given equation $\Delta\lambda/\lambda = v/c$;
rearrangement; evaluation;
e.g. $1.1 \times 10^{-6} / 1.2 = v / 3 \times 10^{8}$
$v = 3 \times 10^{8} \times 1.1 \times 10^{-6} / 1.2$
v = 280 (m/s)

Q7.(a) (i) any one from:
satellite orbits a planet/Earth, planet orbits a star/Sun;
orbital radius/time period of planet is greater than satellite;

(ii) any one from:
both orbit a planet/Earth;
both have same shape of orbit;

(b) (i) substitution into $v = 2\pi \times r / T$;
conversion of 24 hours into seconds;
rearrangement and evaluation of orbital radius;
evaluation of height;
e.g. $3.1 = 2 \times \pi \times r / [24 \times (60 \times 60)]$
$T = (24 \times 60 \times 60 =)$ 86 400 (s)
r = 42628 (km)
(height = 42628 – 6400 =) 36 000 (km)

(ii) any three from:
MP1. speed of waves constant;
MP2. if source moving away, wavefronts spread out / wavelength increases;
MP3. speed = frequency × wavelength;
MP4. (higher wavelength and constant speed of waves) gives lower frequency;

(iii) idea that there is no (relative) motion between point on Earth's surface and satellite; (therefore) no wavelength/frequency change;

Q8. P = Infra-red
R = Green
T = Ultra violet